

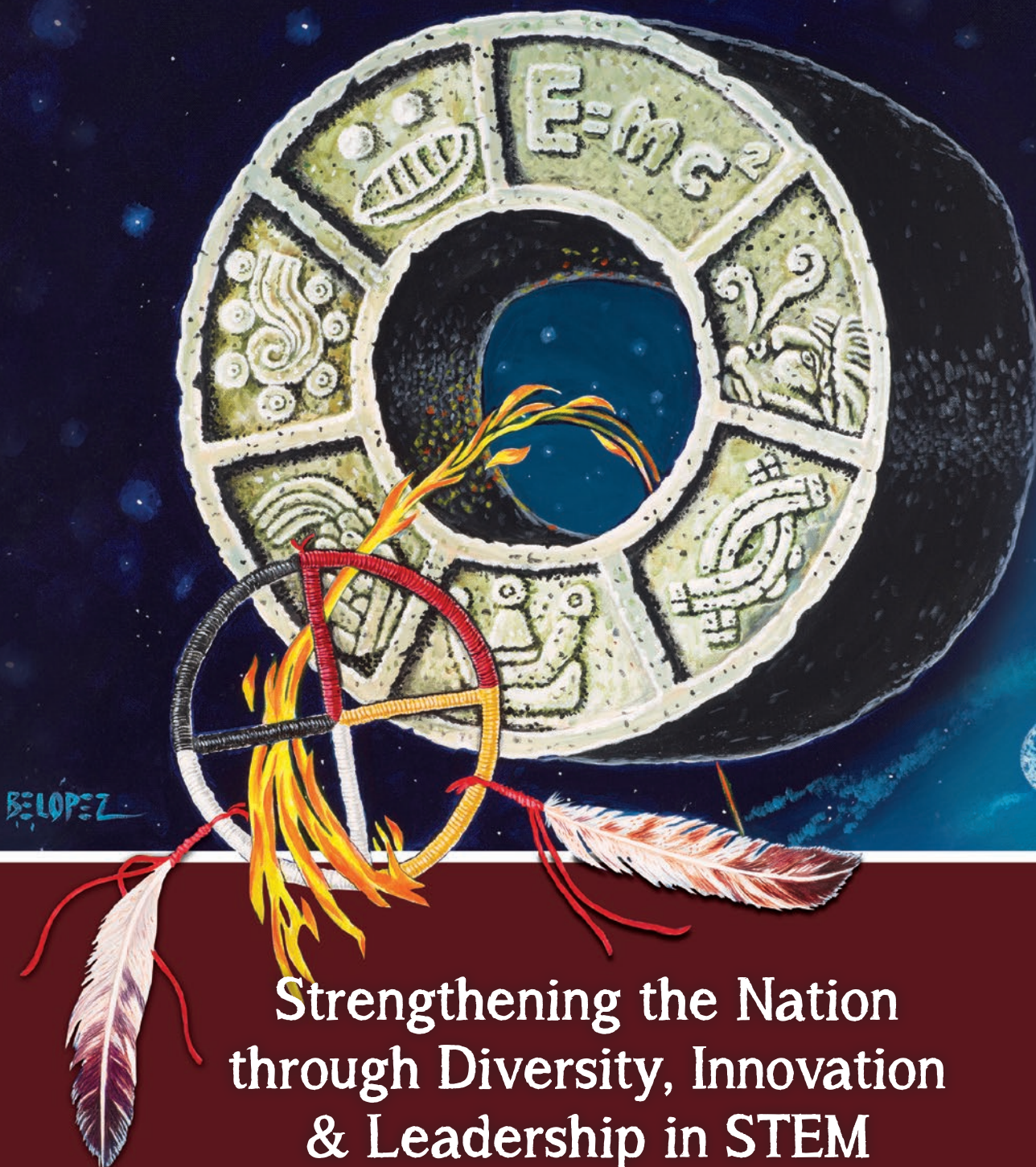


*Advancing Hispanics/Chicanos
& Native Americans in Science*

2013 SACNAS

NATIONAL CONFERENCE

RESEARCH PRESENTATION ABSTRACTS



Strengthening the Nation
through Diversity, Innovation
& Leadership in STEM

San Antonio, Texas • October 3-6, 2013



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2013 SACNAS National Conference
San Antonio, Texas / October 3 - 6, 2013



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SACNAS is pleased to present the tenth annual SACNAS National Conference Abstracts Volume, featuring the research conducted by undergraduate and graduate students under the guidance of a dedicated cadre of SACNAS mentors.

GRADUATE STUDENT ORAL PRESENTATIONS

ROOM	DISCIPLINES
214 C	Applied Mathematics
214 B	Biochemistry/Biophysics, Bioengineering/Biomedical Engineering, Chemistry I
217 A	Biochemistry/Biophysics, Bioengineering/Biomedical Engineering, Chemistry II
207 A	Botany, Plant Sciences
211	Cellular/Molecular Biology I
210 A	Cellular/Molecular Biology II
210 B	Cellular/Molecular Biology III
212 A	Chemical Engineering, Engineering Sciences, Materials Engineering, Physics
206 A	Chemistry III
213 B	Civil Engineering, Environmental Engineering, Atmospheric Sciences/Meteorology, Computer Systems Engineering, Computer/Information Science
217 D	Education
208	Electrical/Electronics/Communications Engineering, Mechanical Engineering
217 C	Environmental Science I
213 A	Environmental Science II
205	Mathematics & Statistics
217 B	Microbiology I
214 D	Microbiology II
207 B	Psychology & Social Sciences
212 B	Physiology/Pathology, Genetics, Health: Medicine, Neuroscience
214 A	Traditional Ecological Knowledge
209	Zoology/Entomology, Ecology I
206 B	Zoology/Entomology, Ecology II

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GRADUATE STUDENT SCIENTIFIC SYMPOSIA PRESENTERS CHECK-IN

All graduate presenters are required to check in and receive their presentation ribbons during the registration process at the Registration & Information Area in the Henry B. Gonzalez Convention Center.

GRADUATE STUDENT SCIENTIFIC SYMPOSIA PRESENTATION SETUP

Graduate presenters must arrive between 3:30 and 4:00 pm on Thursday, October 3, at their assigned presentation room. Bring all PowerPoint materials at this time to be loaded onto presentation equipment.

UNDERGRADUATE STUDENT POSTER PRESENTATIONS

All undergraduate student poster research presentations take place in Exhibit Hall C on Friday afternoon and Saturday morning.

Friday, October 4

Poster Session 1, 1:30 – 3:30 pm

Saturday, October 5

Poster Session 2, 9:00 – 11:00 am

POSTER PRESENTERS' CHECK-IN

All poster presenters are required to check in and receive their presentation ribbons during the registration process at the Registration & Information Area in the Henry B. Gonzalez Convention Center. Ribbons are required for entry into Exhibit Hall C for poster setup.

POSTER PRESENTATION SETUP

All poster presentations are designated by poster board number and date. Presenters may set up poster materials in Exhibit Hall C ONLY during the setup times corresponding to their presentation day.

Friday Session 1 – Presenters' Setup

Friday, October 4, 7:00 – 7:30 am
Exhibit Hall C

Saturday Poster Session 2

Saturday, October 5, 7:00 – 7:30 am
Exhibit Hall C

POSTER PRESENTATION TAKE DOWN

All Friday posters must be taken down by 3:45 pm on Friday, October 4. Saturday posters must be taken down by 11:30 am on Saturday, October 5. SACNAS is not responsible for posters that have not been taken down at the designated time; unclaimed posters will be discarded.

GRADUATE STUDENT & POSTDOC RESOURCE FAIR

All graduate student poster presenters and postdoc poster research presentations will take place during the Graduate Student & Postdoc Resource Fair inside the Henry B. Gonzalez Convention Center in Ballroom C on Friday, October 4, from 4:00 to 6:00 pm

GRADUATE & POSTDOC POSTER SETUP

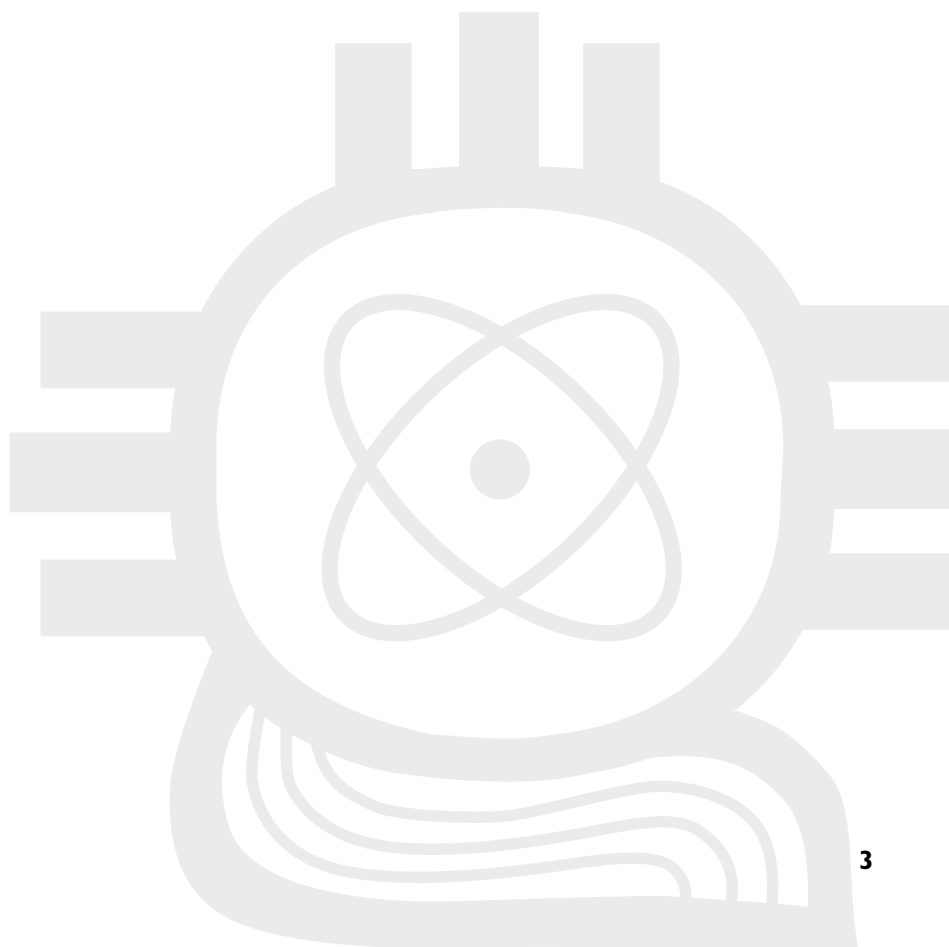
Friday, October 4, 3:00 - 4:00 pm
Ballroom C

GRADUATE & POSTDOC POSTER TAKE DOWN

Friday, October 4, 6:00 – 6:15 pm
Ballroom C

FLOOR PLANS

Please refer to the Exhibit Hall floor plan on the inside back cover of this publication, and to the floor plans on pages 130–134 of the conference program to help you navigate the conference.



ABSTRACT REVIEW PROCESS

The SACNAS Student Presentations Committee organizes activities related to the student scientific sessions. These sessions advance the organization's strategic efforts to support students' preparation for their professional science careers and, more specifically, the demanding rigors of discipline-focused professional conferences. Our goal is to provide a fair, positive, and nourishing experience to students through the abstract review, presentation mentoring and judging, and awards-selection processes. Accordingly, our abstract selection and scientific presentation evaluation processes are focused on constructive, student-professional engagement and mentoring. We feel this dialogue between students and scientists is invaluable in providing experience, insight, and professional growth for emerging scientists, mathematicians, and engineers.

Students and mentors alike respond positively to our efforts. This year, more than 1,200 abstracts were submitted for the 2013 SACNAS National Conference. Professionals recruited from our membership generously and enthusiastically volunteer their time and energy to reviewer abstracts. Reviewers provide a fair and unbiased appraisal of the abstract's quality in the overall score, and also give each student constructive feedback and suggested improvements. Each abstract is reviewed by at least two experts in this manner, similar to evaluations in traditional scientific societies. Student abstracts are evaluated according to the following criteria, and given a numerical score:

- Clarity—the research topic and motive are easily identified
- Communication—language and style are appropriate for a general scientific audience
- Scientific Essentials—the purpose or goal of the study, project methods and analyses, results (or predictions), and impact/value are present and easily identified

As the size of the Student Presentations effort has grown considerably, we are limited in the number of presentations we are able accommodate at the National Conference. We are unable to accept abstracts scoring less than 60% in the review process. However, as a testament to the quality of the submissions from students, this year our acceptance rate is nearly 83%.

At the conference, all student presentations are offered with no scheduling conflict to promote attendance and interaction with our presenters. We coordinate the efforts of our volunteer judges who preside over oral presentations, visit numerous posters, and provide a mentoring experience through their critical, yet constructive, interaction with the students. The Student Presentations Committee is indebted to the hundreds of professionals who graciously and tirelessly volunteer as judges on site—without their sharing of our vision, our efforts at the conference could never be as successful as they are.

Lastly, we would love to thank SACNAS Program Manager Asis Lopez for his dutiful work with the Student Presentations Committee over the year. Congratulations, Asis, on your one year research fellowship at UC Santa Cruz and the best of luck in all your endeavors.

Sincerely,
2013 SACNAS Student Presentations Committee



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SACNAS Student Presentations Program Manager

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If you are interested in participating in the SACNAS student presentations program as a mentor, please visit sacnas.org, log in, and update your profile by selecting “Volunteer Interests” to enroll yourself as a conference judge, conference mentor, or a preconference abstract reviewer.

SACNAS appreciates the many dedicated individuals who work to mentor and develop the next generation of SACNAS talent.

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Tenure-Track Assistant Professorship in Chemistry (Inorganic) — Harvard University —

Candidates are invited to apply for a tenure-track assistant professorship in inorganic chemistry, broadly defined to include catalysis, synthesis, mechanism, materials, and energy-related research. The appointment is expected to begin on July 1, 2014. The tenure-track professor will be responsible for teaching at the undergraduate and graduate levels. We are seeking candidates who have an outstanding research record and a strong commitment to undergraduate and graduate teaching. Doctorate required by expected start date. Candidates should arrange to have three letters of recommendation sent independently and provide a curriculum vitae, statement of teaching philosophy, list of publications, and outline of their future research plans. All applications and supporting materials must be submitted via the ARIeS portal (<https://academicpositions.harvard.edu/postings/4913>) no later than October 15, 2013. Harvard is an Equal Opportunity/Affirmative Action employer. Applications from women and minorities are strongly encouraged.

Northern Arizona University Committed to Student Success



At Northern Arizona University, we're honored to be recognized for enabling our minority students to achieve their dreams:

- NAU was named one of the "Top 100 Colleges for Latinos" by *Hispanic Outlook in Higher Education* magazine.
- NAU was ranked 8th in the nation for awarding bachelor's degrees to Native Americans by *Diverse: Issues in Higher Education*.

Learn why at
nau.edu/Top100



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The Dean's Postdoctoral Fellowship is a two-year program available at Harvard Medical School's basic and social science departments. The Fellowship will prepare postdoctoral scientists, particularly underrepresented minority scientists, for cutting-edge research careers. It will also provide financial support and exceptional opportunities to develop networks and grow professionally. This Fellowship will position the right candidates to make major contributions as scientific and societal leaders. Applications will be considered on a rolling basis.

- Biological Chemistry & Molecular Pharmacology
- Cell Biology
- Genetics
- Global Health & Social Medicine
- Health Care Policy
- Microbiology & Immunobiology
- Neurobiology
- Stem & Cell Regenerative Biology
- Systems Biology



For more information:

Brian Anderson, Program Manager | E-mail: brian_anderson@hms.harvard.edu | Phone: 617.432.1083 | Web Site: www.hms.harvard.edu/dcp/deanspdfellowship

THE MONGAN COMMONWEALTH FUND FELLOWSHIP IN MINORITY HEALTH POLICY

(Formerly The Commonwealth Fund/Harvard University Fellowship in Minority Health Policy)



Applications now accepted for a one-year, full-time fellowship at the Harvard Medical School, Boston, beginning July 2014. Program prepares physicians for leadership roles in transforming health care delivery systems and promoting health policies and practices that improve access to high performance health care for racial and ethnic minorities, economically disadvantaged groups, and other vulnerable populations. Program offers intensive study in health policy, public health, and management. Fellows complete academic work leading to an MPH degree at the Harvard School of Public Health, or an MPA degree at the Harvard Kennedy

School. Fellows also participate in leadership forums and seminars with nationally recognized leaders in health care delivery systems, minority health, and health policy. An optional second year of practicum experience to supplement the fellows' academic and leadership development training at Harvard with practical experience is also available.

QUALIFICATIONS: BC/BE required, experience in addressing health needs of vulnerable populations, interest in transforming health care delivery systems for vulnerable populations, and U.S. citizenship.

SALARY/BENEFITS: \$60,000 stipend, master's degree tuition, health insurance, travel for professional meetings and site visits.

APPLICATION DEADLINE: December 16, 2013

For more information:

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Web Site: www.mfdp.med.harvard.edu/fellows_faculty/cfuf



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UNDERGRADUATE POSTER ABSTRACTS

BIO/AGR/ENV LIFE SCIENCES

ANIMAL SCIENCE

SAT-453

CARBON-13 BREATH TESTING CAN BE USED TO CHARACTERIZE SEQUENTIAL CHANGES IN ENDOGENOUS SUBSTRATE OXIDATION DURING ACUTE NUTRITIONAL STRESS: A CASE STUDY USING JAPANESE QUAIL (*COTURNIX JAPONICA*)

Alice Yang, James Amaya, Marshall McCue.
St. Mary's University, San Antonio, TX.

Most fasting animals undergo a sequential process of switching from the preferential oxidation of one metabolic substrate to another, i.e., from glucose, to lipids, to proteins. Here we show that changes in metabolic substrate oxidation can be characterized using stable isotope enrichment of the body nutrient pools and subsequent $^{13}\text{CO}_2$ -breath testing. Eighteen *Coturnix japonica* were raised from age 2 weeks to adulthood (10 weeks) on balanced diets enriched with either ^{13}C -1-L-leucine, ^{13}C -1-palmitic acid, or ^{13}C -U-D-glucose. Quail were then fasted for 72 hours during which VO_2 , VCO_2 , $\delta^{13}\text{C}$ of exhaled CO_2 , body mass, and blood metabolites (i.e., glucose, ketone bodies, and triacylglycerides) were continually measured. The fasting quail exhibited expected reductions in body mass m_b (20%), T_b (0.6 °C), and metabolic rate (55%), but blood metabolites exhibited varied responses. Plasma glucose remained at prefasting levels throughout the fasting period. Plasma β -hydroxybutyrate increased, peaking at 72 hours of fasting, and remained elevated thereafter. Triacylglyceride values were highly variable and showed no clear trends. The production of $^{13}\text{CO}_2$ was useful in differentiating between nutrient oxidations during fasting. By 8 hours, lipids became the predominant oxidative fuel, continuing for the remainder of the fasting trial. Protein oxidation reduced in 8 hours and continued to fall until 24 hours of fasting, thereafter leveling off. The $^{13}\text{CO}_2$ production of the birds raised on the glucose tracer was nearly identical to the birds raised on the ^{13}C -palmitic acid tracer suggesting that they were able to convert most of the exogenous glucose carbon into lipids that were later oxidized during fasting.

FRI-453

THE EFFECTS OF HUMAN-INDUCED ENVIRONMENTAL CHANGE ON TROPICAL FOREST BIRD ECOLOGY AND INTERSPECIES INTERACTION

Conor Handley¹, Jessie Knowlton²

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Tropical forests are undergoing rapid change caused by factors such as clear cutting, global warming, and invasive species. Some of the methods we will use to measure birds' responses to changes in their habitats include examining their genetic structure, demography (e.g., nest success, adult survival), movement patterns, and behavior (e.g., foraging, social interactions). One key factor we will explore is how habitat disturbance affects interactions between species. A large proportion of tropical birds spend all or part of their foraging time in mixed-species flocks, strongly suggesting that this behavior increases their fitness. The increase in fitness may come from enhanced protection from predators due to earlier warning calls or lower probability of being singled out by a predator, greater foraging efficiency due to the flushing of insects as the flock moves through an area or learning new methods of food capture by watching other flock participants; or some combination of these factors. Our research will be an attempt to understand how forest birds respond to human induced changes so we can predict and enhance species long-term survival. This research will help shed light on the vast importance of avian biodiversity in tropical habitats and how it effects the greater forest ecosystem.

FRI-452

ASSESSING HYPOXIC STRESS IN HIGH-ANDEAN BIRDS BASED ON RIGHT VENTRICULAR MORPHOLOGY

Ashley Smiley, Geneva Williams, Natalie Wright, Christopher Witt.
University of New Mexico, Albuquerque, NM.

Birds whose ranges span the entire elevational gradient of the Andes defy ideas about niche limitations: they experience huge ranges in abiotic factors including differential partial pressures of oxygen and temperature and

precipitation variations. How do these environmental factors affect avian physiology? The House Wren (*Troglodytes aedon*) and the Pied-Crested Tit-Tyrant (*Anairetes reguloides*) are two passerine songbirds that occur from sea level to over 4,000 m elevation in the Peruvian Andes. Exposure to hypoxia has led to pulmonary hypertension in low-altitude mammals followed by right-ventricular hypertrophy. However, it is unknown whether birds employ the same compensatory response. We tested whether high-altitude populations of widespread Andean bird species exhibit the enlarged right ventricles suggestive of chronic pulmonary hypertension. The right ventricles of high-altitude House Wrens were significantly enlarged, indicating that House Wren populations in the high Andes are not optimally adapted to hypoxia. Right ventricular enlargement represents a plastic developmental response to hypoxic stress as opposed to a genetic adaptation to hypoxic environments. Inter-family relative heart mass comparisons in Andean birds indicate species-specific patterns of high-altitude adaptation that likely reflect unique biogeographic histories.

FRI-454

HEMODYNAMIC ALTERATIONS FOLLOWING ATRIAL TACHYPACING IN THE SWINE

Evymarie Prado¹, Bari Olivier².

¹University of Puerto Rico, at Mayagüez, Mayagüez, PR, ²College of Veterinary Medicine, Michigan State University, East Lansing, MI.

Hemodynamics is the study of the forces in the circulation of the blood through the body. Our focus is the after effects of abnormal rhythms on blood pressure and heart rate, specifically in fast arrhythmias. Heart rate and blood pressure are differentially altered following the termination of fixed, sinusoidal (sine) and randomly varying atrial tachycardia. Through the swine model, cardiovascular experimentation was done to perform atrial overdrive pacing in order to achieve a pacing effect. Three sequences were performed on the swine: fixed, random and sinusoidal for 1 hour with 10 minutes of post pacing data collection. Data analysis is by measure of post pacing divided in thirty-second intervals with averages. For initial observations, heart rate shows sine lower than other pacings. In end systolic pressure, random pacing appears lower than others. No apparent difference was observed in mean pressure, systolic pressure and contractility (dP/dt).

SAT-455

OUTDOOR WEATHER CHARACTERIZATION FOR A SWINE TRANSPORT ASSESSMENT

Dana Anderson¹, Angela Green².

¹Northeastern Illinois Univeristy, Chicago, IL, ²University of Illinois Urbana-Champaign, Urbana, IL.

Transportation of animals has potential impacts on the humane treatment of animals and the safety of both the animals and the people involved. The swine industry recognizes that problems occur during transport that result in dead or down pigs, most commonly during extreme weather conditions, and supports research focused on trailer management to improve challenging environmental conditions. A year-long monitoring study was completed for assessing the thermal environment during pig transportation over a wide range of outdoor weather conditions. During this study, the trailer was managed according to industry practices (Transport Quality Assurance program of the National Pork Checkoff). Temperature was recorded inside the trailer to generate a 3D representation of the temperature profile. GPS coordinates were recorded for every minute of each trip. A weather data set of hourly outdoor temperatures that correspond to the geographical trailer location was generated using the GPS coordinates and the data from the nearest local NOAA weather station. The outdoor weather data was summarized into an overall weather distribution to represent the outdoor conditions over the complete study. This distribution will be compared to geographical distributions within the US, based on ASHRAE records, to represent the study applicability. Additionally, correlations were assessed between the inside and outside environmental data to identify trends, specifically during extreme hot and cold conditions. Results of this study have the potential to identify areas of management for reducing the number of dead or down pigs during and after transport. Analysis is ongoing and complete results will be presented.

SAT-456

EFFECT OF STRAWBERRY GUAVA ON SURVIVAL AND REPRODUCTION IN THE NATIVE HAWAIIAN TERRESTRIAL LAND SNAIL *LEPTACHATINA CEREALIS* (PULMONATA: AMASTRIDAE)

Kaile Costa, Daniel Chung.

University of Hawaii Kapiolani Community College, Honolulu, HI.

The endemic Hawaiian land snail *Leptachatina cerealis*, was fed differing diets of mamaki (*Pipturus albidus*) leaves, its preferred food in the wild, and strawberry guava leaves (*Psidium cattleianum*), an invasive that forms vast

monocultures in Hawaii. The diets ranged from 100% mamaki, to mixed mamaki-strawberry guava leaf diets, to 100% strawberry guava. Survivorship, wet weight, and eggs laid were recorded during a course of 66 days for four groups of these snails (10 adults, 10 juveniles, and a few neonates) fed these different diets. The number of eggs laid was highest for snails fed 100% mamaki leaves, and was virtually zero for snails fed on 100% strawberry guava leaves. Snails fed 100% strawberry guava showed a mortality of 35% over the 66-day period, while snails on 100% mamaki showed only a 5% mortality. Snails fed 100% strawberry guava leaves showed the greatest decline in wet weight, while snails on 100% mamaki showed a small gain. Strawberry guava is not likely to sustain populations of *Leptachatina*, or any other terrestrial amastriids, and is likely to lead to their localized extinction. This is the first experimental demonstration of a negative effect on an endemic snail of an invasive species of weed in Hawaii.

FRI-455

THE ALLEVIATION OF PAIN ASSOCIATED WITH THE DISBUDDING OF CALVES

Amanda Mathias¹, Dan Stein¹, John Gilliam², Michelle Calvo-Lorenzo¹.

¹Oklahoma State University, Stillwater, OK, ²Oklahoma State University Center for Veterinary Health Sciences, Stillwater, OK.

Disbudding, the removal of horn buds on a calf, is a necessary management procedure because it eliminates costs associated with horns and improves safety. However, disbudding is known to cause pain and distress in calves. Extra-label use of some pharmaceuticals allows for some alleviation of pain and distress, but it is not the best method. FDA-approved pharmaceuticals would be better options to alleviate pain, however none exist. This study evaluates the effectiveness of ethyl alcohol (EtOH) to produce a cornual nerve block, when the area surrounding the horn is numb. To test this, calves were given 1 of 3 treatments: 5 ml saline solution (SAL), 5 ml of 2% lidocaine (LID), a solution mixture of 2.5 ml of 2% lidocaine and 2.5 ml of 75% EtOH (MIX), or 5 ml of 75% EtOH (ALC). The calves were needle pricked in the area surrounding the horn bud at 5, 10, 15, 20, 30, and 60 minutes after treatment on day 1 to determine onset of the cornual nerve block, and once daily on days 2-14 to test duration. The study found SAL calves exhibited "not blocked" behaviors at all time points; all other treatments exhibited initial "blocked" behaviors at 5 minutes post-treatment. The study also found that MIX and ALC treatments maintained a cornual nerve block for 2 weeks. Results indicate the potential of using EtOH as a form of pain relief for disbudding calves. Future research incorporating the removal of the horn buds after EtOH administration will further evaluate the effectiveness of EtOH as a cornual nerve block.

FRI-456

AGOUTIS ON THE ALERT

Sharonda Carson¹, Enzo Aliaga-Rossel.

¹University of Central Oklahoma, Edmond, OK, ²San Andres University, La Paz, BO.

Agoutis (*Dasyprocta punctata*) are mammals that are a key component of the Neotropical forest as agents for seed dispersal, seed predators, and prey for several species. They spend the day defending their territory from invading agoutis, searching for food, looking for potential mates, and watching for predators. The objective of the research will be to study the alert behavior of agoutis in two different habitats in Las Cruces, Costa Rica. A group of agoutis from the secondary forest and from the garden will be studied to see which are more alerted. One group has grown accustomed to the presence of humans and hearing disturbances while the other group lives in a less disturbed area where there is less influence from people. To test how alert the agoutis can be in the presence of a predator or an invading agouti, a series of test calls from an ocelot and an invader will be sounded. The calls will start at a distance far away and will advance the longer it takes the agoutis to respond. Observation notes will be taken after every test call to note the agoutis' reaction. With one group having fewer interactions versus another group that is used to everyday disturbances, the expected conclusion will be for the agoutis in the secondary forest to be more alerted than the agoutis in the garden. The overall goal for the research project will be to have a better understanding of the agoutis' alert behavior and the contribution they make to their habitat.

SAT-454

EXPRESSION OF WNT-SIGNALING TRANSCRIPTS AT SPECIFIC STAGES OF FOLLICLE DEVELOPMENT IN BOVINE GRANULOSA CELLS

Allison Potts¹, Andrea Stapp¹, Belinda Gomez¹, Bailey Parker¹, Craig Gifford¹, Dennis Hallford², Jennifer Gifford¹.

¹Oklahoma State University, Stillwater, OK, ²New Mexico State University, Las Cruces, NM.

Follicular maturation is a dynamic process requiring input from pituitary gonadotropins and ovarian-derived factors. Members of the wingless-type mammary tumor virus integration site (WNT) signaling pathway have been recognized as differentially expressed and hormonally regulated in rodent ovaries. However, the role and expression of WNT-signaling molecules in ovarian follicle development in cattle is unknown. Therefore, the objective of this study is to characterize components of the WNT-signaling pathway at specific stages of follicular development by real-time PCR. To identify gene expression changes in bovine folliculogenesis, granulosa cells and follicular fluid were collected from ovary pairs containing a stage III CL. Granulosa cells were isolated from small (1 to 5 mm) and large (8 to 22 mm) follicles and the corresponding CL. Real-time PCR quantification of select WNT family members was evaluated at distinct stages of development. Compared to small follicle granulosa cells, expression of the WNT transcriptional cofactor *CTNNB1* was similar in large, dominant follicles ($P = 0.53$) but was decreased in the CL ($P < 0.01$). Expression of WNT ligands also demonstrated stage-specific regulation as *WNT2B* was reduced in large dominant follicles ($P = 0.10$) but increased in CL ($P = 0.03$) compared to small follicles. A comparable pattern of expression was demonstrated for *WNT5A* as small follicles had greater expression compared to large follicles ($P < 0.01$) and was similar to CL ($P = 0.56$). Results from the current experiment indicate WNT-signaling molecules may be inhibitory to follicle development and luteinization in cattle.

BIOCHEMISTRY/BIOPHYSICS

FRI-116

BIODISTRIBUTION IN TISSUE OF NOVEL DRUG MOLECULES VIA MALDI-IMAGING MASS SPECTROMETRY

Joseph Wayne Fowler, Jonathan Waxer, Carly Ferguson, Richard Gatti.

University of California, Los Angeles, Los Angeles, CA.

Premature termination codons (PTC) are the result of mutations within an organism's genome that can cause a wide variety of genetic disorders. One such genetic disorder is ataxia-telangiectasia (AT), which affects the brain causing malignant health defects in mammals due to an AT-mutated protein. Nonaminoglycoside compounds induce a read-through of PTCs, developing functional, AT-mutated proteins theoretically treating AT. Nonaminoglycosides have been found to treat PTC genetic disorders *in vitro* but have been untested *in vivo*. Two nonaminoglycosidic read-through compounds of interest (RTC 6 and 16) should theoretically be able to pass the blood-brain barrier to treat PTC disorders because of their small size and nonpolar characteristics. A total of 48 mice were tested following an intraperitoneal injection: 16 untreated, 16 RTC-6 treated, and 16 RTC-16 treated. Imaging mass spectrometry was used to identify the presence of RTC 6 and 16 in the liver, heart, kidneys, lungs, and brain of dosed mice. As expected, no traces of RTC 6 or 16 were found in the brains or livers of 8 control mice. RTC 16 was discovered in the brains of 3 treated mice. Although RTC 16 was located in the liver of 4 treated mice, no trace of RTC 16 was found in the brain of 8 treated mice. After complete tissue testing, the next step will be to test mouse models to obtain enough data on the stability of nonaminoglycoside compounds and to ultimately synthesize a capable drug to treat ataxia-telangiectasia.

SAT-105

CHARACTERIZATION OF THE ACYL-COENZYME A SYNTHETASE PA4198 IN PSEUDOMONAS AERUGINOSA

Rachel Gomez, Debra Dunaway-Mariano.

University of New Mexico, Albuquerque, NM.

Pseudomonas aeruginosa is an opportunistic pathogen with antibiotic resistance and is a large contributor to hospital infections, including those affecting patients with cystic fibrosis. As a member of the Pseudomonadaceae family, *Pseudomonas aeruginosa* can use a variety of organic compounds such as fatty acids for energy. A key enzyme for metabolism of fatty acids are acyl-coenzyme A synthetases which activate fatty acids for further reactions. The focus of this project is to characterize the acyl-CoA synthetase PA4198 in terms of its biological function and range as well as its efficiency as an enzyme. This includes cloning, expression, purification and kinetic analysis of PA4198

and Pput_2221, an ortholog in *Pseudomonas putida*. Further investigation into the biological function of PA4198 also includes the characterization of the adjacent gene *PA4199*, a putative acyl-CoA dehydrogenase. Results show that PA4198 displays a selective high efficiency with medium chain fatty acids while PA4199 displays efficient dehydrogenase activity towards medium chain acyl-CoA substrates. These results could implicate PA4198 and PA4199 as members of a medium-chain fatty acid metabolism pathway. By helping shed light on PA4198's biological role, this project will expand our general knowledge of acyl-CoA synthetases and their importance in biological systems.

SAT-118

EFFECTS OF SALICYLIC ACID, ACETYLSALICYLIC ACID, AND METHYL SALICYLATE ON R-PHOSPHOFRUCTOKINASE-1-ENZYME ACTIVITY: COMPARISONS TO ASCORBYL FATTY ACID INHIBITIONS

Louciana Sanchez¹, Edward Alexander¹, Percy Russell², Alberto Palacios¹, Rogelio Estrada¹, Anita Williams².

¹San Diego Mesa College, San Diego, CA, ²University of California, San Diego, La Jolla, CA.

Research has confirmed the benefit of aspirin and salicylates in cancer prevention. One proposed mechanism for this action involves inhibition of the enzyme cyclooxygenase (COX). Studies on fatty acid derivatives of ascorbic acid (AA) have shown them to have antimetastatic action on certain cancers. *In vitro* experiments have shown that these fatty acid derivatives inhibit the activity of the enzyme r-phosphofructokinase (r-PFK-1). Mechanisms for the fatty acid derivative inhibitions may involve antioxidant by the 2, 3-ene-diol group in ascorbic acid and allosteric effects of lipophilic side chains. The purpose of this research was to investigate the inhibition properties of salicylic acid (SA), acetylsalicylic acid (ASA), and methyl salicylate (MS) on r-PFK-1. Our hypothesis was, since these compounds are antioxidants, antioxidant by SA, ASA, and MS on r-PFK-1 should take place and yield results similar to those found for ascorbic acid derivatives: ascorbic acid 6-butyrate, ascorbic acid 6-palmitate, ascorbic acid 6-sterate, ascorbic acid 2, 6-dibutyrate, and ascorbic acid 2, 6-dipalmitate, (Ic50: 0.13, 0.021, 0.026, and 1.2 mM). SA, ASA, and MS were obtained commercially. The r-PFK-1 enzyme was purified employing centrifugation and ion-exchange filtration. Inhibitions were carried out in buffered solutions of 95% ethanol. Our results show that SA, ASA, and MS show no significant inhibitions of r-PFK-1 when compared to the fatty acid derivatives of ascorbic acid. From these results, we conclude that the side chain length and lipophilic characteristics of the ascorbic acid derivatives may be the major contributors in the inhibition of r-PFK-1 rather than antioxidant.

FRI-111

DETECTING THE MECHANISM OF FEEDBACK INHIBITION OF TYROSINE HYDROXYLASE; DOPAMINE BINDING TO GLUTAMATE RESIDUES IN THE REGULATORY DOMAIN

Jessica Villacorta, Susan Colette Daubner.

St. Mary's University, San Antonio, TX.

Tyrosine hydroxylase (TyrH) catalyzes the rate-limiting step of catecholamines synthesis by converting L-tyrosine to L-DOPA. The post-translational mechanisms that control TyrH activity include phosphorylation by protein kinases and dephosphorylation by phosphatases, feedback inhibition, and protein complexes. This research focuses on the structural changes of the regulatory domain by feedback inhibition caused by dopamine-binding inhibition. When dopamine binds to TyrH, the flexible loop of the regulatory domain changes conformation in order to close off the active site. We hypothesize that one or two glutamate residues found in the flexible loop are responsible for anchoring down dopamine and hence closing the R domain. To test our hypothesis, we replaced the glutamate residues found at positions 43 and 48 of the regulatory domain with a glutamine. Mutants were obtained by site-direct mutagenesis, and the mutated proteins were overexpressed in *E. coli*. Then the proteins were purified through standard chromatographic techniques. The Michaelis-Menten parameters were obtained in order to ensure that the catalytic domain was not affected by the mutation. For the E43Q mutant, the K_m value for tetrahydropterin was 44.4 μM , the K_m value for tyrosine was 49.23 μM , and the V_{Max} value was 48.94 min^{-1} . For the E48Q mutant, the K_m value for tetrahydropterin was 40.06 μM ; the K_m value for tyrosine was 41.61 μM , and the V_{Max} value was 53.64 min^{-1} . Knowing that the mutant proteins are catalytic active allows us to proceed with studies of their interactions with dopamine.

SAT-120

INVESTIGATION OF TRIAZABOROPYRIDINIUM (HPY) DYES FOR A CELL VIABILITY ASSAY

Alan Yazzie, Jeffrey Arterburn.

New Mexico State University, Shiprock, NM.

Bacteria are one of the oldest life forms on earth. They have a wide range of different shapes, and they are found in almost every possible habitat on the planet. Many bacteria are harmless, some are beneficial, and some are pathogenic and cause diseases such as tuberculosis, cholera, and syphilis. *Staphylococcus aureus* (*S. aureus*) is the most common species that causes staph infections and a range of illnesses. The emergence of drug-resistant pathogenic bacteria has created a true health crisis and a serious problem for hospitals where many patients contract a staphylococcal infection. There is a need for sensitive methods to detect the presence of trace amounts of bacteria to ensure sterility and for convenient kits to distinguish living and dead cells. We have developed a new type of fluorescent triazaboropyridinium (HPY) dyes for biological and biomedical applications. The goal of this project is to investigate the interactions of a series of HPY dyes with live and dead bacteria cells, to determine the effects of different dye structures on cell staining, and to identify possible dyes for use in detection and to determine cell viability. We will investigate bacteria stained with HPY dyes that are neutral, charged, or capable of reacting with intracellular proteins using fluorescent microscopy. These results will be compared with existing commercial dyes that are known to stain bacteria.

FRI-119

VITAMIN C IN INVERTEBRATES: IS IT THERE AND HOW IS IT MADE

Maria Pedraza, Alexander Patananan, Lauren Budenholzer, Steven Clarke.

University of California, Los Angeles, Los Angeles, CA.

Vitamin C is an important antioxidant that neutralizes free radicals in cells, participates in a variety of enzymatic reactions, and helps protect against human diseases. There are three main vitamers of vitamin C including dehydroascorbate, D-isoascorbate, and L-ascorbate. The importance of L-ascorbate, the most biologically active vitamer, is well established in vertebrates, yet its biosynthesis is poorly characterized in invertebrates. *Caenorhabditis elegans*, a commonly used invertebrate model organism, requires ascorbate for several of its enzymes in its vertebrate homologs. Therefore, we are investigating the levels of ascorbate or similar species, such as erythroascorbate and arabinoascorbate, in *C. elegans*, and how they are biosynthesized. To identify these compounds, we optimized several methods using normal and reverse-phase, high-performance liquid chromatography (HPLC) and gas-chromatography mass spectrometry (GC-MS). We will then explore the biochemical pathways for the biosynthesis of these molecules. Finding a novel pathway in *C. elegans* will broaden our understanding of the synthesis of vitamin C and its importance to organisms. Most importantly, our research can provide insight into putative human homologs that may affect health.

FRI-105

DEVELOPMENT AND VALIDATION OF A HIGH THROUGHPUT SCREENING ASSAY FOR THE DETERMINATION OF CIDAL ANTIMALARIALS

Yandira Salinas, Armand Guiguemde.

St. Jude Children's Research Hospital, Memphis, TN.

Malaria kills 1 million people per year, making it one of the most deadly infectious diseases. Despite the great world-health impact of malaria, only a limited number of therapeutic agents are available. The malaria parasite's ability to quickly develop resistance to treatments poses a threat to world health. Malaria drugs are either cidal or cytostatic. Cidal compounds act faster and are preferred in the clinic because the development of resistance to cidal compounds is lower. In addition, rapid clearance of the parasite reduces transmission. Using a high throughput screening approach and a 3D7 luciferase transfected strain, we developed a novel assay that would allow us to discriminate between cidal and cytostatic compounds early in the drug development/discovery process. This assay allows the determination of the speed of action of a compound in a 12-hour experiment. Previous methods measure parasite out-growth in a 72-hour experiment. As a pilot study, a small library of 32 antimalarials containing previously reported cidal and cytostatic compounds was screened. This assay was able to accurately discriminate between cidal and cytostatic compounds. Herein, we report the development and validation of this high-throughput screening assay for the determination of fast acting antimalarials.

SAT-126

MECHANISTIC STUDIES OF *FOX*M1Brenda Beas¹, Aimee Marceau², Seth Rubin².¹Hartnell College, Salinas, CA, ²University of California, Santa Cruz, CA.

Forkhead box M1 (*FoxM1*) transcription factors are essential for G1-S and G2-M cell cycle progression. *FoxM1* is over expressed in many cancer types. *FoxM1* is normally held inactive by a possible physical interaction between the N-terminal domain (NTD) and the C-transactivation domain (TAD). In order to test for a possible physical interaction between NTD and TAD, each individual domain will be purified. To test for direct interactions between NTD and TAD, GST-tagged TAD will be incubated with pure NTD in a pull-down experiment. This experiment will provide qualitative information about the interaction between the domains. To generate quantitative data, isothermal titration calorimetry will be employed.

SAT-107

DETERMINING THE ROLE(S) OF PRIME-SIDE RESIDUES IN MACROMOLECULAR INHIBITION OF TRYPSIN-FOLD SERINE PROTEASESCommodore St. Germain, Teaster Baird, Jr.*San Francisco State University, San Francisco, CA.*

Trypsin-fold serine proteases are among the most abundant of all proteases. By identifying residues that are important for enzyme inhibitor interaction in trypsin, we may advance the development of protease-based therapies in general. Lysine-60 (K60) is a highly conserved prime-side residue that may play many roles in trypsin. In cocrystals, K60 hydrogen bonds to tyrosine-39 (Y39) and is positioned to restrict conformational mobility of phenylalanine-41 (F41), possibly limiting the observed hydrogen bond interactions between those residues and macromolecular inhibitors. Substitution of K60 with other amino acid residues may disrupt these interactions and provide insight into their significance with respect to inhibitor binding. To test this hypothesis, we created trypsin variants K60G, K60A, K60V, K60I, and K60R and characterized them with respect to their activities and sensitivities to the macromolecular inhibitors soybean trypsin inhibitor (SBTI) and bovine pancreatic trypsin inhibitor (BPTI). Our initial results show, compared to wild-type trypsin, K60A and K60V are catalytically indistinguishable, more resistant to autolysis, and more sensitive to inhibition by SBTI and BPTI. Further experiments with ecotin and other trypsin variants can provide additional insight on specific interactions. (This work was supported by NSF CAREER Award MCB-0643988-02 and NIH MARC T34- GM008574.)

FRI-106

HTLV-1 PROMOTER REGION NUCLEOSOME BINDING OF THE TRANSCRIPTIONAL COACTIVATOR P300 VIA ITS BROMODOMAIN AND PHD FINGER DOMAINJulio Flores Servin, Whitney Luebben, Jennifer Nyborg.*Colorado State University, Fort Collins, CO.*

Transcription from the integrated human T cell leukemia virus type-1 (HTLV-1) has been shown to require histone acetylation within promoter region nucleosomes. These acetylation events are carried out by the recruitment of p300 to the viral promoter region via interactions with the cellular transcription factor pCREB and the viral encoded oncoprotein Tax. The protein p300 is a large transcriptional coactivator protein with a histone acetyl-transferase (HAT) domain and multiple other domains, including a bromodomain and PHD finger domain. Research has shown that acetylation of histone H3-K14 is crucial for nucleosome disassembly and transcription activation, although the exact mechanism of nucleosome disassembly is not completely understood. Additionally, work on non-HTLV-1 nucleosomes has suggested that the bromodomain and adjacent PHD finger domain of p300 are involved in the binding of p300 to acetylated K residues on histone tails, resulting in an increased binding affinity of p300 to the nucleosome. Bromodomain and PHD finger domain binding have yet to be studied on the promoter region nucleosomes of HTLV-1. Since p300 and histone H3-K14 acetylation are crucial components of efficient HTLV-1 transcription, we have tested the hypothesis that bromodomain binding to the HTLV-1 promoter region nucleosomes requires the presence of acetylated lysine residues and specifically histone H3-K14^{Ac}. Using an immobilized HTLV-1 promoter template assembled into chromatin with various histone acetylation modifications, we observed binding of the bromodomain to the HTLV-1 promoter region. Our results suggest that bromodomain binding to the HTLV-1 promoter requires the presence of acetylated histone lysine residues but not necessarily just histone H3-K14^{Ac}.

SAT-117

THE EFFECTS OF OSMOTIC STRESS ON NUCLEAR PHYSICAL PROPERTIES IN *ARABIDOPSIS THALIANA*

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Chromatin density is critical for regulating gene expression, but what sets the volume of the cell nucleus remains poorly understood. In plants, nuclear volume increases linearly with DNA content. However, in metazoan nuclei, extracellular osmolarity can decrease nuclear volume and alter chromatin condensation. Despite the changes in extracellular osmolarity to which plants are subjected, the effects of osmotic stress on their nuclear physical properties remain unexplored. The aim of the present study is to determine whether osmotic stress in *A. thaliana* alters chromatin density *in vivo*. We hypothesize that changes in chromatin density occur under osmotic stress and may thereby trigger changes in gene expression. To investigate the effects of hyperosmotic stress on chromatin density and nuclear volume, root tissue from *A. thaliana* is incubated in controlled mannitol solutions of varied concentration. Thereafter, laser scanning confocal microscopy and a DNA intercalating dye with emission intensity linear to DNA content is used to concurrently measure nuclear volume and DNA content. Subsequent image analysis reveals the relationship between osmotic stress and chromatin density. A further understanding of the mechanisms by which osmotic stress initiates gene expression changes may provide additional insight to the challenge of producing drought-tolerant plants.

SAT-109

CONSTRUCTION AND ASSEMBLY OF PLANT EUKARYOTIC INITIATION FACTOR 3

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The purpose of this research is to produce the plant eukaryotic initiation factor 3 (eIF3) by expressing its individual subunits in bacteria and allowing complex formation *in vitro*. In producing a functional plant eIF3, we would be able to study its structure and function in translation initiation. The reconstruction of the 800 kDa human eIF3 has been recently achieved, and the complex was assembled in a stepwise manner where the dimer of subunits eIF3a and eIF3c was utilized as the fundamental framework with a subsequent stable octamer formation consisting of subunits a, c, e, k, l, m, f, and h. Based on the success of human eIF3 complex formation *in vitro*, the lab has cloned the plant eIF3 core octamer subunits into 3 expression vectors: ELMK-pACYC, AFHC-pRSF, and k-pET (k with an N-terminal His tag). The plan is to first determine optimal conditions for soluble expression of each expression cassette in bacteria and then mix soluble fractions obtained from each bacterial preparation in hopes of complex formation. Octamer formation would be determined using affinity purification of eIF3k with the N-terminal His tag. Upon successful octamer formation, we will express the rest of the plant eIF3 subunits in attempts to form the complete 13 subunit eIF3 complex *in vitro*. The reconstruction of eIF3 *in vitro* would allow us to further study the biochemical functions of this important complex in translation initiation.

FRI-120

MIG-10 GENE RESCUE IN *CAENORHABDITIS ELEGANS*

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The long-term goal of our research is the clarification of Grb7 protein function in cell migration with respect to the establishment of secondary tumors in cancer. Study of the homologous protein Mig-10 in *Caenorhabditis elegans* (*C. elegans*) provides a suitable whole organism model for exploration of Grb7 function. Both wild-type and mutated (with a truncated Mig-10 gene) *C. elegans* strains are utilized in these studies. *C. elegans* strains missing expression of the Mig-10 gene suffer several phenotypes with varying degrees of penetrance. These phenotypes include foreshortened excretory canals, compromised egg-laying ability, withered tails, and uncoordinated movement. The phenotypes result from deregulated axonal outgrowth of neurons responsible for development of the affected bodily regions. We hypothesize that reintroduction of the *Mig-10* gene (using gene-gun mediated plasmid transfer) into the *Mig-10* deficient *C. elegans* strains will result in subsequent normal (or near-normal) progeny. Thus, we hope to develop a working *Mig-10* gene rescue *C. elegans* system. With this system in hand, the future goal is to use the same technology to introduce a *Mig-10/Grb7* chimeric gene. If expression of this chimeric gene attains the same rescue of the *Mig-10*-deficient phenotype, the implication could be that the Grb7 protein has similar cell migration function to the Mig-10 protein. Such a result may provide valuable insight into the role of Grb7 in cell migration signaling.

FRI-122

A NEW LASER-DRIVEN NMR PULSE SEQUENCE FOR NMR SENSITIVITY ENHANCEMENTGelson Pagan¹, Yusuke Okuno², Jung Ho Lee², Silvia Cavagnero².¹*University of Puerto Rico, at Mayagüez, Mayagüez, PR*, ²*University of Wisconsin-Madison, Madison, WI*.

Many deadly neurodegenerative diseases arise from protein misfolding and aggregation. With its unmatched atomic resolution, NMR spectroscopy is ideally suited to provide structural and dynamic insights to develop rational cures. However, further increases in sensitivity are needed to render NMR even more powerful under mild, physiologically relevant conditions. Photo-chemically induced dynamic nuclear polarization (photo-CIDNP) is a laser-driven method that utilizes the radical pair that forms between oxidizable amino acids and photo-excited dyes. This method is capable of leading to large increases in NMR sensitivity in solution. The application of photo-CIDNP to ¹³C nuclei in conjunction with ¹³C-¹H heteronuclear correlation has proven particularly successful for the highly sensitive detection of aromatic amino acids in liquid state NMR. However, combining ¹³C photo-CIDNP with ¹H-¹³C-¹H heteronuclear correlation has the potential of yielding even further sensitivity enhancements. Therefore, we have combined photo-CIDNP with ¹H-¹³C-¹H heteronuclear correlation to seek such enhancements. While the EPIC-HSQC pulse sequence exploits ¹H-¹⁵N-¹H correlation, the novel sequence that we designed, denoted as ¹³C-EPIC-HSQC, focuses on ¹H-¹³C-¹H correlation. Theory predicts that the novel NMR pulse sequence should provide a four-fold increase in sensitivity. It is hoped that this enhancement will render solution-state NMR more readily applicable to low-micromolar solutions. Method development and applications to tryptophan and other biomolecules of medical relevance will be discussed in the poster.

SAT-123

BACTERIAL DYNAMICS IN THE MOSQUITO GUT VISUALIZED BY FLUORESCENTLY LABELLED BACTERIAL STRAIN OF *ENTEROBACTER* SPAlejandro Uentillie, Jiannong Xu.*New Mexico State University, Las Cruces, NM.*

The mosquito gut is a complex ecosystem filled with microbiomes. The gut content, which has many microbiome fauna, affects the fecundity and immunity of the host's traits. In order to understand the dynamics of bacterial behavior, we introduced the bacterium *Enterobacter* sp. Ag1 into mosquito gut by feeding. To be able to track the bacteria, we tagged the bacterial strain with green fluorescent protein (GFP). After feeding mosquitoes on sugar pad with tagged bacteria, we tracked the bacteria in the gut by observing mosquito gut under a fluorescent microscope. The results showed that tagged bacteria were present in the sugar-fed and proliferated in blood-fed mosquito guts. To further understand how bacteria colonize the gut and the genes involved in colonization, we generated bacterial mutants. Two mutants were selected to test their capability to colonize the gut. One mutant *P1A6* had gene encoding LPS O antigen ligase disrupted. The other mutant *P12D2* had gene encoding ADP-heptose:LPS heptosyl transferase I disrupted. Both genes are involved in LPS biosynthesis. The disruption of those genes had effects on LPS structure on the bacterial cell wall. We mixed the RFP tagged wild type (wt) and GFP-tagged mutants in 1:1 ratio, and let mosquitoes ingest them. Then we tracked their dynamics in the gut. Gut dissection revealed more of the wt/RFP than the mutants *P12D2* and *P1A6*. The results indicate that both genes were required for bacterial colonization in the mosquito gut.

FRI-115

NUTRIENT CONCENTRATION AND ITS EFFECTS ON SECONDARY METABOLITE PRODUCTION IN MYXOBACTERIA CULTURESPeter Gomez, Nicholas Lorig-Roach, Tyler Johnson, Marija Drašković, Mitchel Crews, Phil Crews.*University of California, Santa Cruz, Santa Cruz, CA.*

Myxobacteria, a group of Gram-negative swarming aerobic bacteria found in terrestrial and marine sediments, possess a largely unexplored potential for discovery of novel organic compounds with useful applications as therapeutic leads. Some strains are known to be producers of useful chemotypes such as myxovirescins, secondary metabolites previously reported to possess antibiotic activity from *Myxococcus virescens*. However, myxobacteria are often challenging to grow in culture, making it difficult to acquire enough material for chemical analysis to broaden the knowledge base of obtainable secondary metabolites of this organic type. This experiment attempts to better understand the nutritional requirements for optimal myxobacterial metabolite production by comparing three liquid media types with different nutrient concentrations. As a test subject, we shall be using a myxobacteria strain isolated from sediment samples taken from Wilder Ranch State Park, a coastal region in northern California. Initial

investigations have shown that this strain is a producer of known myxovirescin analogues. We will inoculate three 3 L cultures containing 1X, 1/4X, and 1/8X concentrations of cooked yeast and casitone, the primary nutrients used to feed myxobacteria in our cultures. The produced metabolites will then be adsorbed onto compound-binding resin and extracted with methanol. The extracts will then be chromatographically fractionated and analyzed using LC-MS/ELSD. By quantitatively comparing myxovirescin analogue production from these three different growth conditions, we hope to increase our understanding of myxobacterial nutritional preference and obtain insight into improving culturing techniques.

FRI-113

LOCALIZATION OF EIF4G1 IN ARABIDOPSIS THALIANA

Amy Prater, Karen Browning.

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Translation is a highly regulated process involving initiation, elongation, and termination. One of the first steps in initiation is the binding of the eIF4F complex composed of eIF4G, the scaffolding protein, and eIF4E, the cap-binding protein, to the 5' capped region of the mRNA and bringing it into contact with the 40S ribosomal subunit. The mRNA-bound ribosome then scans along the mRNA until it reaches the correct initiation codon. Upon recognition, a conformational change allows for the 60S ribosomal subunit to associate with the complex, permitting the sequence to be translated into protein. In plants, there is an alternative complex to eIF4F that performs this same function: eIFiso4F, which is composed of two subunits, eIFiso4E and eIFiso4G. There are two possible isoforms of this iso4F complex, iso4G1 with iso4E or iso4G2 with iso4E due to the presence of two genes encoding iso4G. As opposed to the eIFiso4G1 complex, eIFiso4G2 expression is generally low within the plant. However, when 4G or iso4G1 are knocked out, the presumed low expression levels of eIFiso4G2 are still enough to support plant growth. To aid in understanding the role of the eIFiso4G2 and eIFiso4G1, homozygous eIFiso4G2 and eIFiso4G1 GFP-tagged plants were grown on plates and then examined using confocal microscopy to determine where in the cell, as well as where in the plant, eIFiso4G2 expression is localized.

SAT-112

A STUDY OF THE BEHAVIOR OF VOLTAGE-CURRENT CURVES FOR THE PROTOTYPE INTERFACE FILM BACTERIA / MCD-NCD

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The National Institutes of Health reported that 60% of all microbial infections are caused by biofilms, which are due to microbial presence on the surfaces of implants in the human body and on surgery tools. The medical industry can benefit greatly from coatings designed to reduce bacterial viability on implants and medical tools. In the present work, we have evaluated the response to the electric current generated by a biofilm formed by bacteria that can be either Gram negative or positive on the surface of microcrystalline (MCD) and nanocrystalline (NCD) diamond. The preliminary results demonstrated a change in the effective resistance of NCD and MCD material when a biofilm is formed on its surface. Furthermore, an oscillating behavior was observed in the curves of electric current versus voltage due to the presence of a bacterial strain droplet on the surface of MCD and NCD starting at 1.6 v and ranging from 0.2 v to 4.0 v, similar to RC electric circuit. These studies are focused on the hypothesis of the mechanism of bacterial inhibition most accepted, which involves an electrostatic relationship between the organism and the substrate in contact. The voltage-current measurements were taken with modified contact angle equipment, elaborated in the laboratory. Other studies of characterization were done using the scanning electron microscope, atomic force microscope, and Raman spectroscopy. These studies allow us to infer that the formation of biofilm on biomedical instruments can alter their electrical response, thus providing misleading results, which can be prejudicial for patient diagnosis.

SAT-124

CIRCULAR DICHROISM FOR MONITORING THE CONFORMATIONAL CHANGES OF AMYLOIDOGENIC ISLET AMYLOID POLYPEPTIDE

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Islet amyloid polypeptide (IAPP) is an amyloidogenic protein secreted in the β cells of the pancreas. Similar to other amyloid proteins, IAPP has the ability to misfold and form amyloid plaques in the β cells, causing cell death and

symptoms associated with type II diabetes. It is believed that inhibition of plaque formation can delay, or even prevent, the onset of type II diabetes. IAPP has a natural β -sheet conformation when forming the toxic species. Circular dichroism (CD) is a powerful technique used in the determination of the secondary structure of proteins and can be used to determine a change in the secondary structure of IAPP when tested against potential inhibitors. Extracts of seven common fruits were prepared as inhibitors and analyzed for their ability to prevent the change in IAPP from its native form to its toxic configuration.

FRI-124

BIOCHEMICAL AND STRUCTURAL STUDIES OF THE IST1-ULK3 COMPLEX

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The ESCRT pathway mediates membrane fission during the abscission step of cytokinesis. ESCRT-III proteins, including IST1, play important roles during abscission, including membrane constriction and recruitment of other proteins. We have recently shown that the kinase ULK3 interacts directly with IST1 and that depletion of ULK3 induces abscission defects, implying that the two proteins work together during abscission. We are now characterizing how IST1 and ULK3 interact. ULK3 contains two predicted MIT (microtubule interacting and transport) domains which are 3-helix bundles that bind MIMs (MIT interaction motifs) within ESCRT-III proteins. We hypothesize that one or both of the ULK3 MIT domains bind one or both of the two MIM elements within IST1. To map the ULK3-IST1 binding sites, we will compare IST1 binding to wild-type ULK3 vs. ULK3 proteins with inactivating point mutations in either or both of the MIT domains. We are also using NMR spectroscopy to characterize the binding of ULK3 to IST1. Specifically, we have purified a ¹⁵N-labeled ULK3 construct that spans both MIT domains (termed ULK3(MIT)₂) and used chemical shift changes to follow the binding of an unlabeled fragment of IST1 (termed IST1(MIM)). Backbone amide resonances in ULK3(MIT)₂ shift upon titration of IST1(MIM), confirming that the ULK3-IST1 interaction is direct. NMR spectroscopy will now be used to determine the three dimensional structure of the IST1(MIM)-ULK3(MIT)₂ complex. This structure will reveal how IST1 and ULK3 interact, help us to understand IST1 regulation, and possibly guide the design of new strategies to prevent or repair cytokinesis defects.

FRI-112

QUANTIFYING ANTIOXIDANT ABILITY OF IONIC MANGANESE IN WORM-FREE *C. ELEGANS* EXTRACTS BY ELECTRON PARAMAGNETIC RESONANCE SPECTROSCOPY

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While superoxide dismutase and other antioxidant enzymes combat the normal production of free radicals within a cell. An excess of free radicals has been linked to pro-oxidant effects that can lead to cellular damage, promoting aging and various degenerative diseases. Divalent manganese, Mn(II), has been shown to function as a protective factor against free radicals in both prokaryotic and eukaryotic organisms. However, the mechanism by which ionic manganese plays a role in scavenging free radicals is not yet understood. In order to study this mechanism, *Caenorhabditis elegans* is used as a multicellular model organism, with a genome approximately 40% homologous to that of humans, to study ionic manganese and its activity with transient, unstable reactive species *in vivo*. By nitron spin trapping the most reactive intracellular radicals, including hydroxyl radical (OH), we will be able to investigate free radical scavenging ability of divalent manganese within *C. elegans* for the first time via electron paramagnetic resonance spectroscopy. Preliminary control experiments have shown slight reduction of radical signal in the presence of unbound, free divalent manganese. Although these results do not significantly confirm antioxidant effects, these control experiments do not account for the potential effects of small cellular molecules that may improve the antioxidant ability of ionic manganese. Now, our primary goal is to examine antioxidant ability *in vitro* in cell-free low molecular weight *C. elegans* worm extracts in the absence and presence of ionic manganese.

FRI-121

TOWARDS UNDERSTANDING THE FUNCTIONAL CONFORMATION OF THE GRB7 PROTEIN

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Growth factor receptor-bound protein 7 (Grb7) plays a role in cell migration pathways mediated by integrins and focal adhesion kinase (FAK). In previous research, Porter et al. found the dimerization disassociation constants of full length Grb7 and the Grb7-SH2 domain alone were the same order of magnitude (11 mM and 22 mM, respectively).

This suggests the Grb7-SH2 domain forms the primary basis for dimerization in the Grb7 protein. Subsequently, Depetris et al. solved the crystal structure of the Grb10 RA-PH protein domains. Grb10 is a homologous protein to Grb7. In this structure, and through size exclusion data, there is some indication the RA-PH domains of the Grb10 protein also form a dimer. Further, mutation of two residues in the C-terminal α -helix of the PH domain may cause disruption of the dimer interface, and subsequent loss of RA-PH domain association. In our own laboratory we have found, through size exclusion chromatography, the Grb7-RA domain also exists as a dimer. Our own result, and that of Depetris et al., contradicts the Porter et al. findings describing the basis of dimerization in the Grb7 protein. We believe the Grb7-RA domain may play an important role in homodimerization of the full-length Grb7 protein. Exploration of this hypothesis will further clarify the relevant functional form of the Grb7 protein. We report our progress towards establishing the binding strength of the Grb7-RA dimerization interaction and exploring the residue contact requirements at the domain interface.

FRI-126

CRYSTAL STRUCTURE OF THE G-PROTEIN RAC1 IN COMPLEX WITH THE REGULATORY SUBUNIT (RIIB) OF CAMP-DEPENDENT PROTEIN KINASE A

Luis Moreno Jr., Ping Zhang, Susan Taylor.

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Rac1 is a small signaling G protein that belongs to the Ras superfamily of Rho proteins and acts as a molecular switch to control cytoskeletal rearrangements and cell growth via activation of various protein kinases. In recent studies, Rac1 was found to contain A-kinase anchoring protein properties (AKAP), which have the common function of binding to the regulatory subunit of cAMP-dependent protein kinase A (PKA) and restricting the holoenzyme to discrete locations within the cell. Additionally, Rac1 has been shown to bind to the regulatory subunit (RII β) of PKA, forming an inactive stable complex. The scope of this project is to express and purify Rac1 and PKA (RII β) and identify its interactions, and obtain a crystal structure of Rac1:PKA(RII β) complex.

FRI-109

IDENTIFYING INHIBITORS OF ZIPA THROUGH COMPUTATIONAL AND BIOCHEMICAL SCREENING

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Many formerly treatable bacterial infections are becoming harder to cure because widespread overuse of antibiotics has led to the development of antibiotic resistant strains. The aim of my project is to find a new antibiotic that will disable bacteria by a different mechanism than current antibiotics. A new possible pathway to inhibit bacterial growth is by interrupting the interaction of two proteins involved in cell division, ZipA and FtsZ. The interaction between ZipA and FtsZ is found in the vast majority of bacteria, so interfering with it with a small molecule should be effective for many different bacterial strains. The mechanism starts with multiple FtsZ proteins creating a loop of incomplete cytoskeletal filaments which are called the Z-ring. The Z-ring spans the equator of the cell just underneath the cytoplasmic membrane. During cell division, ZipA binds to FtsZ, which causes the filaments to connect and a solid loop to form across the middle of the bacterial cell. This loop then shrinks at the end of cell division, causing the telekinesis of the cell into two distinct cells, thus producing more bacteria. Without ZipA, the fragments do not connect or condense to divide the bacteria. An effective antibiotic would inhibit the interaction in between ZipA and FtsZ. A small molecule would be put in the binding site on FtsZ, hindering the ability of the ZipA to bind. The small molecule would outcompete the ZipA and effectively stop cell division in the bacteria.

SAT-106

BIOPHYSICAL CHARACTERIZATION OF MOUSE POLYAMINE OXIDASE

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Mouse polyamine oxidase (mPAO) is a mammalian flavoprotein that is necessary for the catabolism of polyamines. The mPAO oxidizes the *endo* carbon-nitrogen bonds of N1-acetylspermine and N1-acetylspermidine when oxidized to spermine and spermidine respectively. It is known that normal levels of polyamines are important for cell growth, yet their actual function is not well understood. The structure of mammalian PAO has yet to be determined; however, structures for maize and yeast PAO (Fms1) exist. Although the identity between mPAO, Fms1, and maize PAO is only 20%, it has been shown, through sequence comparison and mutational analysis, that a conserved histidine residue at position 67 of Fms1 and 64 of mPAO helps to properly position the amine substrate for oxidation. Determining

the crystal structure of mPAO will help identify other residues that play a role in substrate binding and catalysis. The mPAO was cloned into pAG8H, a modified pET19d vector that introduces a cleavable his-tag at the N-terminus of the protein. The mPAO was expressed and purified using a nickel column followed by an anion exchange column. Following the purification process, analytical ultracentrifugation sedimentation velocity experiments were performed to determine the oligomerization state and homogeneity of the protein. The sedimentation velocity experiments revealed a homogeneous, monomeric mPAO in solution, in contrast to the dimeric form of Fms1 in solution. Crystallization trials are underway to determine the structure of mPAO.

SAT-125

SYNTHESIS OF AGOUTI SIGNALLING PROTEIN FOR IMPROVING THE TREATMENT OF MELANOMARodrigo Andrade¹ Jillian Miller².¹Hartnell College, Salinas, CA, ²University of California, Santa Cruz, Santa Cruz, CA.

Melanoma causes a large majority of skin cancer deaths. According to the American Cancer Society, approximately 10,000 people are expected to die of melanoma this year in the United States. Melanoma is difficult to treat because melanosomes, organelles containing the pigment eumelanin, prevent chemotherapy from working. Agouti signaling protein (ASIP) binds to melanocortin receptor 1 and suppresses the production of eumelanin; thus, fewer melanosomes are formed and their ability to absorb and inactivate chemotherapeutics is minimized. When cells are treated with ASIP, chemotherapy has been shown to be three times more successful in treating melanoma. In order to continue using ASIP to treat melanoma, ASIP is synthesized using solid phase peptide synthesis, oxidative folding, and purification using HPLC. It will then be further tested for its effectiveness in melanoma treatment in model organisms.

FRI-110

ANTIBACTERIAL PROPERTIES OF MICROCRYSTALLINE DIAMOND FILMS WITH SILVER NANOPARTICLES INCORPORATEDZuania Cordero Badillo¹, Javier Avalos², Gerardo Morell².¹University of Puerto Rico, Rio Piedras, San Juan, PR, ²Universidad de Puerto Rico, Bayamón, Bayamón, PR.

Nosocomial infections are expensive and responsible for millions of deaths per year. To decrease this problem, innovative microcrystalline diamond films with silver nanoparticles incorporated (MCD-Ag) were successfully elaborated, characterized chemically and physically, and tested for antibacterial capacity. Recent studies demonstrated that pure silver films are more effective antibacterial agents compared to microcrystalline diamond films. The incorporation of silver nanoparticles in the microcrystalline diamond films yielded a significant improvement in its antibacterial properties. In order to perform the bacterial characterization of these MCD-Ag films, a rigorous protocol for bacterial culture was executed and the development of the bacterial populations was assessed through growth curves and absorbance measurements with an ultraviolet-visible spectrophotometer. Furthermore, the technique of bacterial transfer was used to conduct a temporal quantitative analysis of the MCD-Ag bacterial inhibition properties resulting in zero bacterial growth within 24 hours. Additionally, scanning electron microscope (SEM) spectroscopy allowed us to obtain imaging of the colonial behavior of the *P. Aeruginosa* on the surfaces of the MCD-Ag films. The elaboration of the ground-breaking MCD-Ag films was achieved via the technique of hot filament chemical vapor deposition. The chemical and physical characteristics of the MCD-Ag films were assayed through transmission electron microscopy (TEM) and Raman spectroscopy.

SAT-121

CHARACTERIZING OLIGOSACCHARIDE STRUCTURE AFTER DIGESTION OF HEPARIN USING HEPARITINASESScott Willie¹, Caitlin Mencio², Kuberan Balagurunathan².¹San Juan College, Farmington, NM, ²University of Utah, Salt Lake City, UT.

Heparin (HP) and heparan sulfate (HS) are glycosaminoglycan chains that have uronic acids and glucosamine disaccharides that can be sulfated in up to 4 positions. These chains bind to other proteins for vitally important cellular events including growth control, signal transduction, cell adhesion, hemostasis, and lipid metabolism. Medically, HP is used as an anticoagulant to prevent blood clots. In 2008, there were reports of heparin-related deaths in the US due to raw stock contaminated with chondronitin sulfate from an overseas factory. Our lab's goal is to understand the interaction of HP with proteins for therapeutic purposes. We are assembling a library of oligosaccharides with diverse lengths and sulfation patterns. Previous studies have shown that heparitinase III digests sulfated chains to create

specific oligosaccharides, and we want to understand whether different isoforms will create different oligosaccharides. With this initial study, we will be using high-pressure liquid chromatography (HPLC) to separate the oligosaccharide chains and analyze sulfation and size using mass spectrometry. Our expected results for the experiments are for the digestion of HP by different heparitinases to produce oligosaccharides with different characters of structure and length.

SAT-108

STRUCTURE-FUNCTION STUDIES OF THE DIVERSE ADPGLUCOSE PYROPHOSPHORYLASE FROM *THERMODESULFOVIBRIO YELLOWSTONII*

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Currently, fossil fuel is the leading source of energy and is rapidly being depleted. A renewable supply of alternative fuel could be made from bacteria and from the conversion of starch to bioethanol. ADPGlucose pyrophosphorylase (ADPG PPase) *glgC* gene product catalyzes the rate-limiting step of glucan biosynthesis in plants and bacteria. Engineering of this enzyme family will allow for the increased production of renewable carbon. The *Thermodesulfobacterium yellowstonii* (*Td.y*) *glgC* gene has been successfully cloned and the recombinant enzyme purified. This enzyme displays only about 30% identity to other characterized ADPG PPases and harbors unusual sequences in regions involved in regulation. Molecular modeling studies revealed that the *Td.y* enzyme was most similar to a plant enzyme, in accord with 3-phosphoglycerate (3-PGA) activation. Heat stability up to 75 °C required the presence of ATP. Initial kinetic studies were performed at 37 °C (pH 7.5) and revealed $S_{0.5}$ values for ATP and Mg of 8.0 mM and 13.9 mM, respectively, and a V_{max} value of 5.33 units/mg. The metabolites PEP (2 mM), glucose-6-phosphate (2 mM), and 3-PGA (2 mM) were found to increase the apparent affinity for ATP by 4.2, 10.3, and 3.8-fold, respectively. PEP also increased the V_{max} by 2.0 fold. Based on alignment studies and molecular modeling, the following site-directed mutants have been generated to probe regulatory properties: E15S, F18K, F23R, S25A, and S28A. Complete characterization of the native and altered proteins is underway.

FRI-114

UNDERSTANDING HOW THE DISTAL POCKET ENVIRONMENT AFFECTS THE LIGAND BINDING AFFINITY OF NITRITE TO HEME PROTEINS

Adriana Garcia, Raymond Esquerra.

San Francisco State University, San Francisco, CA.

Cardiovascular diseases are the leading causes of death worldwide. Nitric oxide plays a fundamental role in cardiovascular health, and disruptions in normal nitric oxide physiology are associated with the progression of cardiovascular diseases. Recently, it was shown that heme proteins can support vasodilatation during hypoxia by converting nitrite (NO_2^-) to nitric oxide (NO), and that this nitrite reductase activity of heme proteins plays an essential role in a variety of physiological processes. There is a large range in nitrite affinity and nitrite reductase activity in heme proteins with the same active site. This research seeks to understand more clearly how the protein environment controls the binding chemistry of nitrite to the heme active site. Our goal is to determine how the distal pocket environment affects the binding affinity of nitrite to metmyoglobin mutants. Our hypothesis is that the distal pocket environment can increase the binding affinity of nitrite by influencing the binding mode (o-nitrito vs. n-nitro) by way of electrostatic and steric interactions. We compare the binding affinity of a series of distal pocket mutants that affect hydrogen bonding, polarity, and the size of the distal pocket. We will correlate coordination chemistry and binding affinity in order to establish a clear picture of how the protein environment controls nitrite-binding affinity in heme proteins. Understanding how the protein environment influences nitrite binding in heme proteins helps to understand how these proteins generate NO physiologically and in designing therapeutics based on the nitrite reductase activity of heme proteins.

SAT-114

DYSSYNCHRONOUS CIRCADIAN RHYTHMS CAUSED BY RESTRICTED FEEDING IS ASSOCIATED WITH DIABETESSteven Just¹, Judith Simcox², Donald McClain².¹University of Minnesota, Morris, Morris, MN, ²University of Utah, Salt Lake City, UT.

Circadian rhythms (CRs) evolved to align energy use with energy availability. The central clock in the brain is set by light while peripheral clocks, found in all major organs, can be independently set by environmental cues other than light. Feeding, for example, resets the liver clock. Dyssynchrony between the central and peripheral clocks leads to aberrant CRs that are associated with diabetes. We tested the hypothesis that creating dyssynchrony between the brain and liver clocks by restricted feeding (RF) will lead to impaired glucose use, a hallmark of diabetes. We restricted the feeding of wild-type C57BL/6J mice to the daytime, when mice normally sleep, and determined glucose tolerance and insulin sensitivity. Control mice that normally eat most of their food at night were fed *ad libitum*. Following a glucose challenge, we observed a significant elevation in fasted blood glucose ($p < 0.05$), increased insulin resistance (HOMA-IR, $p = 0.02$) and decreased beta-cell function (HOMA-B, $p = 0.03$) in the RF mice compared to controls. We investigated the molecular mechanisms of nutrient resetting of the liver clock in a HepG2 cell culture model and observed increased circadian expression of gluconeogenic enzymes PEPCK and G6Pase as well as modulation of circadian transcripts Rev-Erba and Clock. These results will allow us to move toward examining the role of specific nutrients and micronutrients (iron) in feeding and circadian dyssynchrony. Our findings will also lead to a better understanding of how metabolic parameters affect the increased risk of diabetes seen in night-shift workers.

SAT-111

ASSEMBLY OF AMYLOID NANOSTRUCTURES FROM HYBRID PEPTIDE-POLYMER MOLECULESJose Dominguez IV, Sarah Warren, Tania Betancourt.

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Amyloid fibrils have gained much attention recently within the scientific community. Amyloids are insoluble protein aggregates composed of polymerized cross-linked β sheets that are typically between 5 to 12 nm in width and have variable lengths. Amyloids have properties that make them ideal candidates for use in bionanotechnology, namely their exceptional strength, elasticity, and stability as well as their ability to self assemble. In particular, our research is interested in amyloids and their potential use in the assembly of hybrid peptide-polymer supramolecular nanostructures via noncovalent interactions. Studies are being carried out using KLVFFAE, the amyloidogenic peptide sequence of A β protein associated with Alzheimer's disease. These studies focus on the effects of polyethylene glycol (PEG) modification on the amyloid self-assembly process: specifically, the modulation of nanostructures of varying sizes and configurations. Solid-phase synthesis has been used to prepare modified peptides that contain functional amino acids to enable site-specific PEGylation. MALDI-TOF was used to confirm the molecular weight of the synthesized peptides. Peptides were conjugated to PEG using carbodiimide or maleimide-thiol chemistry. Self assembly of these conjugates into amyloid-like structures was investigated under varying temperature and shaking conditions. The resulting nanostructures were characterized using TEM and fluorescence spectroscopy. Results indicate that the presence of PEG alters the properties of the peptide aggregates. While our initial goal is to investigate the self-assembly of hybrid bionanomaterials, we expect these efforts will contribute to a better understanding of the amyloidogenesis processes related to amyloid-related diseases and to the development of self-assembled biomaterials for various applications.

FRI-125

THE EFFECT OF SILVER NANOPARTICLES ON PLANT GROWTH PATTERNSCailin Jones¹, Kwok-Tuen (Raymond) Tse².¹DePaul University, Chicago, IL, ²Harold Washington College, Chicago, IL.

Nanoparticles (NPs) are constantly consumed both voluntarily and involuntarily by living organisms and are used to make everyday products such as make up, medicines, and pesticides. Although bulk material (≥ 100 nm) and NPs (< 100 nm) are made from the same metal, NPs differ not only in size but chemical properties as well, which could pose a potential threat to an organism's health. Metal NPs are insoluble and can easily enter a human's body by inhalation, ingestion, or penetration through the skin. They travel through the blood stream and attach themselves to key organs. The proposed experiment entails preparing NPs and testing their effects on plant-life. It is hypothesized that silver nanoparticles (Ag-NP) will affect seed germination and growth patterns of a plant. The Ag-NPs will be

prepared using chemical reduction to precipitate out the solid Ag-NPs. Radish and mustard-green seeds will be used for this experiment because they are easy to grow and will germinate within a short time. The seeds are cultivated in a Petri dish on a moist paper towel to observe germination rate. To analyze growth patterns, the seeds will be grown in soil and watered with water containing various concentrations of the Ag-NPs. Signs of plant abnormalities will help determine which concentration causes the most damage. The experiment with the plants has not been conducted yet, but silver nanoparticles have been successfully prepared.

SAT-119

CRYSTALLIZATION OF THE HETERODIMERIC 220KDA NUP84-NUP133 NUCLEAR PORE SCAFFOLDING UNIT

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The nuclear pore complex (NPC) is a 40 to 60 MDa protein complex that coats circular openings in the nuclear envelope and serves as the main conduit for molecular transport into and out of the nucleus of the eukaryotic cell. In an effort to understand the atomic structure of the NPC, a divide-and-conquer strategy is applied. The entire NPC is a modular structure built from multiple copies of biochemically defined subassemblies that are individually amenable to structural characterization. The scaffold ring of the NPC coats the nuclear envelope and is characterized by two major subcomplexes: the heptameric Y- or Nup84-complex and the heteromeric Nic96 complex. The Y-complex has 7 universally conserved components: Nup84, Nup85, Nup120, Nup133, Nup145C, Sec13, and Seh1. Crystal structures of many Y-complex fragments are available, making it the best-characterized subcomplex of the NPC. Our work focused on solving the structure of the Nup84-Nup133 complex from yeast. The human homolog has already been characterized in part to high resolution and was used to model the interaction site for the yeast Nup84-Nup133 complex based on sequence conservation. Nup133 truncations were designed based on homology modeling to produce a minimal interacting complex ideal for crystallization. Full length Nup84 was coexpressed with truncations of Nup133 in *E. coli*. The complex was copurified via nickel affinity, ion exchange, and size-exclusion chromatography. Crystallization studies are currently under way with the goal of completing a composite structure of the entire universally conserved heptameric Y-complex.

FRI-107

ER STRESS: A POSSIBLE MECHANISM FOR CLOZAPINE-INDUCED METABOLIC SYNDROME

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The atypical, antipsychotic drug clozapine causes metabolic syndrome as a side effect in some patients. The mechanism through which these side effects come about is unknown. It has been suggested that clozapine could cause mitochondrial dysfunction and endoplasmic reticulum (ER) stress, both of which are known to cause metabolic syndrome. In this study, we are exploring the effects of clozapine on ER stress. We hypothesized that treating cells with clozapine would induce ER stress. The ER is responsible for proper folding and secretion of proteins in normal cellular conditions. Under stressful conditions, however, the ER may initiate the unfolded protein response (UPR) which is intended to minimize the production of misfolded or unfolded proteins. This is accomplished by changes in gene expression and cell death in extreme cases. To test our hypothesis, we measured the expression of ER stress response genes *Gadd34*, *Chop10*, and *Hspa5* in cultured mouse adipocytes (3T3-L1), myoblasts (C2C12), and monocytes (RAW 264.7) treated with increasing concentrations of clozapine: 0, 25, 50, and 75 uM, for 24 hours. After 24 hours, RNA was isolated for qRT-PCR. In 3T3 cells, increasing concentrations of clozapine led to significant upregulation of both *Chop10* and *Gadd34* genes (p values of 0.0199 and 0.0097, respectively). These initial results suggest that clozapine does cause ER stress, and this may be one mechanism by which clozapine causes its adverse effects.

FRI-117

CHARACTERIZATION OF CHEMOTAXIS CLUSTER EXPERIMENTS

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Microscale interactions among marine microbes drive carbon and nutrient cycles in the global ocean. The ecological activities of bacteria and phytoplankton are critical to biogeochemical cycles, yet we lack a fundamental understanding of the physical behaviors that underpin the interactions between these two groups. The focus of this project will be on the physical interactions between two model organisms, the bacterium *Marinobacter adherens* and the diatom

Thalassiosira weissflogii. It is hypothesized that chemotaxis, the sensing of chemical gradients and subsequent movement toward them, enables *M. adherans* to accumulate in dense chemotactic clusters around individual *T. weissflogii* cells. It is predicted that *T. weissflogii* emits pulses of dissolved organic matter (DOM) at distinct times during its growth cycle. *M. adherans* then accumulates due to the increase in nutrients in their immediate microscale environment. Growth behavior for each organism will be characterized. Chemotaxis-cluster experiments will then be performed by combining the model organisms and capturing the interactions using video microscopy. Image analyses (via Matlab) will be performed to quantify chemotactic behavior and chemotactic-cluster intensity surrounding individual diatom cells. Since phytoplankton are at the core of the marine food web, studies of interactions in these model organisms will help explain the fate of marine organic matter.

SAT-116

SECOND GENERATION ANTIPSYCHOTIC ASENAPINE AS A POTENTIAL ADJUVANT TO CIPROFLOXACIN THROUGH BINDING OF EFFLUX PUMP NOR A IN STAPHYLOCOCCUS AUREUS

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Knowledge of efflux-pump inhibition in *Staphylococcus aureus* by the antipsychotic drug chlorpromazine has led to testing of efflux-pump inhibition with the recently FDA approved second-generation antipsychotic asenapine (ASEN). The objective of this study is to determine the capability and potential mechanism of ASEN inhibition of NorA efflux pump activity in *S. aureus*. We determined the following: synergistic growth-inhibitory activity was seen with a treatment of ASEN at 50 ug/mL and 1 ug/mL of ciprofloxacin (CIP); ethidium bromide (EtBr) efflux inhibition was observed with the addition of ASEN at 50 and 100 ug/mL; growth suppression was observed with treatment of ASEN at 50 ug/mL and 2ug/mL of CIP, which led to a bacteriostatic effect after 24 hours; ASEN at 50 - 200 ug/mL with or without CIP at 2 ug/mL did not cause membrane potential perturbation; and *in silico* docking study revealed an ASEN binding site in a predicted NorA model. In conclusion, we propose that ASEN binds to NorA to exert synergistic effects with CIP and EtBr. This warrants further investigation of ASEN as a potential adjuvant with CIP in the management of staphylococcal infections. (Supported by NIH-MBRS-IMSD Grant GM-55246 and Minority Access to Research Careers (MARC) Program, NIH Grant GM-69337.)

FRI-118

DISSECTING THE PROTEIN FEATURES THAT CONTROL SUBSTRATE SPECIFICITY OF AAA+ PROTEASES

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AAA+ proteases are critical in all cells as they are involved in protein quality control and in regulatory circuits. They are composed of a compartmental peptidase (e.g., ClpP₁₄) with active sites sequestered in an interior chamber, and a hexameric ring of an AAA+ unfoldase. *E. coli* ClpX and ClpA are two of the best characterized AAA+ unfoldases; these enzymes contain one or two AAA+ rings, respectively, and each has a unique N-domain that is important for substrate recognition and adaptor protein interaction. ClpS, an adaptor protein that binds the ClpA N-domain, enhances N-end rule substrate recognition and simultaneously inhibits ssrA-tagged substrate degradation. To dissect mechanisms responsible for substrate specificity, we engineered a chimeric AAA+ protease that consists of the ClpA N-domain and the AAA+ ring of ClpX (ClpANX). This chimera carries the major determinants needed for the enzyme to bind the ClpA adaptor ClpS fused to the protein-unfolding/ATPase domain of the ClpX enzyme. With this chimera, we intend to answer whether the adaptor-binding domain of ClpA is sufficient to communicate information about substrate specificity and catalytic activity to the unrelated partner enzyme ClpX. ATP hydrolysis experiments with ClpANX will show if the N-domain of ClpA affects the ATPase rate of the ClpX AAA+ ring. Fluorescent anisotropy with labeled peptide or protein substrates will allow investigation of substrate-binding affinity and specificity. Lastly, degradation experiments with differently controlled classes of substrates (e.g., N-end rule and ssrA substrates) will reveal the degree to which the N-domain rules substrate choice and delivery.

SAT-113

DETERMINATION OF OXIDATION SUSCEPTIBLE CYSTEINES WITHIN MAIZE PHOSPHOENOLPYRUVATE CARBOXYLASE

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Phosphoenolpyruvate carboxylase (PEPC) is an enzyme that is critical for the fixation of carbon dioxide within C4 plants. Evidence from thiol-reactive inhibitors suggests that PEPC is regulated by reversible oxidation of the cysteine thiols. The K_m of the enzyme increases 2-3 fold when treated with a thiol-reactive agent. It is not known which cysteines are responsible for altering PEPC activity. The cysteine oxidation prediction algorithm (COPA) was used to predict the PEPC cysteines that are susceptible to redox-mediated regulation. COPA predicted three sites of oxidation in PEPC (C308, C335, and C424). The goal of our experiment is to map the redox-regulated cysteines within PEPC to give us insight into mechanisms of regulation. Methoxypolyethylene glycol-maleimide (MAL-PEG), a 5000 dal thiol-reactive agent, allowed us to determine the number of cysteines per PEPC that are exposed to oxidant. Mutant forms of PEPC, where cysteines are replaced with serines, were used to map sites that are MAL-PEG reactive. Such cysteines would be predicted to be sensitive to oxidants and downregulate PEPC activity. By exposing the enzyme with a thiol-reactive agent and systematically mutating cysteines into serines, we will gain the ability to predict both the amount and site of redox-regulated cysteines within PEPC. Redox regulation at cysteine residues is a novel way to regulate PEPC. Our research will give us insight into this regulatory mechanism.

SAT-115

STRUCTURAL AND BIOCHEMICAL CHARACTERIZATION OF A UNIQUE SHELL PROTEIN FROM GLYCYL RADICAL ENZYME BACTERIAL MICROCOMPARTMENTS

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Bacterial microcompartments (MCPs) are giant protein complexes that range from 80 to 150 nm in diameter. A thin protein shell surrounds their inner contents similar to a viral capsid. Shell protein monomers of the BMC type oligomerize to form hexamers which typically bear a narrow central pore. Hexamers align tightly together forming flat surfaces that make the flat facets of the polyhedral shell. MCPs encapsulate enzymes and cofactors that are involved in specific metabolic processes. Throughout the years, MCPs have been associated with various metabolic functions. A recently discovered MCP is involved in propanediol degradation via a glycyl radical enzyme. This MCP is found in enteropathogenic bacteria, and has been named the Grp microcompartment. Grp is found in at least 23 different bacterial species, some of which contain a particularly divergent BMC shell protein homolog. We aim to characterize this unique Grp shell protein to gain understanding of its biological function. Using X-ray crystallography, we have determined the structure at 2.7 Å resolution. Additionally, we used site-directed mutagenesis and electronic absorption spectroscopy to show that this shell protein binds an iron sulfur cluster at its central pore. Our work has provided the first shell protein structure from the Grp microcompartment, and has revealed a new type of BMC metalloprotein. Our findings suggest the potential importance of this Grp shell protein in electron or cofactor transport across the shell.

FRI-123

THE EFFECT OF MAGNESIUM ION ON THE *IN VITRO* HOMOLOGOUS RECOMBINATION MEDIATED BY A HYPERACTIVE *E. COLI* RECA MUTANT

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The bacterial RecA protein (352 amino acids) is the main recombinase that contributes an important role in non-mutagenic, recombinational DNA repair. The DNA strand exchange assay is commonly used to test the RecA homologous recombination activity *in vitro*. RecA protein bound to DNA hydrolyzes ATP. One molecule of magnesium ion interacts with one molecule of ATP. However, an additional magnesium ion is needed for an efficient *E. coli* RecA-catalyzed DNA strand exchange reaction. Previous experiments suggest that magnesium ion directly interacts with the RecA protein, likely altering the conformation of the protein's negatively charged C terminus. This is thought to constitute a molecular switch that auto-regulates RecA activity. Several RecA C-terminal deletion mutants are hyperactive relative to wild type. Our lab and others have also identified a RecA mutant altered by point mutation at position 217 that exhibits similar hyperactivity to the C-terminal deletion mutants. In the current project, we have combined one RecA C-terminal deletion mutant with this point mutation at position 217 to understand whether the mechanisms of hyperactivity for the two mutants are independent. This project seeks to provide mechanistic evidence

by determining the effect of magnesium ion on the DNA strand exchange reaction mediated by the RecA double mutant protein compared to the two single mutants.

SAT-122

DISSECTING INTERACTIONS BETWEEN BAM A AND BAM D VIA BINDING AND FLUORESCENCE STUDIES

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The Gram-negative outer membrane contains integral β -barrel proteins that create pores in the membrane to allow nutrients and solutes into the cell, and waste products out. The mechanism used by the cell to integrate the β -barrel outer membrane proteins (OMPs) into the membrane surface is the β -barrel assembly machine (BAM) complex, a five-member protein complex located at the outer membrane that folds and inserts the OMPs into the outer membrane bilayer. BamA, an integral membrane protein, acts as the core of the BAM complex and interacts with the associated lipoproteins BamB/C/D/E via its periplasmic POTRA domains. BamD plays a critical role in the BamA-mediated OMP folding pathway; we anticipate that the interaction between BamA and BamD will reveal details of their functions in the BAM complex. The structure of BamD is identified as a series of TPR domains that act as a structural scaffold and interacts with the POTRA domains of BamA, but the orientation of BamD relative to BamA is not identified. If we are able to bind and pull down purified BamD to BamA, we can determine the exact orientation of this interaction through fluorescence studies and structural biochemistry. Fluorescent thiol-reactive probes will be attached to BamA and to BamD. Labeled BamA to BamD will then be allowed to bind, and fluorescence spectroscopy will be used to measure various distances between the probes and determine their relative orientation. This will provide more structural clues on how these proteins are interacting in the BAM complex.

FRI-108

REGULATION OF HDL CHOLESTEROL METABOLISM AND THE IMPACT OF LONG-TERM FEEDING OF DIETARY JOJOBA OIL AND CHOLESTEROL ON THE DEVELOPMENT OF ATHEROSCLEROSIS IN NEW ZEALAND WHITE RABBITS

Anahis Rincon, Raymond Garcia.

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Dietary jojoba seed oil has been shown to maintain high-density lipoprotein (HDL) concentrations at an elevated level in hypercholesterolemic New Zealand White (NZW) rabbits, suggesting that jojoba oil regulates HDL metabolism and has a protective effect against atherosclerosis, one of the leading causes of death worldwide. We hypothesize that jojoba oil decreases the development of atherosclerosis in NZW rabbits. In this study, NZW rabbits will be fed either a normal chow (N), 3% jojoba seed oil (J), 1% cholesterol (C), or 1% cholesterol + 3% jojoba seed oil (CJ) for 13 weeks. Throughout the study, serum cholesterol concentrations will be monitored via enzymatic assays. Rabbits will be euthanized at 7, 9, 11, and 13 weeks and aortas will be extracted and assessed for atherosclerosis. N- and J-fed rabbits are expected to show no statistical change in their serum lipoprotein concentrations with no development of atherosclerotic lesions. C-fed rabbits are expected to have decreased HDL concentrations with significant atherosclerotic lesion development, while CJ-fed rabbits are expected to have a higher HDL concentration and a lower development of atherosclerotic lesions than those fed the C diet. Validation of the proposed hypothesis will provide a better understanding of how dietary jojoba seed oil, in the presence of dietary cholesterol, regulates HDL metabolism and the development of atherosclerosis. (CSU-LSAMP is supported by the National Science Foundation under Grant # HRD-0802628 and the CSU Office of the Chancellor.)

SAT-110

CHARACTERIZATION OF SECRETED EFFECTOR PROTEINS FROM *CHLAMYDOPHILA PNEUMONIAE*

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Chlamydiae are obligate, intracellular Gram-negative bacteria known to cause various health problems in humans. *Chlamydomphila pneumoniae* is responsible for an infection of the upper respiratory tract that also causes atypical pneumonia, with evidence linking it to the development of atherosclerosis and coronary artery disease. The infectious cycle of chlamydiae is a unique biphasic life cycle in which small extracellular elementary bodies (EBs) attach themselves to the epithelium of susceptible host cells. These metabolically inactive bacterial forms, upon entry into the cell, reside exclusively in a vesicle termed inclusion. Inside the inclusion, EBs differentiate into larger, non-infectious, metabolically active reticulate bodies (RBs) that divide using binary fission. Within 48 hours, RBs transform back to

EBs that are released from the inclusion to infect other cells. Chlamydiae interact with the host cells and manipulate their cell signaling and immune response by secreting effector proteins. Among these proteins secreted during *Chlamydomphila pneumoniae* infection are products of a cluster of six homologous genes encoding the effector proteins cpn0794 through cpn0799. Although it has been observed that cpn0796 and cpn0797 are secreted into the host cell and localized in the cytoplasm, the role of these proteins in infection is yet to be determined. We are interested in studying the structures and roles of cpn0794 through cpn0799 during infection using biophysical techniques including X-ray crystallography and analytical ultracentrifugation.

BIOLOGY (GENERAL)

FRI-462

USAGE OF YEAST BIOASSAYS IN TESTING AGAINST ESTROGEN-DISRUPTIVE COMPOUNDS IN ENVIRONMENTAL SAMPLES

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Endocrine-disrupting chemicals (EDCs) are chemicals that interfere with the endocrine system in humans and animals. These nonsteroidal substances have the ability to bind to the human estrogen receptor and have been found to mimic the activity of estradiol (Estrogen 17 β -Estradiol), the natural form of estrogen. They are widely distributed within our environment; are associated with certain cancers, reproductive disorders, and developmental disorders; and have been previously detected in agriculturally intense watersheds. This study aims to use yeast bioassays to test for estrogenic activity in water and sediment sample extracts from experiments designed to measure 17 β -estradiol and estrogen degradation in water and sediment. Synthetic complete media (SC-UW) and DSY-219 yeast strains were used to test 24 water samples using receptor-mediated β -galactosidase reporter assays. Throughout a 3-month period, results were examined from a number of 4-hour yeast experiments, and samples displayed significant estrogenic activity. These results will be correlated with additional data from chemical analysis in the future. These studies will ultimately aid in the understanding of the environmental fate, transport and degradation of these specific endocrine-disrupting chemicals.

SAT-464

THE EFFECTS OF THE CITRUS FLAVONOID NOBILETIN ON HEPATOSTEATOSIS IN HEPG2 CELLS

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Nonalcoholic steatohepatitis (NASH), also known as nonalcoholic fatty liver disease, is defined as inflammation of the liver due to abnormal lipid levels. It is believed to be the first stage of liver damage leading to liver fibrosis and cirrhosis. Fatty liver disease occurs most often in overweight, pre-diabetic and diabetic individuals. NASH affects 2% to 5% of Americans, with an additional 10% to 20% of Americans who may have elevated levels of lipids in their liver, but no inflammation. This study examined the effects of nobiletin, a polymethoxylated flavonoid from citrus peel, on inflammation induced in a human liver cell line HepG2. Inflammation was induced by exposing the cells to physiological levels of palmitic acid (PA) and insulin found in individuals who are obese and/or pre-diabetic, with and without nobiletin. Oil red O (ORO) staining was conducted to qualitatively and quantitatively analyze the amount of lipids. Inflammation was quantified using an ELISA to detect IL-8, an inflammation biomarker, secreted into the media. Preliminary results show that cells treated with PA in the presence of nobiletin secrete lower levels of IL-8 than cells treated with PA alone. However, in the presence of both PA and insulin, the nobiletin does not reduce the levels of IL-8 secreted. This suggests insulin interferes with the effect of nobiletin on inflammation. We will present additional data on lipid levels as assessed by ORO staining as well as results of further investigation on the effects of nobiletin on the cells treated with insulin and PA.

SAT-458

REGULATION OF THE Na^+/K^+ -ATPASE BETA SUBUNIT IN GILLS OF THREE-SPINE STICKLEBACK DURING ACCLIMATION TO CHANGING SALINITYTara Poyer¹, Shelby Judd¹, Patricia Schulte², Jason Bystriansky¹.¹DePaul University, Chicago, IL, ²University of British Columbia, Vancouver, BC, CA.

The three-spine stickleback (*Gasterosteus aculeatus*) is a euryhaline fish species that inhabits a wide variety of environments ranging from freshwater to seawater with some freshwater populations being landlocked. Gill Na^+/K^+ -ATPase plays an important role in the animal's ability to regulate whole body ion and water levels allowing these fish to migrate between environments with varying salinities. Previous studies have shown that multiple isoforms of the Na^+/K^+ -ATPase alpha subunit are expressed in fish gills, and their levels change during acclimation to changing salinity. The beta subunit of the Na^+/K^+ -ATPase is required for normal function of the alpha subunit, but very little is known about the expression patterns of this protein during salinity acclimation of fish. The genome of *G. aculeatus* has been sequenced and two distinct Na^+/K^+ -ATPase beta isoforms have been identified. This study designed real time PCR primers for each beta subunit and determined their relative expression in gills of wild *G. aculeatus* collected from either freshwater or seawater and following acclimation to either freshwater or seawater for 14 days. Overall enzyme activity of the Na^+/K^+ -ATPase increased during acclimation to both increased and decreased salinity. These results will help us better understand the role of the beta subunit in Na^+/K^+ -ATPase physiology and its importance during salinity acclimation of fishes.

FRI-459

EFFECTS OF THE DIAMETER DISTRIBUTION OF AXONS ON ACTION POTENTIAL PROPAGATION VELOCITIES

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Axons are long projections of nerve cells that conduct electrical impulses or action potentials; they are of interest, as an understanding of their dynamics would allow clarification of neural communication. The purpose of this study is to quantify the effects of axonal structural properties on the speed and propagation of action potentials across different brain structures. Based on previous experimental evidence we hypothesize that the diameter distribution of axons in different regions of the brain follows a power-law distribution. This would suggest that synchronously generated action potentials in an axonal bundle could widely desynchronize over long distances, thus affecting coordinated transmission of synaptic information. We are currently studying the effects of different properties such as delays and neural network size on the distribution of action potential propagation velocities by using computer-based models of integrate-and-fire neurons using MATLAB. In order to enhance our data, we have compiled our MATLAB file and are now running more and faster simulations. Subsequently, we intend to test for a power-law emergence by using our models and other scientific data from the literature to link the effects of different delay times with the effects of the diameter distribution of axons on action potential propagation velocities. This research will provide a functional link between the structural properties of axons and the information transmission limits in the brain. (Partially supported by the NIH/NIGMS MBRS-RISE GM060655 and NSF EF-1137897 and NSF HDR-0932339.)

FRI-463

LIPOPOLYSACCHARIDE-MEMBRANE INTERACTIONS EXPLORED USING LIPID BILAYER ASSEMBLIESKirstie Swingle¹, Gabriel Montano².¹University of New Mexico, Albuquerque, NM, ²Center for Integrated Nanotechnologies, Los Alamos National Laboratory, Los Alamos, NM.

Lipopolysaccharides (LPS) are found in the outer membrane of Gram-negative bacteria and provide stability for the bacteria. LPS is also known to be an endotoxin that can penetrate human cells and induce responses such as toxic shock, which can result in death. Understanding the mechanism of LPS interaction with membranes is crucial in making advances in understanding such pathogenic effects and developing therapeutics. Lipid bilayer assemblies (LBA) can be used as model systems for investigating membrane interactions and responses. In this study, lipid bilayer assemblies were formed using lipids of varying properties and LPS from different species were introduced. Different ion concentrations (i.e., Ca^{2+} and Na^+) in the presence of LPS were also screened to evaluate LPS-membrane interaction as a result of electrostatic conditions. Depending on LPS, lipid, and environment, a variety of membrane responses were observed such as lipid tubule formation, holes in the lipid bilayer assembly or formation of lamellar sheets that appeared to be mobile. These results indicate that a number and combination of conditions can

impact the mechanism of LPS-membrane interaction and are under continued exploration. A detailed understanding of such interactions will allow for refined mechanisms of LPS interaction for the biomedical community and aid in design of therapeutics and biosensor design. The results also indicate promise in using LPS in soft-lithography approaches for biomaterials design and are also being explored as such.

FRI-457

EFFECTS OF HIGH CARBON CONCENTRATIONS ON MARINE MICROBIAL COMMUNITIES

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Heterotrophic bacterioplankton are the most abundant microorganism in the ocean and play a major role in global carbon cycling. Heterotrophic microbes consume most of the organic matter in the marine ecosystem and dictate the extent to which CO₂ is absorbed or released by the oceans. Despite their importance in ocean carbon cycling, we currently lack an understanding of how heterotrophic microbes will change with ocean acidification. This research aims to determine the response of microbial communities to increased carbon supply. Respiration rates of surface and deep ocean microbes from the Rosario Strait were measured. By supplementing these microbes with different carbon concentrations and comparing respiration rates, we were able to determine the dissolved oxygen consumed and ultimately the CO₂ respired. We hypothesize that deep ocean microbes are carbon limited and predict that deep ocean microbial respiration rates will dramatically increase with the introduction of carbon sources while respiration of surface microbes will remain relatively the same. This work will provide valuable insight on microbial response to climate change and more accurate marine food web and earth system modeling.

FRI-471

THE ROLE OF AIRE EXPRESSING CELLS IN SHAPING THE REPERTOIRE OF THYMIC REGULATORY T-CELL RECEPTORS

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The T cell repertoire (variation) in T cell receptors (TCRs) is shaped by the interactions between antigen presenting cells and T cells in the thymus. Regulatory T cells (Tregs) are one type of T cell that plays a vital role in preventing autoimmunity through suppression of autoreactive T cells (non-Tregs). Dysfunctional Tregs can lead to a vast number of autoimmune diseases. Medullary thymic epithelial cells (mTECs) are among these thymic antigen-presenting cells that influence the TCR repertoire. mTECs lead to the deletion of autoreactive T-cells through their unique ability to express the autoimmune regulator (Aire), which allows them to upregulate the expression of tissue-specific antigens (i.e., insulin) and thus delete autoreactive T cells. Although Aire expressing cells are important for deletion of self-reactive T cells, the question of their influence in specifically shaping the repertoire of thymic regulatory T cells still remains. We hypothesize that mTECs shape the repertoire of Treg TCRs. To test our hypothesis, we have taken AIRE-DTR transgenic mice, and administered diphtheria toxin to selectively delete Aire-expressing cells. This approach allowed us to look at the influence of mTECs on Tregs. After isolating Tregs and non-Tregs from DTR- and DTR+ mice, we obtained DNA to sequence the TCR receptors from each pool of T cells. Analysis of the sequences using IMGT software allowed us to determine the CDR3 region of the thymic regulatory T cell receptor. Upon repertoire analysis, our data suggests that mTECs play a role in influencing the development of Tregs and also influencing the decision of the type of T cell that is made.

FRI-467

CHARACTERIZATION OF TISSUE-SPECIFIC EXPRESSION OF *NDI1* IN LONG-LIVED *DROSOPHILA MELANOGASTER*

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As organisms age, mitochondrial activity is reduced, which is thought to be a major cause of aging. Previous studies have shown that the alternative internal NADH-ubiquinone oxidoreductase (*ndi1*), a yeast gene that can functionally substitute for some complex I functions of the electron transport chain in metazoans, can increase mitochondrial activity in *Drosophila melanogaster* and extend life when expressed in neurons. Dietary restriction (DR), reduced fertility, and beneficial bacteria have been correlated with lifespan extension and we set out to determine if the mechanisms involved in *ndi1*-mediated lifespan extension overlap with these paradigms. We examined the influence of tissue-specific *ndi1* expression on lifespan, feeding behavior, fertility, and gut flora. We show that *ndi1* flies live

longer and eat more, suggesting *ndi1*-mediated lifespan extension is not a result of DR. Furthermore, we observed an increase in feeding frequency and an increase in sugar consumption in the long-lived flies. Similarly, decreased fertility that has been associated with some long-lived flies was not observed in *ndi1* flies. To test if *ndi1* expression was dependent on the presence of endogenous bacteria, survivorship in media supplemented with antibiotics was conducted. The addition of antibiotics slightly increased lifespan of both long-lived *ndi1* flies and controls by a similar amount, suggesting that *ndi1*-mediated lifespan extension is not dependent on gut flora. Overall, tissue-specific *ndi1* expression does in fact extend lifespan without any obvious physiological trade-offs. More assays must be done to uncover the mechanism behind *ndi1*-mediated lifespan extension to better understand aging and protect against age-related diseases.

FRI-461

ARSENATE RESPIRATORY REDUCTASE: BIOMARKER FOR DETECTION OF ENVIRONMENTAL THREAT

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Arsenic is a toxic element found in nature which affects human health by causing different types of cancer, neurological, and skin disorders. Arsenic is an odorless, colorless, and tasteless toxin capable of being dissolved in water. For these reasons, arsenic species are almost impossible to detect when present in food, water, and gasses. Recent discoveries have shown that some bacteria can transform arsenic species into more toxic compounds through reductive mechanisms. Dissimilatory arsenate-reducing prokaryotes, DARPs, respire arsenate, mobilizing arsenic into water. The non-Firmicutes DARPs represent several phyla in *Chrysiogenes arsenatis*, *Geobacter uraniireducens*, *Alkalilimnicola*, *Bacillus*, *Halanaerobiaceae* sp. strain SLAS-1, *Sulfurospirillum arsenophilum*, *Shewanella* sp. ANA-3, and *Wolinella succinogenes*. Our goal is to strengthen screening tools with a new method in order to examine the prevalence and diversity of DARPs in nature through the employment of bioinformatics analyses. The prevalence of DARPs in nature is being assessed by the presence of the *arrA* gene among microbial genomes. The *arrA* gene from *Sulfurospirillum barnesii* was subjected to blast analyses among 1470 non-Firmicutes genomes. So far, the highest homology was found for three genomes: 71% for *Wolinella succinogenes*, 74% for *Shewanella putrefaciens*, and 74% for *Shewanella* sp. ANA-3. *Shewanella* species demonstrated large centers of divergence in the middle, about 80% coverage. Less homology was detected at nucleotide level than the amino acid sequence. The *arrA* genes are highly divergent to find sites that flank central islands of difference to support a new detection method. Conserved sequences are useful biomarkers to ascertain prokaryotes capable of arsenate respiration; this will allow us to monitor the risk of arsenate mobilization in nature.

SAT-463

DRUG STUDIES: AGED-RELATED HEARING CHANGES INDUCED BY D-GALACTOSE

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Age-related hearing loss may be caused by deficits in both peripheral (cochlear) and central auditory structures. Deficiency in either peripheral or central auditory pathways makes it difficult to hear and process sound stimuli. These deficiencies can be caused by oxidative stress or other cellular damage. D-galactose has been shown to induce oxidative stress and cause changes in auditory brainstem responses in young animals. The aim of this study was to investigate whether D-galactose serves as a reasonable aging model that can induce changes in sustained responses to sound in young rats. Eight young (3-5 months old) rats were injected subcutaneously with D-galactose for multiple weeks. Auditory, evoked responses were compared to naturally aged rats using three evoked potential tests: the auditory brainstem responses (ABRs), middle latency responses (MLRs), and frequency following responses (FFRs) obtained from both groups of rats using subdermal needle electrodes. ABRs to brief click and tone pips measured peripheral sensitivity by measuring the threshold sound level to evoke ABRs. MLRs measure the thalamocortical responses to brief sounds, and FFRs measure sustained auditory processing in central brainstem and mid-brain nuclei. The stimuli consisted of sinusoidally amplitude modulated tones with the same carrier frequency but different modulation frequencies. If D-galactose serves as a reasonable aging model for hearing we expect to see a delay in ABR responses and/or FFR responses similar to those found in naturally aged animals.

FRI-466

DESIGN OF AN INFRARED FLUORESCENT PROTEIN MARKER FOR *IN VIVO* IMAGING IN MAMMALS

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The fluorescent signal in the infrared (IR) range has minimal absorption by hemoglobin and water making it optimal for *in vivo* imaging in mammals. Bacteriophytochromes (BphPs), bacterial red-light photoreceptors, have been engineered as infrared fluorescent proteins (IFPs) and used as liver markers in mouse models. BphP photochemistry depends on biliverdin (BV), an organic cofactor naturally abundant in mammals as a by-product of heme metabolism. Our goal is to develop an IFP marker using the naturally fluorescent RpBphP3 (P3) from *Rhodopseudomonas palustris*. P3 in tandem with classical RpBphP2 (P2) modulates the synthesis of light-harvesting complexes in *R. palustris*. P2 and P3 share a 52% amino acid sequence identity and bind the same BV chromophore, yet they have different photochemistry. P2 was recently engineered as an IFP, but has a fluorescence quantum yield of less than 10%. To optimize the naturally fluorescent P3 as an IFP, we conducted comparative sequence and structural analyses of homologous BphPs. A highly conserved Asp (D216), found in the PASDIP motif, is essential for stabilization of BV in the chromophore-binding domain. Using site-directed mutagenesis we introduced single point mutations, Asp216His or Asp216Thr, effectively disrupting the photochemistry of P3. Both mutants were cloned into the mammalian expression vector, Adtrack-CMV, and expressed in HeLa cells. Preliminary results include the *in vitro* characterization and comparison of the P3 Asp216His and Asp216Thr mutants with the P2-derived IFP. Subsequent research goals include further optimization of P3-derived IFP through secondary mutations on the Asp216His and/or Asp216Thr templates to improve fluorescence quantum yield.

SAT-468

MOLECULAR CHARACTERIZATION OF IRON STRESS RESPONSE IN SOYBEAN

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Iron deficiency chlorosis (IDC) is a disease resulting from lack of useable iron that eventually results in yield loss at the end of the season. This is particularly important in the midwestern part of the United States because soil conditions favor the development of IDC. To control IDC symptoms, farmers rely on chemical treatments that can be hazardous to the environment. Therefore, we're interested in characterizing soybean's response to iron stress as little is known about short- and long-term responses to iron stress. Our research will take advantage of two near isogenic lines that are 98% genetically identical but differ in their iron response. Clark plants are iron efficient, while IsoClark plants are iron inefficient and will develop symptoms of IDC under iron stress conditions. We have conducted an experiment comparing short-term and long-term iron stress by using a shocking method. Both Clark and IsoClark plants were grown in hydroponics in a greenhouse for a total of ten days. A subset of plants were iron stressed for the entire ten days whereas another set were iron stressed for two days. We will look at transcriptional responses by quantitative PCR, RNA sequencing, and test candidate genes by viral-induced gene silencing.

SAT-461

BACTERIAL PROSPECTS FOR ALIPHATIC ALKANE DEGRADATION ACROSS TROPICAL ECOSYSTEMS

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Contamination by organic compounds has been a consequence of industrial times. High concentrations can be harmful to all living things especially to ecosystems that thrive with the anthropogenic activities that take place each day. Alkanes are organic compounds derived from petroleum, but some plants produce them naturally. Our objective is to study the aerobic bacterial degradation capabilities of the organic compounds pentane and decane. Samples were collected from soil minor (mechanic garage) and major (Caño Tiburones) chronic discharges. Alkane-degrading prospects were isolated by aerobic cultivation on mineral salt media supplemented with specific alkane as sole carbon source. A total of 11 prospects have been isolated so far with alkane-degrading capabilities. Bacterial prospects for aliphatic alkane degradation were subjected to 16S rDNA sequencing. We identified species from the genera *Citrobacter*. Most of the strains prefer decane as a substrate. The prevalence of aliphatic alkane degradation prospects across different ecosystems including the rain forest (El Yunque) has been found for other aliphatic alkanes. By means of this research, we concluded that pentane- and decane-degrading bacteria can be found in the natural ecosystem regardless of the prevailing level of pollution.

SAT-470

CHARACTERIZATION OF EPITHELIAL-TO-MESENCHYMAL TRANSITION AND PROLIFERATION IN LEPTIN-TREATED RAT MAMMARY TUMOR CELLSDenisse Resendiz, Ignacio Camarillo.*Purdue University, West Lafayette, IN.*

Breast cancer is among the most commonly diagnosed cancers among women in the United States and the second leading cause of cancer-related deaths. Hormones play a crucial role in the development and progression of breast cancer. Obese women have an increased risk of developing breast cancer, increasing as adipose tissue increases. The secretion of hormones from adipose tissue is elevated during obesity; in particular, the peptide hormone leptin increases in correlation with increased adipose tissue mass. Leptin has been shown to stimulate breast cancer cell proliferation progression and recently has been correlated with tumor cell metastasis. It is our objective to elucidate the mechanisms of leptin on proliferation and its role in epithelial-to-mesenchymal transition (EMT) in rat mammary tumor cells by identifying key proteins involved in EMT. We hypothesize that in vitro leptin will increase mammary tumor cell proliferation (CRL 1743 cells) and promote EMT through decreasing expression of E-cadherin and increased expression of N-cadherin. The regulation of these proteins by leptin in CRL 1743 cells will lead to a better understanding of the link between obesity and cancer aggressiveness. Ultimately, these studies may lead to identification of novel molecular targets for development of future treatments for obese patients with breast cancer.

SAT-465

IMPACT OF SOIL TEXTURE ON GRAPES AND WINE: COMPARISON OF CABERNET SAUVIGNON AND SYRAH IN THE TEXAS HILL COUNTRYAntonio Moreno¹, Lisa Morano¹, Kenneth Johnson¹, Jay Neal², Aaron Corsi².¹*University of Houston-Downtown, Houston, TX*, ²*University of Houston, Houston, TX*.

Viticulturists are aware that topography and soil characteristics such as soil texture (percent sand, silt, and clay) can have a profound impact on wine quality. Shallow soils or soils high in sand may be lacking in water and nutrients, but soils that are too deep or with a high clay content may create too much vigor in the vine and also reduce wine quality. Our goal was to establish if soil texture impacts wine character and vine vigor differently among Cabernet Sauvignon and Syrah varieties in the Texas Hill Country. Soil and fruit samples were gathered from 28 vines and produced a total of 28 wines. By means of a principle components analysis (PCA), soil texture parameters of sand, silt, and clay were compared to viticulture parameters of stem weight (a vigor parameter) and basic juice and wine quality parameters such as pH, Brix (sugar concentration), and yeast available nitrogen (YAN). Our initial PCA showed that soil texture parameters could be linked to viticultural parameters such as stem weight. We are currently analyzing data to determine if soil texture and vine vigor parameters can be linked to specific aroma and taste characteristics for the Texas Hill Country vineyards we evaluated.

FRI-460

TAP WATER QUALITY: SOCIAL IMPLICATIONS AND POSSIBLE EFFECTS ON HEALTHNicolle Lebrón, Javier Arce.*Universidad de Puerto Rico en Cayey, Cayey, PR.*

The objective of this study was to analyze how social and environmental variables affect the quality of water in Puerto Rican homes and how water quality affects consumers' health. More than 250 interviews were conducted in the towns of Cayey, Caguas, and Comerío which addressed self-reported cases of gastrointestinal illness (GI) and consumers' perceptions of tap water service. We studied communities that receive water from government-managed systems known as PRASA (Puerto Rican Aqueduct and Sewer Authority) and from community-managed water systems known as non-PRASA. After each interview, a water sample was collected from the tap and from any household water treatment system. We measured total coliforms (TC), fecal coliforms (FC), and free chlorine for each water sample. The non-PRASA systems showed a presence of TC in 74% of the houses, while the PRASA systems showed a presence of TC in 17% of the houses. The presence of TC was related to the level of free chlorine in the water. Every house from the PRASA system had free chlorine in the water with the exception of houses with water treatment systems. Almost half (49%) of the water samples collected from household water treatment systems (n = 45) had presence of TC. These results demonstrate that a considerable number of people are affected by improper maintenance of their domestic and community-level water systems, which is an important public health concern. However, GI cases were not correlated to coliform presence, highlighting a need for better water quality indicators in Puerto Rico.

FRI-469

VICTORIA VICTOR SUMMER RESEARCH ABSTRACT

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Dinoflagellates of the genus *Gambierdiscus* produce ciguatera toxin, a polyether molecule that is the causative agent of ciguatera fish poisoning. These single-celled algae reside epiphytically on macroalgae in tropical coastal environments. The toxin is bioaccumulated up the food web in coral reef ecosystems, as herbivorous fish consume the dinoflagellates, carnivorous fish consume the herbivores, and humans catch and eat these reef fish. In order to better understand the ecology of ciguatera toxin production, we are attempting to generate uni-algal cultures of *Gambierdiscus* found in Hawaiian waters. The hypotheses being tested in this project include, but are not limited to: 1) Viability of cultures will vary as a function of the species of macroalgae from which the dinoflagellates were isolated; 2) Viability of cultures will vary as a function of the temperature at which the cells are maintained; and 3) Viability of cultures will vary as a function of the light regime under which the cells are maintained. Methods for establishing cultures include the following: 1) Collection of macroalgae from inshore Hawaiian waters; 2) Mechanical removal of dinoflagellates from macroalgae by mechanical agitation followed by sequential rounds of filtration; 3) Visual identification of dinoflagellate cells under the microscope; 4) Collection of individual cells by pipette; 5) Placement of cells into defined sterile media; and 6) Incubation of cells under defined conditions of irradiation, temperature, and time. Microscopic observation of cell number and growth rate will then be used to determine the viability of cultures.

SAT-469

SCREENING FOR XYLAN DEGRADATION FUNGI

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Leaf litter is the main component of biomass. The specific objectives are to isolate fungi from leaf litter using general and specific culture media and to conduct cellulose lignin and xylan degradation assays. The methodology consisted of taking leaf litter from four forest types at El Yunque National Forest, Tabonuco Palm, Palo Colorado, and Elfin. Particle filtration technique was used to isolate fungi using different general growth media: 50% PDA, 50% MEA, and 50% MEA + 5% NaCl. Fungal isolates were purified and screened for potential cellulase, xylanase, peroxidase, and phenol activity using cellulose agar, remazol blue agar, and xylan agar. Isolates were identified using morphological and molecular characters. A total of 127 isolates were obtained. Of the 127 isolates collected, only 10 were positive for the enzymatic degradation of cellulose and xylan. The 10 fungal isolates belonged to several of the forests' types except for Elfin forest. The isolates were identified by sequencing the fungal ITS region of the rDNA. The following species were identified: *Candida micetangii*, *Glionectria tenuis*, *Mucor nidicola*, *Mucor fragilis*, *Purpureocillium lilacinum*, *Rhizomucor variabilis*, and *Trichoderma koningiopsis*. A degradation test was conducted at variable temperatures. The temperatures were 25 °C and 37 °C. Three of the ten isolates that were successful prospects were analyzed in this test. At both temperature variables, degradation was observed, concluding that the degradation of these fungi can take place in a range of temperatures, but degradation was better at 25 °C. Future plans are to conduct quantitative assays for the degradation of xylan.

FRI-470

VALIDATING GENETIC TOOLS FOR SUPPRESSING MAJOR OXIDATIVE DNA DAMAGE-REPAIRING PROTEINS

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Reactive oxygen species (ROS) are produced as inevitable byproducts of aerobic mitochondrial respiration. ROS can damage DNA by causing base alterations, mutations, and DNA strand breakage. Unless such damage is repaired, the cell will die or enter proliferation arrest. Cancer cells produce higher levels of metabolic ROS relative to normal cells and possess elevated levels of DNA repair proteins to protect themselves. Thus, targeting such proteins in cancer cells is likely to induce cell death or proliferation arrest. Accordingly, loss of function methods such as small hairpin RNAs (shRNA), capable of suppressing major oxidative DNA damage repair proteins, will allow investigation of how a specific DNA repair protein affects cell survival. A commercial shRNA bacterial library was obtained expressing shRNA constructs against the following major oxidative damage repair proteins: OGG1, NTH1, MYH1, APE1, FEN1, and APEX. Individual bacterial colonies were grown overnight in LB broth with ampicillin to ensure only shRNA plasmid-expressing clone survival. Plasmid DNA was then isolated from the bacterial cultures, concentrated using a Qiagen

HiSpeed Plasmid Midi Kit and analyzed via restriction digest and DNA sequencing. Plasmids containing an shRNA sequence exhibited a super-shifted band relative to a control plasmid digested with EcoR1 and Nde 1 and run on an agarose gel. Plasmids with supershifted bands were sequenced to validate the presence of a specific shRNA insert sequence. Validated shRNA constructs will be stably introduced into lung cancer cells to investigate whether the respective target gene can trigger effective tumor suppressor responses.

SAT-466

RED-LIGHT PHOTORECEPTORS IN MYXOBACTERIA: IMPLICATIONS FOR LIGHT-STIMULATED MULTICELLULAR ASSEMBLIES

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Myxobacteria are Gram-negative, non-photosynthetic bacteria known for the multicellular stage in their life cycles. Multicellular fruiting bodies are induced by starvation conditions and house desiccation-resistant myxospores that will germinate into vegetative cells upon exposure to nutrients. Interestingly, fruiting body formation in *Stigmatella aurantiaca*, a well-characterized myxobacterium, is stimulated by blue and/or red light. The *S. aurantiaca* genome annotation indicates two photoactive yellow proteins (PYPs) and two bacteriophytochromes (BphPs) that the closely related myxobacterium *Myxococcus xanthus* lacks. BphPs are red-light photoreceptors found in both photosynthetic and non-photosynthetic bacteria. Six out of 15 sequenced genomes of myxobacteria contain BphPs. Our hypothesis is that BphPs may play a role in fruiting body formation. We cultured *S. aurantiaca* DW4/3.1 and *M. xanthus* DZ2 on starvation agar plates in both light and dark conditions. Our preliminary results show that light-incubated *S. aurantiaca* produce larger and more pigmented fruiting bodies compared to the ones formed in dark. Conversely, fruiting bodies of *M. xanthus* grow better in the dark. We are going to perform transposon mutagenesis to inactivate the genes coding for BphPs in *S. aurantiaca* and observe the fruiting body formation of these mutants. Understanding the role of BphPs in myxobacteria and whether they work in tandem with other genes responsible for fruiting body formation may shed light on developmental biology questions about multicellular life-cycles and cell differentiation.

FRI-464

AMYOTROPHIC LATERAL SCLEROSIS IN *C. ELEGANS*: UNDERSTANDING HOW TDP-43 AGGREGATION AFFECTS MOTOR NEURON FUNCTION

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TDP-43 is an RNA-binding protein that has been linked to neurodegenerative diseases such as amyotrophic lateral sclerosis (ALS), though the pathological mechanisms of TDP-43 are unknown. To study the effects of TDP-43 on neuronal function, we generated a *C. elegans* model for ALS by cloning the human wild-type *TDP-43* gene tagged with a yellow fluorescent protein under a pan-neuronal promoter. The neuronal function of both transgenic and wild-type worms were assessed with behavioral assays to monitor motility, pharyngeal pumping, and egg-laying. Preliminary results show that the presence of wild-type human *TDP-43* in the *C. elegans* system has significant, detrimental effects on worm coordination and ability to move across solid surfaces and in liquid, indicative of GABAergic neuronal dysfunction. The characterization of this neuronal dysfunction will help us gain further understanding of ALS related neurodegenerative disease pathology.

FRI-458

GROWTH AND PHOTOSYNTHETIC CHARACTERISTICS OF PROGENY FROM WINTER AND SUMMER-ACTIVE *HELIANTHUS* IN THE CORPUS CHRISTI, TX AREA

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Helianthus annuus is the most common species of sunflower in North America and is commonly found growing and flowering year round in Corpus Christi, Texas. To determine if there are differences in growth and photosynthetic characteristics between progeny from summer-active and winter-active plants during each season, plants were grown individually and with 2 or 4 associates from the opposite group of plants during the winter and summer growing seasons. Our hypothesis is that there is no difference in growth and photosynthetic characteristics between progeny from winter-active and summer-active plants during either season. If so, as climate changes, this could lead to the establishment of winter-active cohorts in more northern areas. We found no significant difference in the photosynthetic rate measured in February 2013 for target plants between progeny from winter-active and summer-active plants ($P =$

0.0810). In addition, there was no difference in height for target plants ($P = 0.3709$) or for height of associate plants ($P = 0.448$). In the winter growing season, progeny from summer-active plants are doing as well as progeny from winter-active plants. We found no differences in growth and photosynthetic characteristics between progeny from summer-active and winter-active plants indicating that *H. annuus* could extend its growing season in regions farther north of our area if winters become warmer in these areas.

SAT-462

ALTERATIONS IN STEM CELL FUNCTION FOLLOWING A PERSISTENT COXSACKIEVIRUS INFECTION OF NEURAL STEM AND PROGENITOR CELLS, AND ACCELERATED DISEASE PROGRESSION IN A MOUSE MODEL OF ALZHEIMER'S DISEASE

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Coxsackievirus B3 (CVB3) is a human pathogen that can leave long-lasting alterations in the central nervous system (CNS) of the surviving host. Our laboratory has characterized the ability of CVB3 to persist in the CNS, preferentially targeting neural progenitor and stem cells (NPSCs). We wished to examine the effects of a persistent CVB3 infection in hAPP751 transgenic mice, a mouse model for Alzheimer's disease (AD). These mice express the amyloid- β_{1-42} protein under the murine Thy1 promoter and reproduce some aspects of AD pathology observed in patients.

The hAPP751 transgenic mice infected with CVB3 shortly after birth showed increased mortality as compared to either infected nontransgenic littermates or mock-infected hAPP751 transgenic mice over a 7-month period. We hypothesize that fundamental molecular changes in neurons of persistently infected hAPP751 transgenic mice may accelerate the progression of neurological disease in our AD mouse model. To assess this hypothesis, NPSCs were isolated from the cortices of 3-day-old hAPP751 transgenic mice or nontransgenic littermates. These NPSCs were infected with a recombinant CVB3 expressing the enhanced green fluorescence protein (eGFP-CVB3) to establish a carrier-state infection. Infected hAPP751 NPSCs and NPSCs from nontransgenic littermates were monitored for a period of 50 days, and the number of viable cells were quantified. After differentiation in culture, alterations in cell lineage commitment, autophagic flux, and amyloid- β protein levels will be tested. Our preliminary results suggest that a previous neurotropic infection which persists in the host may accelerate the progression of a subsequent neurodegenerative disease by altering neural stem-cell function.

FRI-465

GROWTH AND LIPID PRODUCTION OF THE MICROALGAE *SPIROGYRA* FOR BIOFUEL PRODUCTION

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The finite amount of fossil fuels and the greenhouse gas emissions from their combustion have become significant issues and ignited interest in biodiesel production. Microalgae are one of the most hopeful sources for an alternative fuel because of their ability to reproduce rapidly and their high lipid content which can be transformed into a renewable, carbon-neutral fuel. Moreover, microalgal lipids are biodegradable. Past studies have reported on single-cell microalgae with little attention to filamentous genera. The purpose of this study is to investigate the growth and lipid production of filamentous *Spirogyra*. *Spirogyra* sp. is being grown in Petri plates containing treated sewage effluent, seawater, and tap water adjusted to various pH levels (from 6 to 8). Cultures are incubated at room temperature (20 – 25 °C) with ambient sunlight for 15 days. Cell growth is determined by counting algal filaments and measuring filament length. Lipid content is determined by staining the *Spirogyra* with Sudan black. Preliminary results suggest *Spirogyra* grows best, increasing its filament length 1.5 $\mu\text{m}/\text{day}$ and tripling its lipid content, at pH 7 in tap water. Algae in basic (pH 8) media grew slower (0.5 $\mu\text{m}/\text{day}$) but also tripled its lipid content. Lipid content doubled in *Spirogyra* in sewage effluent, but the algal growth rate decreased (0.8 $\mu\text{m}/\text{day}$). Algal numbers and cellular lipid content decreased in seawater and acidic media. The results may lead to sustainable fuel production that does not promote global warming.

FRI-468

ASSESSING GEOCHEMICAL CONTROLS ON MERCURY TRANSFORMATIONS AND TRANSPORT AT A NORTHERN CALIFORNIA COASTAL LAGOON SITE

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Ephemeral lagoons along California's northern coastline are an important yet poorly-understood part of the coastal ecosystem. They exist in a dynamic environment where nutrient-rich, oxygen-poor groundwater mixes with near shore seawater. This interface creates an environment well suited to the growth of anaerobic bacteria that are capable of converting a common form of inorganic mercury (Hg^{2+}) into monomethylmercury (CH_3Hg^+), which is a bioaccumulative neurotoxin. The toxicity and bioavailability of mercury can therefore be related to factors that influence microbiology, such as nutrient, carbon, and oxygen concentrations. To gain a better understanding of mercury cycling in near-shore systems, researchers in the lab are characterizing the form and concentration of mercury in seawater, groundwater, and lagoon water at a coastal lagoon site in northern California. The concentration of nutrients (NO_3^- , NO_2^- , NH_4^+ , PO_4^{3-} , and SiO_4^{4-}) and dissolved organic carbon (DOC) in the water samples will be determined. These data will be used to describe nutrient gradients at the study area and will contribute to a greater understanding of geochemical controls on mercury transformations and transport at the land-sea margin.

SAT-459

NET-PHYTOPLANKTON SURVEY IN GUAJATACA RESERVOIR, A MESOTROPHIC LAKE IN PUERTO RICO

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Phytoplankton communities play important roles in aquatic systems, serving as main oxygen producers as well as first links in trophic chains. Moreover, phytoplankton species composition has been widely employed as a bioindicator of trophic status. Our purpose is to form a data base on net-phytoplankton composition that can be useful for water management of insular, man-made lakes. Guajataca Reservoir, a mesotrophic lake, was selected because it is at the lowest end of the trophic range among local reservoirs. It was constructed in 1929 by the Puerto Rico Electric Power Authority, and since 1950 its volume of water has been decreasing due to sedimentation. Duplicate samples were taken between March and July 2012 and in January 2013 from Guajataca Reservoir using two attached Bongo nets with mesh size of 64 μm . Samples were preserved with formalin (4% final volume), and the net-plankton composition was determined. Net-phytoplankton density (cells/mL) increased from March to April. In July, there was a decrease in phytoplankton density followed by an increase in species richness. Nevertheless, in January, there was an increase in diatoms. Green algae in all of the samples dominated the phytoplankton composition; within this group, *Pediastrum* was the most abundant in this lake.

SAT-460

FISHING OUT A ROLE FOR TRANSCRIPTION FACTORS IN HUMAN DISEASE: ANALYSIS OF KAISO IN ZEBRAFISH DEVELOPMENT

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Transcription factors control gene expression and play an important role in cell differentiation. Transcription factors function by binding to DNA and to other proteins. Several human diseases are linked to mutations in genes that encode transcription factors. There is consistent evidence of the role of *ZBTB33* (zinc finger and BTB domain containing 33, also referred as Kaiso) and its involvement in human tumorigenesis and specific gastrulation defects. Kaiso is found on chromosome 14 on *Danio rerio* (zebrafish). To investigate the function of Kaiso in development and disease, we aim to characterize its expression in zebrafish by mining expression databases. We also plan to predict its target genes by searching the zebrafish genome for potential DNA binding sites. To validate this data, we will suppress Kaiso expression in zebrafish by injection of morpholinos targeting Kaiso and look for developmental and gene expression defects. Overall, this research will reveal new information on a transcription factor associated with human disease.

SAT-457

QUANTIFYING THE ELECTROPHYSIOLOGICAL EFFECTS OF GOLD, STAR-SHAPED NANOPARTICLES ON CA3 PYRAMIDAL NEURONS

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Nanotechnology is an emergent discipline that has the potential to change biomedical research. We are interested in using metal nanoparticles in neurobiology that can be used for photo-thermal therapy, drug delivery, or as spatial markers to trace neurons or organelles. However, the health hazard of nanoparticles is of concern, given that some nanoparticles have been found to be toxic to cells. We hypothesized that in the nervous system, their effect could be subtle, affecting the electrophysiological properties of neurons. Thus, we investigated how gold, star-shaped nanoparticles affect the spiking activity of hippocampal mouse cells in brain slices. We have synthesized gold nanostars and characterized them optically and morphologically. We have initially developed a protocol to deliver the nanoparticles by pressure injection while recording the extracellular activity of multiple pyramidal cells from 14- to 21-day-old mice. These types of nanoparticles are expected to bind to surface proteins, thus altering the electrical properties of the cell. Our studies show an increase in CA3 firing rate after the introduction of gold nanostars. Understanding the physical, chemical, and optical interactions between nanoparticles and neuronal metabolism is of great importance not only due to their potential toxic effect, but also to their nonlethal effects on the normal functioning of neurons as well. Perhaps more interesting could be their use to monitor and control neuronal activity. (Research supported by: NSF DMR-0934218, RCMI 2G12RR013646-11 and partially funded by NIH/NIGMS MARC U*STAR GM0771.)

BOTANY

SAT-475

FROM FARM TO PHARMACY: SUSTAINABLE HORTICULTURE OF NATIVE HAWAIIAN MEDICINAL FLORA

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The US healthcare industry is in a time of great reform. Economic, technological, and interpersonal change is both needed and imminent. As the demand for preventive care and alternative treatments rises, a look back to traditional ecological knowledge is a source of wisdom. In Native Hawaiian La'au Lapa'au herbal medicine, the plant kauna'oa is used in traditional cancer treatments. There are two main species used in traditional lineages: *Cassytha filiformis* (found across Polynesia) and *Cuscuta sandwichiana* (endemic to Hawai'i). Both are parasitic plants that will be grown on a host plant with a rich history in Hawai'i, *Ipomea batatas*. Loss of native habitat threatens the quality and quantity of harvest locations. The intention of this study is to find efficient and sustainable methods of propagating indigenous herbal medicine. This experiment is designed to test the effectiveness of cultivation of kauna'oa in an emerging agricultural technology, aquaponics. Aquaponics combines the two disciplines of aquaculture and hydroponics together in a single system. The advantages to this method are paramount in maintaining sustainable goals and standards. Plant growth and chemical composition of plant matter will be analyzed for quality. Treatments are propagation technique (aquaponics vs. soil), seeding (from seed vs. vegetative propagation), species variation, and fish population density. The results of this study should lead to greater understanding of the cultivation and propagation of this Native Hawaiian medicinal plant.

FRI-475

MOSES AND MUSEUMS, CONNECTING COLLECTIONS TO ENVIRONMENTAL CHANGE AND EDUCATION

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Worldwide, biodiversity is rapidly diminishing. Some of the species most vulnerable to environmental changes are the bryophytes. Bryophytes are a group of early land plants that include hornworts, liverworts, and mosses. Due to their unique physiology and small size, bryophytes tend to respond rapidly to environmental shifts in temperature, pollutants, and water. We hypothesize that as environmental conditions have changed, the presence and diversity of bryophytes will have altered. Thus, bryophytes can be used as an environmental indicator species. Though found worldwide, the prominent ecological roles of bryophytes tend to be under studied and overshadowed by seeding

plants. In order to solidify their role as an environmental indicator species and to better connect herbarium specimens with the general public, we set out to track and classify local bryophyte species. Using a small university herbarium collection of North American bryophytes donated to the Field Museum, we are tracking nearly 4,000 specimens representing 297 different species over time and correlating their presence, quantities, and habitats with local climate data. The data from this project is being developed into a self-guided taxonomic key and virtual mapping application for web and mobile use by school children and local area teachers. We hope to engage the community and highlight the crucial role that bryophytes play in our environment.

FRI-473

COMPARING STOMATAL CHARACTERS IN ANCIENT AND MODERN PINE AND JUNIPER

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In the last glacial period, low atmospheric CO₂(c_a) may have limited photosynthesis in glacial plants. However, adaptations such as increased stomatal conductance (g_s), which can increase with an increased number of stomata on leaf surfaces, may have increased CO₂ uptake and thereby photosynthetic capacity (A_{max}). Three trends in ¹³C isotope data from conifers were observed. Decreased leaf intercellular [CO₂] (c_i) suggests limited A_{max} in glacial conifers. A lower c_i/c_a ratio suggests different stomatal regulation or possibly higher A_{max} in glacial conifers. A smaller (c_a-c_i) gradient suggests facilitated CO₂ uptake in glacial conifers. Consequently, glacial conifers may have had higher A_{max} than modern conifers, indicating an enhanced CO₂ uptake mechanism. Thus, two hypotheses were proposed: In glacial times, increased stomatal index (SI: the number of stomata per epidermal cells) and/or increased stomatal pore size reduced resistance to CO₂ diffusion into leaves, raising c_i. Plants differing in drought tolerance differ in ability to increase g_s in order to increase CO₂ uptake. A collection of glacial (30,000 – 9,000 years old) pack-rat middens provides a set of ancient pine and juniper leaves with multiple replicates of the same age and genus to compare with herbarium and modern specimens from the same geographic region. To quantify SI and stomatal pore size, leaves were analyzed using a scanning electron microscope and epifluorescence techniques. Preliminary data shows SI and stomatal pore size have not changed significantly in *Juniperus osteosperma* over the last 13,000 years, indicating stomatal characters may not account for variation in A_{max}.

FRI-472

PHYLOGENY OF THE ANGIOSPERM GENUS *GONOCARPUS* (HALORAGACEAE) EMPHASIZING SPECIES DELIMITATION AND BIOGEOGRAPHY IN THE SOUTHWEST AUSTRALIAN BIODIVERSITY HOTSPOT

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The angiosperm genus *Gonocarpus* (Haloragaceae) is a relatively poorly known group with high levels of local endemism throughout its range. It occurs primarily in Australia (34/37 spp.) with six species ranging into New Zealand and/or Asia. Much of *Gonocarpus* diversity is found in the southwest Western Australia International Biodiversity Hotspot where several species are considered rare or of priority concern. The current classification for the genus has been based on morphology and included few specimens of several species, as, until recently, collections from the genus had been limited. This group also has a high level of morphological plasticity and several species are described as highly variable. Here, we use a molecular phylogenetic approach to test hypothesized species limits, evolutionary relationships, and biogeographic origins. DNA data was collected from the nrDNA internal transcribed spacer (ITS) region for 61 accessions and the chloroplast DNA (cpDNA) intron region *trnL* – *trnF* for comparable data. Results from phylogenetic analysis of the ITS region has shown high molecular variability among species and has uncovered cryptic species in southwest Western Australia. Analyses support an origin of the genus in Western Australia with dispersal east and multiple events leading to dispersal into Asia. These results will be used to help define new species of *Gonocarpus*, inform conservation efforts, and provide further evidence regarding phylogeographic patterns in Australia.

SAT-472

ESTIMATING POPULATIONS OF OSHA, *LIGUSTICUM PORTERI*, AN IMPORTANT MEDICINAL PLANT OF THE SOUTHWEST UNITED STATES

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Osha, *Ligusticum porteri*, is an ethnobotanically important medicinal plant whose odiferous and distinctively spicy roots are currently wild harvested by individuals and herbal product companies to treat influenza, bronchitis, and sore throats. We initiated a multi-year, manipulative field experiment to determine acceptable thresholds of harvest intensity that allows for the regeneration and sustainable harvest of *Ligusticum porteri* populations. We also wanted to determine population densities of geographically separated populations and sampled vegetative cover of osha within 8 polygons, or stands. The sample areas had a cumulative area of 507,597 m², with an average of 7.8% osha cover. For our detailed field experiment, we analyzed osha's recovery from harvest by setting up experimental plots in both a meadow site, with high light availability, and in an adjacent forested site, with significant canopy cover. At each of the sites we established 40 replicate, 30 m² plots, collected data on the vegetative cover within, and proceeded to harvest 0%, 33%, 66%, or 100% of roots from mature plants. The meadow site had 15% more mature plants and 58% more kg of roots than in the forested site. From our data we estimate that a population exhibiting a 10% cover will have on average .0349 kg dried root weight per 1 m² area (311 lbs/acre). Baseline data was successfully gathered and subsequent years work will involve monitoring regrowth of harvested plots. These data can determine what a sustainable rate of harvest would be and the conservation measures needed to ensure the long-term viability of this species.

FRI-474

THE CHARACTERIZATION OF THE COMPOSITION OF THE CELL WALL IN THE MODEL C4 GRASS SPECIES *SETARIA ITALICA*

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Setaria italica (foxtail millet) is a good genetic model for C4 bioenergy grasses due to its compact size, short life cycle, large seed production, and close genetic synteny with major bioenergy crops, such as maize, sorghum, switch grass, and *Miscanthus*. Gene discovery of important biomass relevant traits in *Setaria* is directly translatable to these energy feedstocks. Toward this goal, we are mapping the dynamic composition of the cell wall during stem development through characterizing amounts of cellulose, noncellulosic polysaccharides, lignin, and hydroxycinnamic acids. In parallel, we are classifying into large, multigene families cell-wall related genes in *Setaria italica* using rice, sorghum, and maize as backbone sequences. We will use deep RNA sequencing to establish transcriptional dynamics during the course of stem development. Approximately 45 to 50% of the material in the cell wall is composed of cellulose, 20% is composed of lignin, and the remainder is made up of noncellulosic material in basal internodes, with lesser amounts in younger internodes. Preliminary data on the cell wall composition demonstrates that *Setaria* is a suitable model C4 grass for cell-wall development.

SAT-474

COMPARISON OF LEAF HYDRAULIC CONDUCTANCE BETWEEN AN EVERGREEN AND DECIDUOUS CHAPARRAL SHRUB

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The plant water transport system plays key roles in plant development and growth. To transport water in plants, water is pulled from roots to leaves along a negative pressure gradient created by evaporation of water from the leaves. The efficiency of water transport can be quantified as the rate of water flow divided by the driving force causing the flow. We measured efficiency of water transport through leaves (leaf hydraulic conductance) for evergreen and deciduous chaparral shrubs. In chaparral shrub communities, evergreen and deciduous shrub species coexist interspersed with each other. Deciduous species shed all their leaves during part of the year in response to environmental changes. In contrast, evergreen species maintain some leaves throughout the year. We hypothesized that leaf hydraulic conductance differs between an evergreen species (*Ceanothus spinosus*) and a deciduous species (*Ceanothus integerrimus*). We predicted that the evergreen species would have greater leaf hydraulic conductance than the deciduous species. Leaf hydraulic conductance was measured on samples harvested from the California State University-Bakerfield common garden using the evaporative flux method. This method mimics the natural way in

which water flows through plants. Leaves were individually attached to tubing. Water traveled off of the balance, through the tubing, and out of the leaf. Flow rate at which water was taken up by the leaf was then recorded along with the driving force for flow. Comparing the leaf hydraulic conductance between an evergreen and a deciduous species will improve our understanding of how water transport systems differ with leaf habit.

FRI-476

EVOLUTIONARY REFERENCE POINTS FOR THE CONSERVATION OF LEEDY'S ROSEROOT, A RARE AND ENDANGERED CLIFF DWELLING PLANT

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The dynamics of small, natural populations are not well understood. Molecular genetic markers and traditional field studies used together can yield a strong understanding of the evolutionary potential and demographic characteristics of populations. Leedy's roseroot, *Rhodiola integrifolia* ssp. *leedyi*, is a cliff dwelling plant that is located in four populations in Minnesota and two populations in New York. It is classified by the US Fish and Wildlife Service as a threatened species. Our goal is to describe the genetic and demographic characteristics of the Minnesota Leedy's roseroot populations and to compare them with the characteristics of the widespread species *R. integrifolia* ssp. *integrifolia* and *R. rhodantha*, which are Leedy's roseroot's closest relatives. In June 2013, we performed a census of three of the Minnesota Leedy's roseroot populations, and have analyzed microsatellite markers for 23 individuals of *R. integrifolia* and 24 individuals of *R. rhodantha* using three primer pairs. The Minnesota populations range in size from 208 to 923 individuals. The preliminary microsatellite data reveal a total of 8 alleles in *R. integrifolia* ssp. *integrifolia*, 7 alleles in *R. rhodantha*, and 10 alleles in Leedy's roseroot. The larger number of alleles in Leedy's roseroot is surprising because narrow endemics, such as Leedy's roseroot, are generally expected to have less genetic variability than their widespread relatives. We will amplify 5 to 8 more microsatellite regions and investigate the data using population genetics software such as Arlequin and ONEsAMP to understand the demographic and genetic characteristics of Leedy's roseroot and its relatives.

CELL/MOLECULAR BIOLOGY

FRI-493

FUNCTIONAL ANALYSES OF GENES DIFFERENTIALLY EXPRESSED IN THE MICROSCLEROTIA OF VERTICILLIUM DAHLIAE

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The plant pathogenic fungus *Verticillium dahliae* is a causal agent of verticillium-wilt disease. Verticillium wilt is difficult to control because the pathogen is capable of cross infecting multiple plant hosts, and persists for long periods in the field. The fungus produces melanized microsclerotia, which can survive for years in the soil. The microsclerotia also serve as the primary inoculum in the field. We previously identified over 200 genes that were differentially expressed in microsclerotial cultures of *V. dahliae*, suggesting the importance of these genes in the development and maintenance of microsclerotia. Nearly 50% of the genes identified encode hypothetical proteins of unknown function. The objective of this work was to prepare knockout constructs for several of the genes highly differentially expressed in the *V. dahliae* microsclerotial cultures and to assess the role of these genes by functional analyses. The method of one-step construction of *Agrobacterium tumefaciens* recombination ready plasmids was applied for generation of the gene knockout constructs. Following fungal transformation, additional analyses will be conducted to determine whether the genes are important for morphogenesis and pathogenicity as well as microsclerotial development. Assessing the roles of genes involved in microsclerotia development or germination may provide insight into alternative verticillium-wilt control strategies.

FRI-492

THE ROLE OF BIGH3 C-TERMINUS CLEAVAGE IN SMOOTH MUSCLE CELLS

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Since diabetes is a prevalent issue in my community, the purpose of our project is to gain insight into BIGH3 biology in type II diabetes. BIGH3 is a proapoptotic protein that is made in large amounts by aortic and renal cells under diabetic conditions. Based on previous studies, our lab has shown that the C-terminal end of BIGH3 protein is cleaved, inducing apoptosis. Therefore, the logical assumption is that there is a lot of cell death by apoptosis in type II diabetes and that BIGH3 cleavage promotes disease progression. The goal of our research is to study biological mechanisms that can stop this C-terminus cleavage. Our hypothesis is that if the C-terminus of BIGH3 could not be cleaved, there would be less cell death by apoptosis. To test this hypothesis, our research includes two approaches for blocking BIGH3 C-terminal cleavage and then testing for the extent of cleavage. One approach is mixing BIGH3, produced by aortic cells and renal cells, with anti-BIGH3 antibody (Bleed 8). The second approach tests whether extracellular matrix molecules that are known to bind BIGH3, e.g., fibronectin, collagen, will block BIGH3 cleavage. Techniques used include cell culture, protein electrophoresis, western blots, immunoblots, one-way ANOVA to quantify results, and densitometry analysis to measure the extent of cleavage. Preliminary results suggest that fibronectin and anti-BIGH3 antibody prevent BIGH3 C-terminal cleavage, although more tests need to be done to quantify results. If our hypothesis is true, it is expected to lead to novel targets to develop agents to combat diabetes.

SAT-481

IDENTIFYING, CHARACTERIZING, AND INDUCING EFFECTIVE ANTI-HIV T CELL RESPONSES

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With an estimated 33.3 million individuals infected with HIV-1 at the end of 2010 and 2.5 million new infections per year, the need for a prophylactic HIV-1 vaccine is the biggest global health challenge this century. The variability and high mutation rate of HIV makes it difficult to design effective vaccines. Recent studies in individuals at early stages of infection have shown that the presence of HIV-specific CD8⁺ T cells recognizing conserved regions of the virus correlates with longer survival. However, the majority of HIV regions targeted during vaccination in healthy seronegatives are variable rather than conserved. These data led us to hypothesize that immunogens should be redesigned to contain only conserved regions of HIV-1 in order to increase the likelihood that T cells induced by vaccination will be able to recognize diverse incoming viral species. Therefore, the goal of this study is to assess the effectiveness of T cells targeting conserved versus variable HIV-1 epitopes to suppress viral replication. We have designed immunogens that contain only conserved regions of the virus and will compare these to current immunogens that also contain variable viral regions. Recombinant Lentivirus encoding all of the immunogens will be prepared and used to induce HIV-specific T cells by *in vitro* priming. HIV-specific T cells induced by conserved immunogens will then be compared to those induced by current immunogens to determine which are better at suppressing viral replication. To date, experiments have focused on optimization of lentiviral expression of immunogens in monocyte derived dendritic cells.

SAT-496

CORRELATION OF B-CELL MASS AND PLASMA GLUCOSE AS PROXY FOR B-CELL FUNCTION

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Type 1 diabetes (T1D) is an autoimmune disorder that targets insulin-producing β -cells in the pancreatic islets of Langerhans resulting in an inability to regulate blood glucose levels. As there is no cure for T1D, people living with the disease are treated with injections of insulin to prevent dangerously high blood glucose levels. However, insulin injections will not cure T1D; therefore, it is important for researchers to find ways to recover functional β -cell mass which will restore the ability to regulate blood glucose. In order to test the efficacy of any recovered β -cell mass or function, it is necessary to define how glucose profiles and pancreatic morphometry change with respect to diabetic models. Wild-type mice were administered a β -cell selective apoptotic agent, streptozotocin (STZ), or citrate and were monitored for 12 weeks with once weekly measurements by handheld glucometer in order to correlate loss of β -cell mass with the inability to maintain normal glucose profile. Mice treated with STZ demonstrated an increase in hyperglycemia (blood glucose measured > 250 mg/dL at 2 consecutive readings). Analysis of β -cell mass showed a decrease in total insulin-positive surface area in STZ-treated mice. In addition to weekly measurements of blood

glucose, wild-type continuous blood-glucose profiles were established by developing a method of implanting human blood glucose monitors into mice as proof-of-concept for future experiments. This method will allow monitoring of circadian or meal-associated patterns of plasma glucose and enable the detection of rapid changes in blood glucose.

FRI-510

THE EFFECTS OF Fcγ RECEPTOR ILB EXPRESSION ON DENGUE DISEASE

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Dengue is the most prevalent mosquito-borne viral illness of humans worldwide, with 100 million cases annually. Four related serotypes of dengue virus (DENV) cause unapparent infections and a range of disease manifestations, from classic dengue fever to life-threatening dengue hemorrhagic fever and dengue shock syndrome. Previous infection with one serotype results in life-long immunity to that same serotype, but increases the risk of severe disease on infection with a different (heterologous) serotype, possibly due to serotype cross-reactive antibodies or T cells. In antibody-dependent enhancement (ADE), cross-reactive, nonneutralizing antibodies raised during the first infection bind the second infecting serotype at subneutralizing levels and facilitate increased viral entry into target cells through Fcγ receptor-mediated endocytosis and phagocytosis. FcγRIIB is the only inhibitory Fcγ receptor. We hypothesized that the absence of FcγRIIB would lead to increased susceptibility to ADE, and increased disease severity *in vivo*. To test this, we obtained FcγRIIB^{-/-} mice on a C57BL/6 and 129/Sv hybrid background. We are currently backcrossing these mice to C57BL/6 mice deficient in the interferon alpha/beta receptor (IFNAR^{-/-}) to obtain IFNAR^{-/-} FcγRIIB^{-/-} double knockout mice on a full C57BL/6 background. The interferon deficiency is necessary for mice to be infected with DENV, which has proteins that incapacitate the human interferon antiviral pathway but not the mouse counterparts. Characterization of serum from infected mice will reveal the breadth and specificity of the IFNAR^{-/-} FcγRIIB^{-/-} antibody response, and infections performed under enhancing conditions should reveal the role of FcγRIIB in modulating dengue disease severity.

FRI-477

THE EFFECTS OF COMBINED ANTIRETROVIRAL THERAPY ON INFLAMMATORY RESPONSES OF BYSTANDER-UNINFECTED AND HIV-1-INFECTED NEURAL CELLS

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In the postantiretroviral therapy (ART) era, human immunodeficiency virus (HIV)-1-infected patients are living longer. There is growing concern pertaining to altered aging in these individuals in the setting of HIV-associated neurocognitive disorders (HAND) and combined ART (cART). Astrocytes play a critical role in neuronal health and disease. They are not productively infected with virus, but are highly active participants in neuropathogenesis. The effects of antiretrovirals on noninfected/activated neural cells in the aging, HIV-infected central nervous system (CNS) are understudied. We hypothesized that, during chronic HIV infection and inflammation, neural cells have altered inflammatory responses on long-term treatment with ART. Three classes of ART drugs were used in therapeutically prescribed combinations. Altered responses in primary human macrophages and astrocytes were determined by measuring metabolic activity and secretion of proinflammatory mediators. Primary human monocyte derived macrophage (MDM) culture methods were standardized for purity, differentiation, and infectability. The cultures expressed macrophage-specific markers as measured by both immunocytochemical staining and real-time PCR. On treatment with cART, metabolic activity and tumor necrosis factor-α expression were altered during inflammation. Cultured human astrocytes were also treated with cART. Metabolic activity and the secretion of proinflammatory cytokines, CCL2, interleukin-6, and CXCL8, were significantly altered during inflammation. These data suggest that cART may affect the responses of healthy, noninfected MDM and astrocytes in the context of chronic inflammation, as observed in the brain during HIV CNS infection. These altered responses may contribute to increased astrocyte dysregulation and lead to neuronal toxicity and dysfunction, ultimately resulting in HAND.

SAT-488

SITE OF INSULIN GROWTH FACTOR ACTION TO INDUCE OOCYTE MATURATION IN ZEBRAFISH

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Growth factors such as insulin-like growth factors (IGFs) play a large, critical role in oocyte development and maturation in vertebrates. IGFs have been shown to be potent inducers of oocyte meiotic maturation (OM), the final

stage of oocyte development. However, their sites and mechanisms of action are unknown. In this study, we tested the hypothesis that IGFs act directly on fully grown oocytes to induce OM using an *in vitro* zebrafish model of OM. Treatment with IGF-1 or IGF-2 (100 μ M) for 3 to 6 hours increased *in vitro* OM of follicle-enclosed oocytes several-fold compared to vehicle-treated controls. Both IGFs retained their ability to induce OM after removal of the follicle cells. We conclude from these experiments that IGFs act directly on oocytes to induce OM. Interestingly, IGFs also induced OM of smaller oocytes that were unresponsive to other hormones that regulate OM. The mechanisms of IGF stimulation of OM of both large and smaller zebrafish oocytes are currently being examined. An understanding of the control of OM in fish by IGFs and other growth factors and hormones could lead to improved procedures to control the onset of OM, ovulation, and spawning of captive broodstock and, therefore, could potentially be very valuable to the aquaculture industry.

SAT-483

EXPRESSION OF CLASSICAL MARKERS OF PLURIPOTENT STEM CELLS IN ADULT TISSUE OF THE SEA URCHIN *LYTECHINUS VARIEGATUS*

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Our global aging population poses one of the most significant challenges of the 21st century. Understanding the molecular and cellular mechanisms that underlie aging is an area of intense investigation. The sea urchin is a unique model organism to study aging as these animals grow indeterminately, a condition in which age is not correlated to functional decline or increasing mortality. Some species are extremely long-lived, living up to 200 years without showing signs of aging, cancer, or other age-related diseases. Sea urchins may achieve their extraordinary life history through continued tissue regeneration with age as a result of maintenance of stem cell populations. To test this hypothesis, we investigated the expression of a panel of stem cell genes in embryos and adult tissues of the sea urchin *Lytechinus variegatus*. Primers were designed for classic markers of stemness such as the transcription factors Sox2, Oct4, Ronin, myc, and a component of telomerase, TERT. We detected expression of these stem cell markers in RNA from four developmental stages and in adult coelomocytes, ampullae, gonad, esophagus, radial nerve, and Aristotle's-lantern muscle tissue using qRT-PCR. These initial findings suggest that stem cells may be present in adult sea urchins, and future work will be conducted to understand their role in tissue regeneration. Understanding the mechanisms by which these animals maintain good health throughout their lives may ultimately lead to new avenues for prevention or treatment of age-related diseases in humans.

SAT-505

PERSISTENT EGF SIGNALING SERVES TO PROMOTE LACTOTROPE DIFFERENTIATION IN GH4 PITUITARY SOMATOLACTOTROPE TUMOR CELLS, WHEREAS ACTIVATION OF THE PI3K/MTOR/S6K PATHWAY PROMOTES CELL PROLIFERATION AND THE TRANSFORMED PHENOTYPE

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Pituitary somatotropes and lactotropes, expressing GH and PRL respectively, retain plasticity, allowing rapid cell expansions in response to increased physiological demands. For example, the somato-lactotrope cell expands into lactotropes during pregnancy and into somatotropes with exercise. Unfortunately, very little is known about the signaling events that instruct somato-lactotrope cells to proliferate and then terminally differentiate or that contribute to the transformed phenotype. *In vivo* transgenic mouse studies revealed that uncontrolled activation of growth factor Ras/MAPK signaling pathways in lactotropes results in lactotrope hyperplasia. Moreover, *in vitro* studies using GH4 and GH3 rat somato-lactotrope tumor cell lines have shown that pMAPK is necessary for both short-term proliferation and differentiation, with the duration of pMAPK activation possibly dictating differential responses. However, these proliferation studies all relied on short-term (6 - 24 h) assays. Thus, the specific role of MAPK in durable lactotrope proliferation and differentiation responses (i.e., cell counts and phenotypic characterization over about 5 days), remain unknown. Furthermore, the role of mTOR signaling in either of these as durable responses is not well understood. In order to directly interrogate the role of EGF and mTOR, we used persistent EGF addition or pharmacological inhibitors to interrogate the role of these pathways in GH4 cell proliferation and clonogenicity. Using long-term proliferation and clonogenicity assays, we found that treating GH4 cells with EGF reduced cell proliferation and clonogenicity. Collectively, these data reveal that the EGF-signaling pathway, via Ras/Raf/MAPK, serves to promote lactotrope differentiation, whereas activation of the PI3K/mTOR/S6K pathway regulates lactotrope proliferation and transformed phenotype.

FRI-515

WOLBACHIA, AN INTRACELLULAR BACTERIUM PRESENT IN MOST INSECTS, RELIES ON CONSERVED MEMBRANE TRAFFICKING COMPONENTS FOR TRANSPORT THROUGH THE FEMALE GERM LINEAlejandra Santiago, Catharina Lindley-Casper, William Sullivan.*University of California, Santa Cruz, Santa Cruz, CA.*

Wolbachia is a bacterial endosymbiont that is efficiently transmitted through the female germ line in millions of insect species. Wolbachia is the cause of river blindness and elephantiasis, diseases afflicting over 200 million people worldwide. Similar to other pathogens, Wolbachia is surrounded by a host membrane. Rab GTPases play a role in cellular trafficking of these pathogens. Because of this, we hypothesized that Rabs, which are proteins involved in the regulation of membrane transport, may also participate in Wolbachia biology either by direct transport of the bacteria or by transport of nutrients for bacterial growth. Previous studies demonstrate that Wolbachia rely on microtubules and motor proteins for efficient transport into the oocyte from the neighboring nurse cells in *Drosophila melanogaster* female ovaries. Using microscopy, we demonstrate that Wolbachia transport also relies indirectly on membrane trafficking pathways. We find that Wolbachia transport from the nurse cells into the oocyte is reduced in ovaries expressing transgenic YFP-Rab6, a small GTPase specifically required for Golgi-to-ER membrane trafficking. We are investigating whether this ectopic expression is similar to expression in oocytes of infected mutant Rab6 lines. The results will allow us to better understand the role Rab6 plays in the distribution of Wolbachia throughout oocyte development. This finding has important implications for developing new drugs to target the bacteria.

SAT-497

G-CSF PREVENTS ACUTE LOSS OF PLZF+ SPERMATOGONIA AFTER STERILIZING BUSULFAN TREATMENT IN MICERose Joachim, Ryan Haley, Brian Hermann.*University of Texas at San Antonio, San Antonio, TX.*

Spermatogonial stem cells (SSCs) maintain spermatogenesis throughout a man's life. Transplanted SSCs have been shown to regenerate spermatogenesis in a variety of animal models, and most recently, in rhesus macaques that were made infertile due to high-dose busulfan chemotherapy. In that recent study, the hematopoietic deficits induced by high-dose busulfan chemotherapy were addressed using autologous transplants of granulocyte colony-stimulating-factor (G-CSF)-mobilized hematopoietic stem cells. While this regimen reconstituted each animal's hematopoietic system, a meta-analysis revealed that G-CSF treatment surprisingly protected rhesus spermatogenesis from busulfan-induced infertility. Thus, G-CSF may be able to prevent infertility after chemotherapy and obviate the need for risky procedures like SSC transplantation. Similar G-CSF treatments in mice led to significantly better recovery of spermatogenesis after busulfan treatment than in untreated controls, suggesting enhanced SSC survival. To determine if G-CSF treatment caused increased survival of undifferentiated spermatogonia (including SSCs) after busulfan treatment, we compared the testes of mice treated with busulfan with and without G-CSF 4 days after busulfan treatment. Testis sections were costained for PLZF (a marker of undifferentiated spermatogonia) and either activated caspase3 or TUNEL (apoptotic markers) are currently being analyzed. Our initial results demonstrate that testes from busulfan/G-CSF-treated mice contain more PLZF+ cells than testes of mice treated with busulfan alone. Although our analysis is ongoing, these preliminary results suggest G-CSF promotes survival of PLZF+ spermatogonia after busulfan treatment. Ultimately, this work may solidify a new fertility-sparing treatment that will circumvent the need for risky interventions like SSC transplantation.

FRI-488

EFFECTS OF HYPERGLYCEMIA AND ESTROGEN ON RHESUS MONKEY ENDOTHELIAL CELLSSteven Anzaldúa, Brandi Betts-Obregon, Andrew Mendiola, Jeff Grigsby, Andrew Tsin.*University of Texas at San Antonio, San Antonio, TX.*

Diabetic retinopathy (DR) is characterized by the leakage of blood into the eye in its nonproliferative stage and by hypoxia-induced angiogenesis in the retina in the more advanced proliferative stage. This in turn will cause blood to leak into the vitreous humor resulting in more complications such as retinal detachment and blindness. It is well documented that young women and pregnant women have fluctuating levels of estrogen in the body which is known to exacerbate DR. Although no cure for DR currently exists, the purpose of this study is to further our understanding of the mechanisms involved in the progression of DR. The effects of various estrogen concentrations on rhesus monkey retinal endothelial cells (RhREC) will be tested. Moreover, we hypothesize that the viability of a continuous cell line of RhREC will increase under hyperglycemic estrogen conditions but not under hyperglycemic conditions alone. RhREC

will be tested *in vitro* under hyperglycemic conditions using a glucose concentration of 18.5 mM (versus a control concentration of 5.5 mM) along with estrogen (E2) at 0.0, 0.1, 1.0, and 10.0 nM. Cell viability will be tested over 72 hours with interval time points every 24 hours along with imaging of cell morphology to determine if E2 + 18.5 mM glucose effects are dose and time dependent. This is a novel approach, attempting to show a relationship between high glucose and exogenous estrogen effects on RhREC. Results from our experiments will provide important information on the development of progressive DR.

FRI-494

EFFECTS OF MONOAMINES ON TEMPERATURE-SENSITIVE SEIZURES IN MUTANT *DROSOPHILA*

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Mutations in the voltage gated sodium channel gene *SCN1A* cause a wide spectrum of epilepsy disorders, from the mild form of genetic epilepsy with febrile seizures plus (GEFS+) to the severe form of Dravet syndrome (DS). GEFS+ is characterized by childhood-onset febrile seizures that persist beyond 6 years. In DS, seizures appear within the first year of life, can lead to cognitive impairment by the age of 2, and are often resistant to pharmacotherapy. We used 2 knock-in fly lines, one with a GEFS+ (K1270T) mutation and 1 with a DS (S1231R) mutation, as model systems to search for new therapies. Consistent with disease symptoms in humans, the GEFS+ and DS flies exhibit heat-induced seizures and the seizure phenotype is more severe in DS compared to GEFS+ flies. Our initial studies focused on the monoamine signaling since we found that seizure sensitivity was altered in DS and GEFS+ flies in a genetic background (white eyes) that affects monoamine levels. Feeding flies the serotonin precursor, 5-hydroxytryptophan (5-HTP) significantly reduces seizure sensitivity in DS mutants, but increases seizures in GEFS+ mutants. In contrast, a dopamine synthesis inhibitor, 3-iodotyrosine (3-IY), significantly reduces seizure sensitivity in GEFS+ mutants, but marginally reduces seizure sensitivity in DS flies. Neither GEFS+ nor DS flies showed a significant difference in seizure activity when fed histamine or dopamine. These data suggest that the serotonin and dopamine pathways regulate DS and GEFS+ seizure phenotypes, suggesting alternative therapeutic targets for the treatment of epileptic disorders.

FRI-490

DEACTIVATION OF *VIBRIO VULNIFICUS*, *SALMONELLA TYPHIMURIUM*, AND *BACILLUS CEREUS* VEGETATIVE CELLS AND SPORES BY A NON-THERMAL PLASMA FOR FOOD INDUSTRY APPLICATIONS

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Bacillus cereus, *Salmonella enterica*, and *Vibrio vulnificus* are among common species causing foodborne outbreaks in the United States. This study investigates effectiveness of cold plasma in sterilizations of *B. cereus* vegetative cells and spores; *S. Typhimurium* on eggs shells, chicken meat, tomato, and papaya; and *V. vulnificus* on live oysters. Plasma was applied to *B. cereus* vegetative cells on tryptic soy agar plates (TSA) for various exposure times, incubated, and inactivation recorded. *B. cereus* spores were dispersed on Petri plates, treated for 360 s, and suspended to determine inactivation. Plasma was applied to *Salmonella* on sample surfaces for various times, suspended, and plated to record inactivation. Plasma was then applied to *V. vulnificus* on agar oysters. Surfaces of treated oysters were swabbed and plated. Meat of treated oysters was homogenized and plated. Oyster surface and internal inactivation was recorded. Results confirmed 99% inactivation of *B. cereus* vegetative cells after 90 s and 0.84 log reduction of spores after 360 s. Inactivation of *Salmonella* on agar was 1.6 logs after 120 s, 0.49 logs on chicken eggs after 360 s, 1.1 logs on chicken meat after 360 s, 2.6 logs on tomato after 360 s, and 1.7 logs on papaya after 360 s. Lastly, *V. vulnificus* was completely eliminated on agar after 180 s, completely eliminated on oyster surface after 120 s, and reduced by one fold on internal homogenate of oyster after 360 s. Results show that cold plasma can be an alternative sterilization method in the food industry.

FRI-513

DEFINING THE EXTENT OF THE SPERMATOGONIAL STEM CELL POOL IN PRIMATES

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In mammals, spermatogenesis occurs in the seminiferous tubules in the testes, and is dependent on the continual self-renewal and differentiation of spermatogonial stem cells (SSCs). The characteristics and extent of the SSC pool in primate species remains the subject of intense scientific debate. Undifferentiated spermatogonia in primate

testes include A_{dark} and A_{pale} spermatogonia, which have been designated reserve and renewing SSCs, respectively. However, a male germline stem cell system with two distinct stem cells would be unique among mammals, and recent data suggests A_{dark} and A_{pale} share many phenotypic characteristics. A recent study in mice revealed inhibitor of DNA binding 4 (ID4) is exclusively expressed by A_{single} SSCs and is restricted to stem cells in the testes. Thus, assuming that the characteristics of rodent spermatogenesis are conserved in primates, ID4 may be a useful marker to define the extent of the SSC pool in primates and resolve the debate about whether A_{dark} and/or A_{pale} spermatogonia are the bona fide SSC in primate testes. Thus, we are examining ID4 expression in rhesus, macaque, and baboon testes using immunohistochemistry to determine whether A_{dark} and/or A_{pale} spermatogonia label for this marker. While this work is currently ongoing, we expect the results will give us insight into the identity of the primate SSC, which has important implications for understanding the basic biology of primate spermatogenesis and leading to clinical techniques such as SSC transplantation to regenerate spermatogenesis in infertile testes.

SAT-482

MECHANISMS THAT MEDIATE SDF-1-INDUCED APOPTOSIS IN ACUTE MYELOID LEUKEMIA

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In acute myeloid leukemia (AML), abnormal myeloid precursors accumulate in the bone marrow and blood. Most AML patients die within 1 year of diagnosis. Unfortunately, current therapies do not effectively kill AML cells in the bone marrow, thus new therapies are needed. Our lab recently found that signaling by SDF-1/CXCR4, a chemokine abundant in the bone marrow and its chemokine receptor expressed on most AML cells, causes apoptosis of AML cells via a mechanism that is normally inhibited in the bone marrow by nearby osteoblasts. We hypothesized that, for AML cells expressing high levels of CXCR4, the C-terminus of CXCR4 mediates SDF-1-dependent apoptosis via either G proteins or non-G protein mechanisms. Using the human AML cell line KG1a *in vitro* and molecular genetic approaches, we found that both the CXCR4 C-terminus and PKC activity were necessary for the SDF-1/CXCR4-dependent apoptosis of AML cells. In contrast, G_{α_i} , Src, PLC activation, and β -arrestin1 are not required. Ongoing research aims to identify other molecules required for this pathway. Elucidating the mechanisms of SDF-1/CXCR4 apoptosis could permit the design of more effective therapies that treat AML by enhancing the death of AML cells in the bone marrow via endogenous SDF-1/CXCR4.

FRI-489

ROLES OF MACROPHAGES AND BIGH3 IN RETINAL MICROVASCULAR CELLS

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Diabetic retinopathy (DR) is the leading cause of blindness in the United States. An early hallmark of DR is the loss of pericytes, which help to maintain the integrity of the blood vessels. The underlying cause for pericyte dropout is not known, although it can lead to microaneurysms, hypoxia, and damaging angiogenesis. We propose a novel pathway in which the secretion of TGF β -Induced Gene Human Clone 3 (BIGH3), a pro-apoptotic protein, is upregulated by macrophage-derived TGF β in the retina of diabetic patients. Immunohistochemistry (IHC) was performed to compare levels of BIGH3 and macrophage infiltration in the eyes of healthy and diabetic mice. We studied BIGH3 expression and protein upregulation by rhesus retinal endothelial cells (RhREC) and human retinal pericytes (RPC) in response to exogenous TGF β and medium conditioned by macrophages that were normal, called macrophage-conditioned medium (MCM), or macrophages precultured in high glucose and high LDL diabetic conditions, called diabetic macrophage-conditioned medium (dMCM). IHC showed increased macrophage infiltration and BIGH3 localization in eyes from diabetic mice as compared with the normal mice. BIGH3 expression was increased in RhRECs and RPCs in response to dMCM, and TGF β increased BIGH3 expression. Polyclonal BIGH3 antibodies blocked apoptosis. We found that TGF β secreted by diabetic macrophages upregulated BIGH3 expression and promoted BIGH3-dependent apoptosis in RPCs and RhRECs. This mechanism may contribute to pericyte loss and microvascular damage seen in the initial stages of diabetic retinopathy and could lead to better understanding of this disease.

FRI-501

IFN- γ IS PROTECTIVE IN EXPERIMENTAL AUTOIMMUNE ENCEPHALOMYELITIS BY LIMITING LIPID PEROXIDATION DAMAGE TO MYELIN SHEATHS

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Multiple sclerosis (MS) is the most common autoimmune disease of the central nervous system (CNS), affecting over 400,000 individuals in the U.S. MS is characterized by demyelination and inflammation of the CNS. Proinflammatory cytokines are believed to promote disease in MS and its animal model experimental autoimmune encephalomyelitis (EAE), whereas the role of IFN- γ is less clear. Higher levels of IFN- γ are found in the CNS of MS patients as compared with healthy individuals, yet mice genetically deficient in IFN- γ or its receptor (IFN- $\gamma^{-/-}$ or IFN- $\gamma R^{-/-}$) develop more severe EAE than wild type (Wt) mice, arguing for a protective role of this cytokine. We previously found that increased EAE severity in IFN- $\gamma^{-/-}$ and IFN- $\gamma R^{-/-}$ mice corresponded to an increase in myelin debris in CNS lesions. Since it is believed that peroxidation of myelin lipoproteins may contribute to disease severity in MS, we hypothesize that IFN- γ may play a protective role in EAE/MS by limiting lipid peroxidation of myelin debris. We will test this hypothesis by inducing EAE in IFN- $\gamma R^{-/-}$ and Wt mice and determining whether treatment with inhibitors of lipid peroxidation ameliorates clinical disease. Treatment effects on lipid peroxidation of myelin debris, demyelination, and inflammation will be corroborated in CNS tissue by confocal microscopy, flow cytometry, and thiobarbituric acid reactive substances (TBARS) assay. We anticipate that treatment with lipid peroxidation inhibitors will ameliorate EAE in IFN- $\gamma R^{-/-}$ to Wt levels and decrease lipid peroxidation of CNS tissue. If correct, inhibitors of lipid peroxidation could open up new avenues for the treatment of multiple sclerosis.

FRI-506

USING PHAGE DISPLAY TO PRODUCE ANTIBODIES AGAINST BOVINE SERUM ALBUMIN

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Current methods for monoclonal antibody production utilize hybridoma technology. This requires the repeated immunization of mice followed by the harvest and fusion of spleen cells with an immortalized cell line in order to produce and select for antigen-specific antibody-producing clones. Because of the cost, time, and expertise required for traditional monoclonal production, we are now investigating the efficacy of using phage display to generate novel antibodies. The aim of this study is to develop proficiency in phage display and allow for a supplemental approach to produce antibodies at our campus Monoclonal Antibody Training and Service Center. Phage display utilizes a library of modified bacteriophages that display single-chain variable fragments (ScFvs) of diverse specificities. Through repeated antigen-targeted biopanning and bacterial transformation, target phages with the desired specificity can then be isolated and amplified. Thus far, we have been successful in replicating the phagemid library and have performed various infection assays to validate the phage library as well as the background genotypes of the vectors involved. Initial studies will target bovine serum albumin (BSA), a serum protein derived from cow blood which functions *in vivo* as a carrier protein for steroids, fatty acids, and thyroid hormones. Once successful phages have been isolated, amplified, and banked, this technology will allow for epitopic tagging of antigens, immunoprecipitation, antigen isolation and characterization, and recombinant modifications of antibody variable regions. Moreover, this platform will allow us to increase antibody output, expand to more topical targets, involve more students in antibody production, and incorporate components of the process into select lab courses.

FRI-491

DEVELOPMENTAL ROLE OF THE TRANSCRIPTION FACTOR ZBTB24 IN *Danio rerio*

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Transcription factors are proteins that are responsible for the initiation and regulation of transcribing gene sequences from DNA into mRNA by binding to a sequence-specific DNA region. Mutations in humans of the transcription factor ZBTB24 are associated with facial-cranial anomalies, immunodeficiency, and other abnormalities. Because this transcription factor is conserved in *Danio rerio* (zebrafish), we hypothesize that a knockdown of transcription factor ZBTB24 in zebrafish embryos will result in defective developmental characteristics resulting in phenotypic abnormalities. Accordingly, by injecting embryos in the 1, 2, or 4-cell stage of development with the ZBTB24-blocking morpholinos, we expect it will negatively affect the development of the zebrafish. Observing the growing *Danio rerio* until maturity, phenotypic characteristics will be recorded and compared to wild-type danios. We will also use a yeast

one-hybrid system to identify the binding sites of ZBTB24 on the *Danio rerio* genome. In addition, danio ZBTB24 DNA binding and zinc finger domains will be aligned with human ZBTB24 sites to identify similarities in function between the two species. A bioinformatic comparison will subsequently identify target genes of both ZBTB24 and a control transcription factor with known linked facial cranio anomalies. To this end, we will clone the full-length ZBTB24 cDNA from danio RNA for yeast expression using zebrafish genomic DNA as a bait. Collectively, this project will establish a role for this transcription factor in animal development.

FRI-482

REDUCTION OF FIBROSIS IN TYPE 2 DIABETES BY (-)-EPICATECHIN

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Fibrosis, the buildup of connective tissue (mainly collagen), decreases the contractility and elasticity of the heart which can lead to heart failure. In this study, we looked at the effects of (-)-epicatechin (EPI) on reducing the progression of type 2 diabetes and fibrosis *in vivo*. Type 2 diabetes was induced by feeding rats a high energy diet (HED) consisting of 10% lard and 20% glucose. After 4 weeks, a low dose streptozotocin (30 mg/kg) was given IP to cause partial dysfunction of pancreatic β -cells and suppress insulin secretion. Control animals were maintained on normal chow and received an IP injection of vehicle (water). Animals were also treated with EPI (1 mg/kg/day) or water by oral gavage. Results demonstrated that diabetic animals had significant weight gain (~44%) and increased blood glucose levels (519 mg/dL) compared to control (37% and 185 mg/dL, respectively). EPI significantly reduced changes in body weight (~33%) and blood glucose levels (351.2 mg/dL) compared to diabetic animals. Histological analysis elevated collagen levels in diabetic hearts compared to control and EPI-treated animals. In conclusion, our results demonstrate the ability of EPI to reduce body weight, plasma glucose levels, and fibrosis in type 2 diabetes. (This study was supported and funded by CSU-LSAMP which is supported by the National Science Foundation under Grant # HRD-0802628 and the CSU Office of the Chancellor.)

SAT-499

MOLECULAR CLONING OF CHONDROITINASE ABC FROM PROTEUS VULGARIS FOR USE IN GLYCOSAMINOGLYCAN RESEARCH

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Many biological processes involve the use of glycosaminoglycans (GAGs), which are composed of alternating hexosamine and uronic acid residues. Chondroitin sulfate (CS), belonging to a subset of GAGs called galactosaminoglycans (GalAGs), is known to inhibit nerve regeneration following an acute injury to the central nervous system (CNS). The enzyme chondroitinase ABC (ChABC) depolymerizes CS into tetrasaccharides and disaccharides. The removal of CS polysaccharides at the sight of CNS injury promotes the recovery of the adjacent neurons. This project focuses on the cloning of ChABC, which is used in the lab for further research into nerve regeneration. Using *Proteus vulgaris* genomic DNA as a template, a forward primer was designed to include an XhoI restriction site, and the reverse primer was designed to include a BamHI restriction site. The ChABC DNA was amplified and cloned into the pET-19b vector. Efforts are currently under way to express, purify, characterize, and utilize this current enzyme. This technique, along with other variations, will then be used to efficiently produce other pure GAG enzymes. Results will be accessible in this presentation.

SAT-504

POLY (N-ISOPROPYL ACRYLAMIDE)-COATED SURFACES: INVESTIGATION OF CYTOTOXICITY OF CPNIPAM

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Poly (N-isopropyl acrylamide) (pNIPAM) is a thermoresponsive polymer that undergoes a phase change at a physiologically relevant temperature range, which leads to cell release. Above its lower critical solution temperature (LCST approximately 32 °C), pNIPAM is relatively hydrophobic and mammalian cells can be cultured on pNIPAM-grafted surfaces. When the temperature is lowered below the LCST, the polymer is hydrophilic and becomes hydrated. In this state, its chains become more extended and cells detach as intact cell sheets. These cell sheets can then be used to engineer tissues. Before the detached cell sheets can be used on humans, the cytotoxicity of the surfaces must be assessed. In recent studies, cytotoxicity testing showed an abnormal increase in the cytotoxicity of the polymer cpNIPAM. In this work, we investigate the reasons behind this anomaly. The cpNIPAM-coated surfaces

were evaluated for their thermoresponse and surface chemistry using standard surface science techniques (e.g., goniometry, X-ray photoelectron spectroscopy). The relative biocompatibility of the substrates was evaluated using bovine aortic endothelial cells and MTS, live/dead, plating efficiency. We find that the diminished cell viability of BAECs exposed to cpNIPAM substrates is due to a combination of factors, including the inclusion of short chain length polymers, the presence of unreacted catalyst, and other factors. This work will provide valuable insights into the cytotoxicity of cpNIPAM-coated surfaces, and therefore, into the applicability for human subjects of cells grown on this surface.

SAT-480

MEASUREMENT OF RELATIVE TELOMERE REPEATS IN HUMAN CANCER CELL LINES USING A MONOCHROME MULTIPLEX QUANTITATIVE PCR ASSAY

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Telomere length (TL) has recently shown prognostic value in Ewing sarcoma, nonsmall cell lung tumors, gastric cancer, and neuroblastoma. A TL pattern among cancers may provide information to create a better understanding of the molecular or pathogenic characteristics of specific cancer types. Telomeres are hexamer-nucleotide repeat sequences (5'-TTAGGG) at the ends of the chromosomes that serve as cap-like protective mechanisms to maintain the chromosome's structure after DNA replication. Once TL becomes too short after several cell divisions, a normal cell undergoes senescence or apoptosis. In order to avoid this biological fate in cancer, a tumor cell can activate telomerase to maintain telomere length or elongate their TL by initiating the alternative lengthening of telomeres (ALT) pathway. To measure TLs or telomere repeats, we based our assay on a monochrome, multiplex quantitative PCR. This approach measures the signal generated from the telomere repeats against the signal from a single copy gene in the same DNA sample. The method is unique by measuring 2 fluorescent signals at 2 different temperatures using 1 DNA-intercalating dye within the same reaction tube. Our study included various cancer cell line DNAs including the NCI-60 panel. Preliminary data show statistically significant differences within breast cancer, pancreatic cancer, and osteosarcoma cell lines. In osteosarcoma cell lines, telomere repeat values correlate with ALT activity and demonstrate potential in our assay as a screening method for cancer patients. We plan to further investigate additional cell lines and to validate the utility of the assay on FFPE specimens.

SAT-502

ROLE OF REVERSE TRANSCRIPTASE DOMAIN 0 IN NONLTR RETROTRANSPOSON INTEGRATION

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Transposable elements (TEs) are genomic parasites (mobile DNA) with the ability to replicate within the host genome. Of these TEs, nonlong terminal repeat retrotransposons (NLR) make up over 34% of the human genome. NLRs use a "copy out as RNA, copy in as DNA" replication mechanism. NLR integration occurs through target-primed reverse transcription (TPRT) where the element encoded DNA endonuclease generates a free chromosomal 3'-OH that is used to prime cDNA synthesis directly at the site of insertion. In addition to DNA endonuclease and reverse transcriptase (RT) activities, NLRs must encode the ability to bind element RNA. The RT of NLR elements has a domain (domain 0) not present in the RT found in long-terminal repeat retrotransposons or retroviruses. It is hypothesized that domain 0 of the NLR RT may be involved in recognizing element RNA. The R2 NLR element from *Bombyx Mori* is an excellent model system for the molecular and biochemical dissection of TPRT because of R2's site specificity and the ability to obtain purified components that retain activity *in vitro*. Site-directed mutagenesis was used to generate a point mutation within domain 0 of the RT. The mutant protein has been purified and is being tested for loss of function using *in vitro* based DNA and RNA binding reactions that will be analyzed by electrophoretic mobility shift assays and denaturing gel electrophoresis. Characterization of any loss of function when compared to the wild-type protein will determine the role of domain 0 in the R2 integration process.

FRI-484

CHARACTERIZATION OF PREVALENT OPHTHALMIC MICROORGANISMS ISOLATED AT AN OPTICAL CLINIC SERVING ECONOMICALLY DISADVANTAGED AND TRANSIENT POPULATIONSRoquita Garcia, Martha Gonzales, Ricardo Mata, Ana Vallor.*University of the Incarnate Word, San Antonio, TX.*

This study seeks to investigate the prevalence of opportunistic microbial species on eyewear. Eyeglasses, when infrequently cleaned or sterilized, may serve as ecological niches for ophthalmic pathogens as compared to eyeglasses which are routinely maintained. If colonization of opportunistic microbes occurs, eyeglasses would serve as a continuous source of reinoculation giving rise to recurrent ocular infections and development of drug resistance. In addition, eyeglasses may serve as a point of transmission between individuals who share eyeglasses or health care providers handling them during routine exams in an optical setting. A total of 60 subjects will be recruited, 20 from each of the following populations: patients and health care workers recruited from I Care San Antonio optical clinic serving economically disadvantaged and transient populations and control subjects with no clinical association. Surveys were administered addressing hygiene habits and recent episodes of infection and treatment. Samples were taken from subjects and their eyeglasses. Initial microbial characterization entailed identification by microscopy, isolation on differential media, and biochemical tests. Currently, of 40 subjects recruited, 181 microbial samples have been collected and 54 have been isolated from eyeglasses. Preliminary identification of species include *Serratia* sp., Gram negative and positive rods, *Micrococcus luteus*, and *Staphylococcus* spp. Assessment of resistance to antibiotics and germicides routinely used in the clinic is currently being conducted. We predict that there will be a unique microbial populations demonstrating germicide resistance colonizing poorly maintained eyeglasses and transmission from patient to health care worker of these organisms.

FRI-479

THE TWO YEAST GYF PROTEINS SMY2/SYH1 IMPACT CELLULAR PRE-MRNA ABUNDANCERoberto Tapia, Min Chen, Brian C. Rymond.*University of Kentucky, Lexington, KY.*

Eukaryotic gene expression is regulated at multiple levels. Two structurally related cytoplasmic yeast proteins Smy2 and Syh1 belong to the phylogenetically conserved GYF protein family, whose members generally function in RNA metabolism. While genetic/physical interaction partners of Smy2 and Syh1 are highly enriched in the splicing and mRNA decay categories, direct evidence linking Smy2 and Syh1 function in cellular RNA processing or stability is still lacking. Here we tested whether the Smy2/Syh1 proteins impact the cellular abundance of unprocessed pre-mRNA exported to the cytoplasm bound with the BBP splicing factor. We predicted that if Smy2/Syh1 help promote the degradation of unprocessed pre-mRNA, then pre-mRNA levels would be elevated in the mutant background. Yeast with either the *smy2::KAN* or *syh1::KAN* single deletions or both deletions grow well. RNA extracted from these cells was assayed by northern blot for the levels of several intron-containing ribosomal protein transcripts (*RPS17A*, *RPS22B*, ...) and other intron-bearing genes. When cell density increases to the point where growth slows and ribosome demand diminishes, we see a clear increase in unspliced ribosomal protein pre-mRNA in the double deletion mutant. These and related observations support our hypothesis that Smy2 and Syh1 act in pre-mRNA metabolism and suggest that these proteins may promote the turnover of excess pre-mRNA under conditions of growth restricted ribosomal protein demand.

SAT-500

MOLECULAR MECHANISMS OF THE ANTI-BREAST-CANCER EFFECT OF *PHYLLOSTACHYS EDULIS* BAMBOO EXTRACT AND COMPOUNDSMatthew Lim, Jason Higa, Jun Panee.*John A. Burns School of Medicine, Honolulu, HI.*

Breast cancer (BC) is one of the most common cancers in women in America, and mortality is disproportionately high in some minority groups. Alternative forms of treatment are being considered for those unable to receive or hesitant concerning chemotherapy. This study investigated the molecular mechanisms of the anti-breast-cancer effect of *Phyllostachys edulis*, which is a widely distributed bamboo. The general hypothesis is that the extract from *Phyllostachys edulis* may inhibit the development of breast cancer through decreasing cell proliferation and/or inducing cell death. Estrogen receptor positive and negative (ER+ and ER-) human BC cell lines were used as *in vitro* models, and noncarcinoma mammary cells were used as a control. Fractions and compounds were isolated from the extract through chromatography. Cell proliferation, cell cycle, apoptosis, and ERalpha binding activity was measured

by DNA-ethidium bromide binding, propidium iodide (PI) staining, and flow cytometry, competitive binding assay, and luciferase reporter assay. The raw extract and compounds from *Phyllostachys edulis* were more effective in inhibiting the proliferation of ER+ BC cells in comparison to that of the ER- BC cells. This inhibitory effect was associated with weak binding activities to ER α ; G1 arrest and apoptosis induction; increases of p21(WAF) and BAX protein expression; decrease of cyclin D1 protein expression; increase of total peroxisome proliferator-activated receptor activity; and O-methylation of flavones as active compounds. Further research on the molecular mechanisms and metabolites of bamboo extract may determine whether individual or multiple compounds provide anti-breast-cancer effects.

SAT-495

OVEREXPRESSION OF THE G PROTEIN-COUPLED ESTROGEN RECEPTOR PROMOTES EARLY MAMMARY TUMORIGENESIS IN A MOUSE MODEL

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Tumor progression in the mouse mammary epithelium caused by ectopic expression of the polyoma middle T oncoprotein (PyMT) is a reliable model for studying human breast cancer. The G protein-coupled estrogen receptor (GPER) is an intracellular transmembrane estrogen receptor that is localized to the endoplasmic reticulum. GPER plays a role in estrogen pathophysiology by promoting proliferation in breast cancer cells. The goal of our study was to examine the effects of increased GPER activity on early mammary tumorigenesis; therefore, we created mice that overexpressed GPER through transgenic technology and crossbred them to PyMT transgenic mice. The abdominal-inguinal mammary glands were collected and fixed from seven-week-old female offspring that were either PyMT transgenic only or doubly transgenic for both GPER and PyMT. One gland was prepared for wholemount, stained with carmine, and photographed. The other gland was embedded in paraffin and sectioned for H&E staining. Morphometric analyses were used to quantify the proportion of mammary gland area containing hyperplasias and tumor-like growths. Our results revealed that mammary glands from mice that were PyMT transgenic and overexpressed GPER had a significantly ($p = 0.015$) larger tumor-involved area distal to the lymph node when compared to glands from mice that were PyMT transgenic only. Based on these results, it is evident that overexpression of GPER promotes early mammary tumorigenesis.

FRI-504

DEFINING THE CORTICAL DETERMINANTS OF THE DIVISION SITE DURING STARFISH MEIOSIS

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Meiosis in animal cells involves a series of reductive divisions that ultimately give rise to a haploid gamete. In oogenesis, only a single gamete is generated at the end of meiosis, as a result of two highly asymmetric cell divisions that conserve cytoplasm within the oocyte. During prometaphase of meiosis I, the meiotic spindle translocates toward the cell cortex, and eventually docks one pole against the cell surface. Our lab is interested in understanding the cortical cues that enable meiotic spindle migration and docking in starfish oocytes, where meiotic divisions occur at the animal pole. Work in other systems has implicated the PAR complex of proteins in polarized cell divisions, and we wished to test the hypothesis that the PAR complex defines the cortical site of meiotic cell division. Toward these ends, we obtained immature oocytes from the atlantic starfish, *Asterias forbesi*, and induced meiotic maturation with 1-methyl-adenine. In these oocytes, germinal vesicle breakdown occurred within 20 minutes with a prominent prometaphase MI spindle lying parallel to the animal pole by 45 minutes post-activation. To interfere with PAR complex function, oocytes were pretreated and activated in the absence or presence of a pseudosubstrate inhibitor of atypical PKC (aPKC i). Examination of MI spindles by immunolocalization revealed that inhibition of aPKC had no initial effect on spindle migration to the animal pole. Current efforts are focused on examining spindle rotation in cells with compromised aPKC activity, both by immunofluorescence as well as timelapse live-cell microscopy.

FRI-480

IDENTIFICATION OF MIR-137 TARGETS IN COLON CANCER

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MicroRNAs (miRNAs) are non-protein-coding RNAs that negatively regulate gene expression by inhibiting protein translation. MicroRNAs are frequently dysregulated in many types of cancer, resulting in aberrant gene expression.

We recently identified miR-137 as a tumor-suppressive miRNA, and found its expression decreased in approximately 70% of colon cancer tumor samples, as compared to normal tissue. Furthermore, when we reexpressed miR-137 in cancer cell lines, we reduced cell growth, colony formation, and tumorsphere growth. We identified oncogene Musashi-1 (*Msi1*) as a target of miR-137. However, microRNAs such as miR-137 are known to regulate hundreds of genes, therefore, our goal is to identify additional targets of miR-137 that may be overexpressed in colon cancer. We hypothesize that the loss of miR-137 in colon cancer results in an overexpression of oncogenes, such as *Msi1*, contributing to colon cancer initiation and progression. Using miRNA-prediction programs PicTar and TargetScan, we identified predicted targets of miR-137. Colon cancer cell line HCT-116 was transfected with miR-137 mimic for 24 to 48 hours and total RNA was isolated. RNA was then converted to cDNA using reverse-transcription PCR and cDNA expression of our genes of interest was measured using quantitative real-time PCR (qRT-PCR). By identifying additional miR-137 targets, we hope to gain a better understanding of colon cancer etiology. Additionally, understanding the role of miRNAs such as miR-137 is important to developing miRNA-based molecular therapy, deliverable to tumors via Dr. Xu's patented nanoparticle.

SAT-512

THE ROLE OF MTORC1 SIGNALING IN SPERMATOGENIAL STEM CELLS

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Mammalian target of rapamycin complex 1 (mTORC1) is a multisubunit protein kinase complex that senses the cellular environment in order to determine whether conditions are optimal for protein synthesis and cell proliferation. There is evidence that suggests mTORC1 may also play a critical role in the self-renewal versus differentiation-fate decision in spermatogonial stem cells (SSCs). SSCs are the unipotent stem cells responsible for sperm production in the testis and male fertility. This project will investigate the effects of inhibiting mTORC1 in cultured SSCs. We hypothesize that the SSC population will be depleted due to uncontrolled stem cell differentiation when mTORC1 signaling is inhibited. To test this hypothesis, we will inhibit mTORC1 in SSCs using RNA interference (knockdown) of RAPTOR, the substrate recognition component of mTORC1. For this purpose, we will optimize mouse RAPTOR knockdown using short-hairpin RNAs. Currently, we are cloning an expression plasmid that will contain the entire mouse Raptor cDNA, which we will use to express RAPTOR protein by transient transfection into human cells. Cotransfection of this expression construct with knockdown plasmids followed by RAPTOR western blot analysis will optimize RAPTOR knockdown. We anticipate that this approach will confirm which knockdown target efficiency depletes RAPTOR and allow us to proceed to test the consequences of mTORC1 loss in SSCs. Ultimately, this experiment will determine whether mTORC1 signaling is required for normal SSC fate determination and, consequently, confirm its role in spermatogenesis and male fertility.

FRI-478

PEDF GENE THERAPY USING BONE MARROW-DERIVED MACROPHAGES: A NEW MEAN FOR TREATING PROSTATE CANCER

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Macrophages have been described as one of the main inflammatory components involved in prostate cancer (PCa) initiation, progression, and metastases. PEDF (pigment epithelium-derived factor) is an antiangiogenic factor with differentiation activities and was recently suggested as an immune-modulating factor. PEDF expression has been shown to be downregulated in PCa compared to normal tissues. In previous studies we demonstrated that PEDF reexpression in PCa cells curbs tumor growth *in vivo* and prolongs the survival of tumor-bearing mice. More recently, we have showed that PEDF induces the migration of macrophages and stimulates their differentiation towards a tumor-cytotoxic phenotype leading to phagocytosis of tumor cells. While these results emphasize on PEDF anti-tumor properties, the delivery of PEDF still remains challenging. The objective of the present study is to investigate PEDF gene therapy using bone-marrow derived macrophages (BMDMs) as a novel therapeutic modality for advanced PCa. Our hypothesis is that PEDF expression will induce the migration and differentiation of BMDMs into a tumor-cytotoxic phenotype, block tumor growth and metastases formation, and prolong survival. To validate this hypothesis, we are isolating BMDMs from C57BL/6 mice. After differentiation, macrophages are treated with or without PEDF, or transduced with PEDF or control lentiviruses, then analyzed for tumor-promoting or tumor-cytotoxic differentiation. In the present proposal, we will use the transgenic adenocarcinoma of the mouse prostate and the LNCaP-derived CL1 orthotopic xenografts to investigate the effect of PEDF expression by BMDMs on tumor growth and survival. This project may lead to development of improved therapeutic approaches for treatment of prostate cancer.

SAT-486

EVALUATION OF THE TOXICITY OF VIRAL VACCINES ON THE CENTRAL NERVOUS SYSTEM OF RAINBOW TROUT

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Vaccines must be innocuous or cause minimal side effects to humans and animals. Many viruses have a tropism for the central nervous system (CNS). Viral vaccine formulations may consist of a live, attenuated viral strain that can potentially reach the CNS. Since the 1970's, fish vaccines have been widely used to control aquatic diseases. The infectious hematopoietic necrosis virus (IHNV) is known to cause fatal infections in salmonids worldwide and to have neurotropic manifestations. The aim of this study is to evaluate the safety of a live, attenuated IHNV vaccine in rainbow trout delivered by intramuscular injection (i.m.) or intranasally (I.N.). Rainbow trout were vaccinated once (trial 1) I.N. or i.m. with the IHNV vaccine or phosphate buffer saline (PBS). Trout received a booster vaccination 28 days after primary immunization in trial 2. Five fish from each group of both trials were sampled 1, 4, 7, 14, 21, and 28 days post immunization (dpi). Brain tissue samples were collected and the presence of IHNV was detected by RT-qPCR. Three i.m. trout 4 dpi and 1 i.m. trout 21 dpi tested positive for IHNV in the first trial while 1 i.m. and 1 I.N. specimen tested positive for IHNV 4 dpi and 28 dpi, respectively. Presence of IHNV correlated with expression of IL-1B in the brain. Nasal vaccination appears to be a safer vaccination route than injection in our IHNV trout model. Future studies will develop nonlethal toxicity tests using magnetic resonance imaging (MRI) to track vaccine fate in the central nervous system.

FRI-511

DIRECT INTERACTION BETWEEN DISHEVELLED AND DISCS LARGE INDUCES MICROTUBULE POLARIZATION IN DROSOPHILA

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Asymmetric cell division, which generates cellular diversity, requires properly regulated cell polarity. Cell polarity is essential for proper development of adult tissues, and human diseases such as cancer have been linked to defects in cell polarity. The mechanisms involved in cell polarity remain incompletely described. Two proteins that influence cell polarity in a range of cellular systems include Dishevelled (Dsh) and Discs large (Dlg), which are thought to induce cell polarity partly by regulating microtubule stability. Adenomatous polyposis coli (APC), a tumor suppressor protein, interacts with Dsh and Dlg, enhancing microtubule stability. This suggests a possible interaction between these proteins even though a direct functional interaction between Dsh and Dlg has not yet been identified. We have identified an interaction between the PDZ domain of Dsh (Dsh^{PDZ}) and an internal Hook domain of Dlg (Dlg^{Hook}). We hypothesize that a functional protein complex forms between Dsh-Dlg accompanied by APC that is crucial for microtubule polarization. The objective of this project is to define the molecular basis for the Dsh-Dlg interaction and analyze its role in microtubule dynamics. We will first examine binding of Dsh^{PDZ} to a series of Dlg^{Hook} truncations to determine the minimal binding sequence. Additionally, we will determine the X-ray crystal structure of the Dsh-Dlg complex to define the molecular basis of this interaction. Lastly, we will examine the function of the Dsh-Dlg complex in regulating microtubule polarization in cultured *Drosophila* cells. Overall, we look to identify the binding site and the function associated with this complex.

FRI-508

DEFINING MOLECULAR MECHANISMS THAT LINK OBESITY WITH BREAST CANCER AGGRESSIVENESS

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Breast cancer in women is the second leading cause of cancer death in the United States. Obesity (body mass index of >30) is associated with increased breast cancer risk and morbidity. The molecular mechanisms leading to tumor formation and progression are not yet fully understood. Our experiments focus on defining protein markers that play a role in epithelial to mesenchymal transition (EMT), a process by which epithelial cells become invasive and can acquire stem-like properties. Toward this goal, expression of adiponectin receptors (AR1 and AR2) and EMT markers in mammary tumor tissue of lean and obese female Sprague-Dawley rats, both on high fat diets, were evaluated through western blots. Obese rats predominately developed invasive tumors, verified by histology. The EMT markers quantified include E-cadherin, a protein responsible for cell-cell contact, and N-cadherin and vimentin, markers that indicate that cells have entered a mesenchymal state. In brief, our results reveal an increase in expression of

AR1, N-cadherin and vimentin markers in mammary tumor samples from obese rats, as compared to lean rats. In contrast, decreased levels of E-cadherin were observed in tumors of obese rats, as compared to lean rats. Defining the changes in expression of AR1 and EMT markers in mammary tumor tissue in an *in vivo* model is an important first step in gaining mechanistic insights into the link between obesity and breast cancer risk and morbidity.

FRI-507

STRUCTURAL AND SEQUENCE ANALYSIS OF A BACTERIOPHYTOCHROME FROM THE MYXOBACTERIUM *STIGMATELLA AURANTIACA*

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Bacteriophytochromes (BphPs) are red-light photoreceptors found in various photosynthetic and nonphotosynthetic bacteria. They are unique in their ability to undergo reversible photoconversion between spectrally distinct red (Pr) and far-red (Pfr) light absorbing forms. They are composed of a photosensory module covalently linked to an effector domain, which is usually a histidine kinase. BphPs require biliverdin (BV) as an organic cofactor for photoactivity. We recently solved the crystal structure of a BV-bound BphP from a nonphotosynthetic myxobacterium, *Stigmatella aurantiaca* (SaBphP1). Unlike classical BphPs, SaBphP1 undergoes limited Pr/Pfr photoconversion. The complete photoconversion of SaBphP1 can be restored by mutating threonine (Thr289) to a histidine (His) in the photosensory module. In classical BphPs, the conserved His stabilizes the D-ring of BV in the Pr state. Based on structural analysis of SaBphP1 in the wild-type and mutant (Thr289His) forms, we propose that Thr is too far away to form a hydrogen bond with the D-ring of BV resulting in the partial Pr-Pfr photoconversion of the wild-type protein. When Thr is converted to His in SaBphP1 (Thr289His) mutant, increased photoactivity is observed due to the ability of His to hydrogen bond with the D-ring. In related BphP's, RpBphP2 and RpBphP3 from *R. palustris*, mutating conserved His to Thr abolishes photoconversion. Mutations were also introduced to highly conserved residues (Asp208His and Tyr262Phe) in SaBphP1 that stabilize BV by forming hydrogen bonds. Our structural and sequence analyses of SaBphP1 and related BphPs from *R. palustris*, RpBphP2 and RpBphP3, emphasize the importance of His289 interactions with BV for complete Pr/Pfr photoconversion.

FRI-496

PH SENSITIVE REGULATION OF YEAST TORC1: THE ROLE OF V-ATPASE

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Vacuolar proton ATPase (V-ATPase) is a membrane protein complex that uses energy from ATP hydrolysis to pump protons into organelles against a concentration gradient. V-ATPase can affect cell function directly through its proton pumping activity or indirectly by regulating the activity of other proteins. It is known that V-ATPase activity is necessary for activation of the target of rapamycin complex 1 (TORC1), which is a major regulator of cell growth. However, it is unknown exactly how V-ATPase activates TORC1. We propose using budding yeast as a model system to study the V-ATPase-TORC1 axis. We showed that the yeast TORC1 activity is compromised in V-ATPase mutants grown at pH 6 or above, whereas it is normal when cells are grown under more acidic conditions. This result suggests that the extracellular pH interplays with V-ATPase to regulate TORC1. We hypothesize that cellular pH homeostasis controls TORC1. It is our aim to determine whether cytosolic or vacuolar pH regulates TORC1. We are using fluorometric assays employing BCECF, a pH-sensitive fluorescent dye, and pHluorin, a pH-sensitive green fluorescent protein, to measure yeast vacuolar and cytosolic pH respectively. The TORC1 activity will be evaluated by measuring phosphorylation of Sch9p, a direct TORC1 substrate. The correlation between the TORC1 activity and the vacuolar or cytosolic pH will be determined in wild-type and V-ATPase mutant cells that are grown in medium buffered to various pHs, ranging from pH 4.0 to pH 6.0.

SAT-479

IDENTIFICATION OF *LEGIONELLA PNEUMOPHILA* EFFECTOR PROTEINS THAT BIND ON HUMAN RAB5 PROTEIN

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Legionella pneumophila is a Gram-negative bacterium that normally lives in a fresh-water amoeba. Inhalation of aerosolized water containing *Legionella pneumophila* can cause severe pneumonia in immunocompromised

individuals. Normally, when alveolar macrophages engulf pathogens in the respiratory track, it results in transport to the lysosome through the endolysosomal pathway for degradation. *Legionella pneumophila* are able to evade degradation in the lysosomes by manipulating intracellular trafficking within their host. The bacterium secretes effector proteins through its DOT/ICM type IV secretion system that allow *Legionella* to change the fate of the *Legionella*-containing phagosome (LCP). Rab proteins are small GTPases that direct intracellular transport. Studies have shown that LCP does not acquire Rab5, the GTPase that regulates fusion of early endosomes and endocytic vesicles. We hypothesize that *Legionella* secretes an effector protein that inhibits Rab5 binding to the LCP. A yeast 2-hybrid analysis identified several potential Rab5-binding candidates. Constitutively active and dominant negative Rab5, Rab5Q79L and Rab5S34N respectively, expressed as GST- or His-tagged proteins have been mixed with *Legionella pneumophila* cell lysates. Analysis of GST versus GST-Rab5 binding demonstrates unique protein binding to Rab5. Large-scale GST-pulldowns are currently underway in order to purify these unique Rab5 binding proteins to be identified by mass spectrometry. Identification of effector proteins that bind to Rab5 will contribute to our understanding of how *Legionella pneumophila* manipulates host endolysosomal trafficking to establish an intracellular niche.

SAT-490

TRANSCRIPTOME-TO-REACTOME™ BIOSIMULATION: BASAL FOREBRAIN CHOLINERGIC NEURON NEUROTROPHIN SIGNALING

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Signaling of cholinergic basal forebrain (CBF) neurons is critical for survival and plasticity. Human CBF neurons revealed a shift in neurotrophin receptors toward cell death in Alzheimer's disease (AD). In this study, transcriptomics from mouse basal forebrain cholinergic neurons (BFCNs; NCBI GEO GSE13379) were used to derive parameters for deterministic kinetic model of nerve growth factor (NGF) signaling. Transcriptome-To-Reactome(TTR)™ biosimulation was performed using COPASI; 11 compartments, 435 species, and 263 reactions. Two hundred forty-five genes were used to determine initial values of species and kinetic values of reactions. BFCN model biosimulations were run with 2 doses of NGF, 500 μ M and 10 mM, as a bolus, for 10 and 240 seconds. This tested p75NTR and TrkA receptor mechanisms. Another test used 25 μ M brain derived neurotrophic factor and 10 μ M NGF continuously for 60 min, evaluating stimulation of p75NTR, TrkA, and TrkB. From human results, downregulation of TrkA (50%) and TrkB (60%), corresponding-parameters in TTR™ biosimulation were decreased. Baseline results were validated on neuronal calcium levels mediated via phospholipase C- γ and inositol-3-phosphate at both bolus doses of NGF alone. With corresponding parameters decreased in TTR™ biosimulation, reaction flux for c-RAF1 phosphorylation of MEK1 was delayed to peak value by 1.5 min from exposure, but peak value was increased 5 times. Moreover, a right shift of flux over time was observed with B-RAF phosphorylation of MEK1. These results show transient responses to neurotrophins accentuated, whereas sustained MEK activating pathway is blunted in AD, and may represent potential mechanisms for failure of prosurvival pathways in Alzheimer's disease.

SAT-503

COMPARING MICROARRAY AND QPCR RESULTS TO VALIDATE AGE-RELATED CHANGES IN GENE EXPRESSION

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The effects of aging contribute to a multitude of negative variables within organisms. If it were possible to slow, stop, or reverse some portion of the damage that the aging process causes, the benefits to health would be immense. Pluripotent stem cells have the ability to become any cell type in the adult body and may one day be used to fix cells that have been damaged by aging. There is great interest in using induced pluripotent stem cells (iPSCs) for cellular therapy. However, since these cells are reprogrammed from differentiated cells, it is not clear whether cells from aged individuals can produce iPSCs of the same quality as cells from younger individuals. Our lab has a microarray dataset (> 20,000 genes) that indicates there are gene expression differences between differentiated cells and iPSCs generated from young and old mice. Quantitative PCR (qPCR) will be used to validate these results for a smaller subset of genes related to insulin signaling factors since insulin signaling has been known to affect aging processes. We expect that the qPCR results will match the microarray analysis, thus potentially providing a more efficient and inexpensive way of comparing specific gene expression profiles. These results will be useful for future experiments designed to improve iPSC quality from aged individuals.

SAT-493

BIOCHEMICAL CHARACTERIZATION OF THE RBFOX PROTEINS

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The Rbfox proteins are a family of homologous splicing regulators composed of Rbfox 1, Rbfox 2 and Rbfox 3 proteins, which play important roles in alternative splicing processes. The Rbfox proteins contain a highly conserved RNA recognition motif which binds specifically to the sequence element UGCAUG. The Rbfox proteins act as splicing activators when bound downstream and splicing inhibitors when bound upstream of regulated exons. To characterize the upstream and downstream Rbfox complexes, recombinant Rbfox and Rbfox RRM clones were expressed in *E. coli*, purified, and assayed *in vitro* for binding to RNA containing a UGCAUG element. A mutant RNA sequence with the UGCAUG mutated to UCAGUC was also assayed. The mutant did not show any RNA-protein complex with Rbfox 3. These results confirmed that the UGCAUG hexanucleotide is critical for mediating the interaction between the Rbfox 3 protein and the RNA. Based on RbFox 2 RRM and Rbfox 3 RRM protein binding assays, it appears there must be interactions, other than the Rbfox RRM-RNA interactions, required for the Rbfox proteins to bind to the UGCAUG sequence located in the downstream control sequence of the *csrc* alternative N1 exon. This knowledge, coupled with previous hypotheses that the N- and C-terminus of the Rbfox proteins are involved in protein-protein interactions, underscore the importance of determining the types of interactions between Rbfox proteins and splicing associated with neurodegenerative and muscular dystrophy disorders. This may ultimately lead to insights as to how these disorders progress.

FRI-502

EVALUATION OF ENDOTHELIAL PROGENITOR CELL POPULATIONS IN HUMAN OMENTUM AND SUBCUTANEOUS TISSUE

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Angiogenesis is thought to be one of the ways the omentum responds to injury *in situ* and why omental flap transfer is so helpful in wound healing. Studies have shown that endothelial progenitor cells (EPCs) induce and facilitate angiogenesis. Therefore finding EPCs in the omentum would provide evidence that the omentum contributes to wound healing through promotion of angiogenesis. We hypothesize there will be more EPCs in the omentum than in subcutaneous fat because the omentum is highly vascularized. We will test for the presence of EPCs in these two tissue types and in control hMSCs using the antibodies CD34, CD309, and CD133 and the corresponding isotypes. Each cell type will be plated, counted, and given a mixture of the antibodies or isotypes and stained with DAPI. Flow cytometry will be run on each sample. Comparison of the flow cytometric antibody data versus isotope data will differentiate between specific and nonspecific binding. The flow cytometry results will be analyzed for EPC population frequency in the two tissues and in control hMSCs. If our hypothesis is true, we will conduct *in vitro* angiogenesis assays to see if tubules form. If formation of tubules is detected, we would isolate EPCs from human omentum and evaluate their ability to contribute to wound healing in a mouse model of impaired wound healing. Demonstrating that human omental EPCs promote wound healing could lead to new stem cell therapies for wound healing in humans.

FRI-499

TOWARD AN UNDERSTANDING OF HERPES VIRUS RRM2 AND HOST CELL METABOLISM

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Ribonucleotide reductase small subunit (RRM2) is a component of the enzyme that catalyzes the reduction of ribonucleotides to deoxyribonucleotides, which is essential for DNA replication. It is ubiquitously expressed in human cells and has a viral homolog conserved throughout the herpes virus family, suggesting an important role in viral replication. Human RRM2 is known to be regulated by phosphorylation at serine residue 377, and notably there is conservation of an aspartic acid in the viral protein at a position adjacent to the serine residue. This observation has led to the hypothesis that the negatively charged aspartic acid lies in the same pocket as the serine residue and mimics the human phosphorylation event, resulting in constitutively heightened activity of viral RRM2 that promotes viral replication. To test this hypothesis, nontransformed human breast epithelial cells were engineered to stably overexpress RRM2 or mutant versions of the protein, corresponding to amino acid substitutions S376D and S377D. Expression of the S377D mutant was not tolerated by the cells, causing rapid apoptosis during selection. Only low levels of RRM2 expression were detected via immunoprecipitation of cells selected for expression of the wild-type and

S376D constructs. These results suggest cells cannot tolerate constitutively elevated levels of RRM2. To overcome the observed repression of constitutive RRM2 expression, the wild-type, S376D, and S377D RRM2 constructs will be subcloned into a doxycycline-inducible vector. Using this system, the cellular effects of elevated wild-type and mutant RRM2 expression will be investigated and compared via proliferation assays, cell cycle analysis, and metabolic profiling.

SAT-487

SGTA: AN IDENTIFIED INDEPENDENT REGULATOR OF STEROID HORMONE RECEPTOR FUNCTION

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Steroid hormone receptors (SHR) are responsible for maintaining a reproductive, developmental, and physiological balance in eukaryotes. The receptors glucocorticoid (GR), progesterone (PR), mineralocorticoid (MR), estrogen (ER), and androgen (AR) belong to the nuclear receptor superfamily. Essentially, SHRs need the Hsp70-Hsp90 assembly system for receptor maturation to translocate to the nucleus and become functionally active. A variety of proteins regulate receptor maturation. A recently identified protein called SGTα (human small glutamine rich TPR-containing protein alpha) has been described as a regulator of AR's activity. Prior experiments in our lab have demonstrated that SGTα binds to both Hsp70 and Hsp90 to negatively regulate AR's, GR's, and PR's activity in both yeast and mammalian cells. FKBP52, a specific positive AR and GR regulator, shares the same specificity for receptor activity (MEEVD motif). However, SGTα-mediated downregulation of AR's activity does not appear to be the result of simple competition with FKBP52 for binding Hsp90 because the observed effect in yeast is independent of the presence of FKBP52. In addition, another TPR protein called Cpr7 that positively regulates AR is present in yeast. Thus, we assessed the ability of SGTα to regulate AR's activity in yeast-based assays in the presence and absence of Cpr7. We observed that SGTα can abrogate AR's activity independent of a competition for the MEEVD motif on Hsp90. These observations suggest there may be another role for SGTα at a transcriptional level independent of its TPR region. Future studies aim to identify how the structural function SGTα regulates AR's activity.

FRI-485

EFFECTS OF ACID AND NONACID TREATMENT OF Ag@BaTiO₃ NANOPARTICLE TOXICITY TO RHESUS MONKEY ENDOTHELIAL CELLS IN CULTURE

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Nanoparticles are presently being studied for optical and biomedical applications such as medical imaging and drug delivery. Nanoparticles impact the cellular environment because of their size, shape, and composition. How these factors affect cell viability is not fully understood. The purpose of this study is to test the cellular toxicity of silver-coated (Ag@) acid (AT) and nonacid (NA)-treated BaTiO₃ nanoparticles on rhesus monkey retinal endothelial cells (RhREC's) in culture. The addition of silver to the nanoparticles increases their nonlinear optical properties significantly, making the Ag@BaTiO₃ nanoparticles good candidates for nonlinear microscopy contrast agents. We hypothesize that acid treating the Ag@BaTiO₃ nanoparticles will cause a decrease in cell viability at higher concentrations when compared to NA-Ag@BaTiO₃ nanoparticles. RhREC's were treated with Ag@AT-BaTiO₃ and Ag@NA-BaTiO₃ at concentrations of 0, 1.0, 10.0, and 100 µg/ml for 24 h at 37 °C + 5% CO₂. After the 24 h incubation with the respective nanoparticles, cell viability was determined using the trypan-blue exclusion method. Cells treated with 0, 1.0, and 10.0 µg/ml of Ag@AT-BaTiO₃ showed no effect on cell viability. Treatment with 100 µg/ml of Ag@AT-BaTiO₃ showed a decrease of 10% in viable cells. Comparatively, cells treated with 0, 1.0, and 10 µg/ml of Ag@NA-BaTiO₃ showed no effect on cell viability while the 100 µg/ml treatment resulted in a decrease of 51% in viable cells. These results show that Ag@BaTiO₃ nanoparticles affect cell viability when delivered at a high concentration and that acid treatment protects RhREC from nanoparticle-induced cell toxicity.

FRI-498

ALL-TRANS RETINOL DELIVERY BY IRBP

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The cone cycle involves the constant recycling of all-trans retinol (ATOL) and 11-cis-retinol (11COL). This occurs between Müller cells and cone photoreceptors cells within the retina. One abundant protein found in the interphotoreceptor matrix is interphotoreceptor-retinoid-binding protein (IRBP). IRBP has the ability to bind to these

retinoids, suggesting that IRBP plays a major role in transferring these photosensitive retinoids in the cone visual cycle. We hypothesized that IRBP can deliver ATOL to the Müller cells. To test IRBP delivery of ATOL to Müller cells, 10 μ M of ATOL and 2 μ M of bovine IRBP were suspended in serum-free media (SFM) of rat Müller cells (RMC1). Retinoids were extracted from the cells every 12 hours over a 24-hour period. Cells were homogenized and extracted for retinoids using n-hexane followed by HPLC analyses. Before the addition of IRBP and ATOL, no retinol was extracted from RMC1. After a 12-hour incubation period, these cells contained 354 pmol/mg of protein and 305 pmol/mg of protein at the 24-hour time. These results were based on duplicate observations per time point. Our results show that IRBP facilitated the delivery of ATOL to RMC1 during the 24-hour experimental period. The change in ATOL concentration in the cell at the 12-hour and 24-hour points suggested that an increase in incubation time did not increase the delivery of ATOL to RCM1. Based on our results, we conclude that IRBP may play an important role in the cone visual cycle by delivery of ATOL to Müller cells.

SAT-476

HUR AND MIR-16 REGULATION OF CYCLIN E1 IN BREAST CANCERMelanie Connick¹, Rebecca S. Hartley².¹University of New Mexico, Albuquerque, NM, ²University of New Mexico School of Medicine Cancer Center, Albuquerque, NM.

Breast cancer is the second leading cause of cancer deaths in women and is the most common female cancer in the United States. RNA-binding proteins (RBPs) and microRNAs (miRNAs) have been shown to post-transcriptionally regulate gene expression in the development of cancer. Cyclin E1 is a cell-cycle regulator that is overexpressed in 30% of breast cancers. Overexpression correlates with cancer aggressiveness and poor prognosis. We have shown that the RBP HuR, also overexpressed in 30% of breast cancers, stabilizes Cyclin E1 mRNA leading to protein overexpression. MiR-16, a small, noncoding miRNA that is decreased in breast cancer, destabilizes and therefore decreases expression of Cyclin E1 mRNA. We set out to test the hypothesis that HuR impedes miR-16 destabilization of Cyclin E1 mRNA. To determine if Cyclin E1 mRNA bound by HuR can also bind miR-16, HuR was immunoprecipitated from MCF-7 cells, a human breast adenocarcinoma cell line in which Cyclin E1 and HuR are overexpressed. Argonaut 2 (Ago2), a protein that associates with miRNAs and is necessary for their function, was also immunoprecipitated. Immunoprecipitates were analyzed by western blot to determine if HuR and Ago2 are associated. Real-time PCR on RNA obtained from the cell lysates will further determine if Cyclin E1 mRNA is bound by Ago2 and HuR, and if miR-16 is bound by Ago2 and/or HuR. Determining the association of RBPs and miRNAs is important for understanding how their interaction plays a role in the development of breast cancer.

SAT-508

EFFECTS OF BIGH3 PROTEIN ON RHESUS MONKEY RETINAL ENDOTHELIAL CELLSJennifer Espinoza¹, Andrew Mendiola², Brandi Betts², Andrew Tsin².¹Texas A&M International University, Laredo, TX, ²University of Texas at San Antonio, San Antonio, TX.

Diabetic retinopathy (DR) results from microvascular retinal changes that lead to vision loss. The diabetic milieu promotes inflammation that results in retinal tissue damage. The link between DR and inflammation remains unsolved; however, we have recently shown that macrophages cultured in hyperglycemia and hyperlipidemia secrete TGF- β , which induces TGF β -induced gene human clone 3 (BIGH3), a proapoptotic protein. The aim of this study is to assess cell viability of a continuous cell line of rhesus monkey retinal endothelial cells (RhREC) in response to the addition BIGH3. We will examine the hypothesis that BIGH3 will induce a time- and dose-dependent effect on cell viability. Our general strategy is to culture RhREC and introduce recombinant BIGH3 protein at different concentrations in the condition media and measure cell viability over 96 h via trypan dye-exclusion assay. The results obtained from this experiment will provide information on the development of diabetic retinopathy.

FRI-512

INVESTIGATING THE ROLE OF ASCORBIC ACID IN MAINTAINING GENOMIC INSTABILITY IN HUMAN-INDUCED PLURIPOTENT STEM CELLSBrian Truong, Patrick Lee, Jason Awe, Agustin Vega Crespo, James Byrne.

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Human-induced pluripotent stem (iPS) cells hold significant promise for future personalized treatments, but mitochondrial and nuclear genetic aberrations have been widely observed following the *in vitro* manipulation and culture of human iPS cells, making these cells unacceptable for personalized cellular therapeutics. Ascorbic acid is an

antioxidant that has been used to improve the efficiency of both mouse and human iPS cell generation and facilitated the first generation of all-iPS-cell mice from terminally differentiated B cells. This property indicates its potential role in maintaining a normal karyotype capable of sustaining normal murine development. In this study, we will investigate the hypothesis that augmenting iPS cell-culture media with ascorbic acid can significantly enhance genomic stability following the stressful conversion of human iPS cells to clinical-grade (xeno-free substrates). This will be determined via gamma-histone 2AX immunocytochemistry, single nucleotide polymorphisms (SNP)-based loss of heterozygosity analysis, and karyotypic analysis after clinical-grade conversion in the presence of different concentrations of ascorbic acid.

SAT-492

SURVIVIN GENE EXPRESSION IN MULTIPLE MYELOMA CELLS UNDER TREATMENT WITH RESVERATROL

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Multiple myeloma is a type of cancer characterized by malignant plasma cells in the bone marrow. Patients with multiple myeloma are prone to lytic bone lesions and deficient immunity. *Survivin*, a survival gene, codes for a protein involved in the inhibition of apoptosis. It has been shown that cancer cells can become resistant to chemotherapy by multiple routes, including inhibition of apoptosis. Our objectives were to investigate the expression levels of the *survivin* gene in myeloma cells treated with resveratrol, a natural antioxidant found in grapes that has been shown to be a potential anticancer treatment. In this study, we analyze gene expression using real time quantitative PCR. Results showed that the level of expression of *survivin* declined after 24 and 48 hrs of treatment with resveratrol. Further studies are required to determine if the decrease in *survivin* expression is inhibiting apoptosis.

FRI-509

DEVELOPING A NEW SYSTEM AND IMPROVED TOOLS FOR THE STUDY OF NOVEL BACTERIOPHAGES

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Bacteriophages are viruses that infect bacteria. They first bind to the surface of their specific bacterial host, then inject their DNA into the bacterium where their genome is replicated. Bacteriophage proteins are expressed and the replicated bacteriophage DNA is assembled into new viral particles. The infectious cycle concludes as the cell lyses and the new phages are released from the host. Bacteriophages are of particular interest for their potential as therapeutic and diagnostic agents of bacterial infections and for their potential uses to manipulate the genomes of their bacterial hosts. The objective of this study is to establish procedures for isolation of bacteriophages that infect the bacterial species *Actinomyces arthrobacter* for which only a few phages have been isolated. Soil from the University of California, Santa Cruz (UCSC) campus will be sampled for *arthrobacter*-specific bacteriophages. These viruses will be purified and characterized by electron microscopy and isolation and restriction analysis of their DNA genomes. In the second project, proteomic analysis of bacteriophage Dori will be performed. This novel bacteriophage was isolated at UCSC using *Mycobacterium smegmatis* as the host. By performing mass-spectrometry on purified viral particles, Dori's structural proteins will be identified and compared to previous genomic annotations. These experiments will allow a better understanding of the genetics and structure of bacteriophage.

FRI-505

DETERMINING MRNA TARGETS AND FUNCTION OF CPEB4 IN ADIPOCYTES USING BIOINFORMATICS APPROACHES

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Metabolic syndrome (MetSyn) is a group of metabolic conditions that occur together and promote the development of cardiovascular disease (CVD) and type 2 diabetes. The incidence of MetSyn is predicted to increase as obesity has become a worldwide epidemic. Genome-wide association studies have identified over 400 genomic loci that are associated with obesity, CVD, and other MetSyn conditions. However, most of the underlying genes and the roles they play in the disease pathology remain unknown. Preliminary results have identified a causal gene called cytoplasmic polyadenylation element binding protein 4 (*CPEB4*), which encodes an RNA binding protein. It binds to target mRNAs to control translation. *CPEB4* is significantly associated with waist-to-hip ratio in humans, one indicator of obesity. The function of *CPEB4* has not been extensively explored, and its exact role in MetSyn is unknown. The main objective is to identify the mRNAs that are potentially targeted by *CPEB4* using bioinformatics approaches. Using known

binding sequences of *CPEB4*, an algorithm will be developed to scan the genome for potential target mRNAs. These *in silico* approaches will be used in conjunction with *in vitro* experiments to identify the target mRNAs of *CPEB4*. Understanding the biologic and gene networks that underlie the complex interactions in metabolic syndrome traits is essential for disease prevention, diagnosis, and treatment.

FRI-481

CHARACTERIZATION OF PLURIPOTENCY GENE EXPRESSION IN BABOON INDUCED PLURIPOTENT STEM CELLS

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Induced pluripotent stem cells (iPSCs) are typically derived from fibroblasts that are induced with pluripotency factors to be reprogrammed to a state similar to embryonic stem cells (ESCs). ESC lines have been established from humans; however, these lines are of concern due to ethical issues. Induced pluripotent stem cells (iPSCs) are derived from adult somatic cells, so they do not carry the same ethical concern but must still be optimized for therapeutic use. Nonhuman primate-derived iPSCs provide a clinically relevant model for studies of the efficacy and safety of stem cell-based therapy because baboons share 92% genome sequence homology with humans. Many factors involving the therapeutic application of iPSCs need to be optimized prior to initiating clinical trials in humans. Baboons provide an ideal model system for this purpose. To be characterized as iPSCs, reprogrammed cells must express the *OCT4*, *SOX2*, and *NANOG* pluripotency genes. Primers were designed specifically for the baboon sequence of these genes plus β -actin (as a control), using the *Rhesus macaque* genome sequence as a reference. Multiple baboon iPSC (biPSC) lines were derived by transduction with pluripotency factors (*OCT3/4*, *SOX2*, *NANOG*, and *KLF4*). We plan to use RT-PCR to confirm the presence of mRNA transcripts for these pluripotency factors in biPSC lines. To date, we have optimized RT-PCR primers and conditions for detection of the β -actin and *Oct4* transcripts in biPSCs. Our goal is to validate each of our baboon iPSC lines for future use in preclinical studies of patient-specific stem cell-based therapies.

SAT-510

THE ROLE OF ZFP148 IN VASCULAR FORMATION IN MOUSE SMOOTH MUSCLE CELLS

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Aortic aneurysms (AAs) are an abnormal widening of a portion of an artery caused by smooth muscle cell death and extracellular matrix degradation. In the US, AAs are the 15th leading cause of death, and around 12,000 patients die each year. Since AAs are largely asymptomatic and surgery is the treatment option, the development of novel diagnostic tools and treatments is critical to improve patient mortality. Zinc finger protein 148 (ZFP148) is a krüppel type zinc-finger transcription factor that plays a key role in hematopoiesis, skeletal muscle development, and gastric development; however, the role of ZFP148 in vascular development and disease remains unknown. The role of the current study is to determine the role *in vitro* of ZFP148 following elastase treatment in cells important for AA formation. We will knock down the expression of ZFP148 using siRNAs and then examine, using qPCR and zymography, the expression of: 1) smooth muscle marker genes (*SM-actin*, *SM22*, and smooth muscle myosin heavy chain); 2) inflammatory markers (MCP1, IL1β and IL6, TNFα); and 3) matrix metalloproteinases (MMP2 and 9) in smooth muscle cells and macrophages as appropriate. We predict that knockdown of *ZFP148* will attenuate inflammatory gene expression and MMP activation during AA formation. From these studies, we hope to conclude that *ZFP148* has a role in AA formation and could represent a viable treatment target for human disease. Future studies will include comparing *ZFP148* and krüppel-like factor 4 (KLF4), a stem cell pluripotency factor whose deletion in smooth muscle cells results in attenuated aneurysm formation during AA formation.

SAT-509

CHARACTERIZING THE PLASTICITY OF NEURAL ECTODERM IN *XENOPUS LAEVIS*

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During embryogenesis, the 3 embryonic germ layers give rise to distinct cell types that form specific tissues and structures within the adult organism. In the young embryo, cells are plastic and are thus able to differentiate into many different cell types. However, as development progresses, cells lose their plasticity and eventually give rise

to a specific cell types. Previous work has shown that embryonic cells remain plastic during gastrulation. However, the duration of plasticity after gastrulation within specific regions of the embryo remains unclear. Using a cell transplantation approach, we examined the extent of neural ectoderm plasticity between the anterior and posterior regions of the developing embryo. Fluorescently labeled neural ectoderm cells were grafted to the prospective dorsal-lateral mesoderm region of host embryos in order to determine whether the grafted neural ectoderm cells could adopt a muscle cell fate. By varying the developmental stage of the donor cells, we are able to show that the anterior neural ectoderm cells lose their plasticity prior to posterior neural ectoderm cells. The parameters of plasticity are tested by varying the temporal and spatial placement of the grafted neural ectoderm cells. Neither the age of the host embryo nor the placement of the cells within the host embryo influence the plasticity of the grafted anterior neural ectoderm cells. However, the plasticity of the posterior neural ectoderm cells varies depending on graft location and host stage. These results offer new insights into the ability of embryonic cells to regulate pluripotency during development.

FRI-514

VALIDATION OF PICHIAPRO, A PROGRAM FOR AUTOMATED PROTEIN EXPRESSION AND FERMENTATION OF *PICHIA PASTORIS*

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Pichia pastoris is a methanotrophic strain of yeast widely used for expression of recombinant proteins. Induction of methanol utilization is controlled by the *AoxI* promoter, which is activated by the presence of methanol and suppressed by the presence of other carbon sources such as glycerol. Because the concentration of methanol and glycerol control the level of *AoxI* transcription and growth rate, optimization of carbon source ratios and feed rate can be used to tune protein expression levels and growth rate by placing the desired protein coding sequence under the control of the *AoxI* promoter. While feed rates can be crudely controlled without automation, it becomes a laborious and inaccurate process. The Capecchi lab has used mathematical models of *Pichia* metabolism to create a program, PichiaPro, which interacts with a benchtop fermentor. These models allow PichiaPro to predict the current amount of methanol and glycerol necessary to achieve a set growth rate. Monitoring the continuously changing culture density and volume, while simultaneously calculating methanol and glycerol demands, enable complete growth rate control and automation. Similar systems are currently available only for industrial use; we hope to make this technology accessible to others for a wide variety of applications. To first validate the program's ability to control culture growth and *AoxI* induction (protein yield), we compared expression of tdTomato under a variety of programmed culture conditions. The data presented here demonstrate that by enabling growth-rate limited feeds, PichiaPro allows for precise control of growth conditions for optimization of protein expression.

SAT-491

SCREENING NOVEL SYNTHETIC COMPOUNDS FOR THEIR CYTOTOXICITY AND MECHANISM OF CELL DEATH

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Cancer is a collection of diseases hallmarked by uncontrolled cell division. Cancer treatment involves varying combinations of surgery, radiation, chemotherapy, and hormone therapy. Chemotherapy employs the use of drugs that kill rapidly dividing cells, a characteristic of cancer cells. Various chemotherapeutic drugs such as paclitaxel and vinblastine interrupt cell division by binding to tubulin, a protein responsible for spindle formation which is a critical step in cell division. For more than 50 years, tubulin-binding drugs have been used to treat cancer. Scientists are still in search of novel anti-cancer compounds targeting tubulin for two reasons: 1) patients develop resistance to existing drugs, and 2) tubulin is one of the most validated targets for cancer treatment. Eighteen analogues of coscinamides were screened for their cytotoxic effects on 5 different cancer cell lines. Our initial screen identified three compounds (TMCOS-3, 6, and 11) that caused cell death with IC₅₀ less than 1µM. TMCOS-3, 6, and 11 caused cell death via apoptosis when investigated for their mechanism of cell death using DNA fragmentation as an apoptotic marker.

SAT-511

SURVEY AND DETECTION OF THE WESTERN BLACKLEGGED TICK (*IXODES PACIFICUS*) AND THE LYME-CAUSING SPIROCHETE (*BORRELIA BURGDORFERI*) IN UTAH

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According to the Centers for Disease Control and Prevention, Lyme disease is the most reported vector-borne disease in the United States. In Utah, an average of 7 Lyme disease cases are reported annually; however, no cases are believed to have originated in Utah. In 2010, 36 individuals from Lehi, Utah claimed to be infected with Lyme disease, *Borrelia burgdorferi*. This prompted the Utah Health Department to create a Lyme Disease Taskforce to investigate these cases. As a taskforce member, Utah State University surveyed for and tested western blacklegged ticks (WBLT), *Ixodes pacificus*, for the presence of *B. burgdorferi* using PCR techniques. Ticks were collected by dragging a 1 m x 1.25 m white felt cloth (flag) through tick-conducive areas. Collected ticks were placed into a 70% ethanol solution, identified, and imaged. A total of 119 *I. pacificus* and 188 *Dermacentor andersoni* were collected. Zero *I. pacificus* tested positive for *B. burgdorferi*. Since *D. andersoni* ticks are not competent vectors of Lyme disease, they were not tested. Weather, temperature, elevation, GPS coordinates, and habitat/vegetation data were also collected and summarized.

SAT-498

DEREGULATED MICRORNA EXPRESSION IN THE PROGRESSION OF SALIVARY GLAND CANCERHao Zheng¹, Alan Kiang¹, Weg Ongkeko².¹Veterans Administration Medical Center, San Diego, San Diego, CA, ²University of California, San Diego, La Jolla, CA.

Salivary gland cancer constitutes 1 of the 5 main cancers in the head and neck region. Nonresectable malignant tumors demonstrate a low 20-year survival rate due to radioresistance and a high propensity for metastasis. The molecular mechanisms underlying pathogenesis of salivary cancer remain poorly understood. MicroRNAs (miRNA) are small noncoding RNAs that are predicted to regulate up to 30% of protein-encoding genes. Signature miRNA expression profiles have been identified in various malignancies, implicating miRNAs in the progression of human cancer. In order to better understand the role of miRNAs in salivary cancer, we profiled the miRNA expression levels of normal salivary tissue, benign salivary tumor, and salivary cancer. A total of 17 formalin-fixed, paraffin-embedded salivary tissues, including 4 normal, 4 pleomorphic adenoma (PA), 3 squamous cell carcinoma (SCC), 3 mucoepidermoid carcinoma (ME) and 3 adenocarcinoma (AC), were collected and the endogenous expression of 95 miRNAs was analyzed by microarray. A large number of miRNAs were observed to be aberrantly expressed. An unsupervised clustering and a Student t-test were performed with a threshold p-value less than 0.05, resulting in the identification of 22 miRNAs differentially expressed at a statistically significant level. Eight candidate miRNAs were selected and further validated by RT-qPCR. The results suggest 3 miRNAs in SCC (miR-200a, let-7-family, and miR-192) and 3 miRNAs in AC (miR-107, miR-15b and miR-200a) to be highly involved in the carcinogenetic process of salivary cancers. The miRNAs identified in this study may serve as potential biomarkers and targets for future miRNA based therapy.

SAT-485

THE EFFECTS OF GLYCOPROTEINS IN HANTAAVIRUS PSEUDOVIRIONS ON INFECTION OF VERO E6 CELLS

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Hantaviruses (family Bunyaviridae) are carried by rodents and can infect humans through aerosolized feces. Hantavirus infection can lead to death by producing hemorrhagic fever with renal syndrome and pulmonary syndrome. Glycoproteins G_n and G_c are two surface proteins encoded by the hantavirus genome. G_n and G_c are involved in the virus-host interactions, however the function of the glycosylation sites within these proteins remains unclear. To study this role, pseudovirions will be used. Pseudovirions provide a safer alternate by expressing the glycoproteins on the surface of a vesicular stomatitis virus (VSV) core modified with the reporter gene, luciferase but lacking the ability to replicate in its entirety. We have seen that hantavirus pseudovirions are capable of infecting Vero E6 cells and we are now poised to evaluate the function of the glycosylation sites on the G_n protein. Glycoprotein constructs will be expressed and deglycosylated with different enzymes. After incorporating these modified glycoproteins onto the VSV viral core, infection rate will be determined by fluorescence. We anticipate viruses containing deglycosylated

Gn proteins will display lower levels of infection. Our expected findings will help understand the function of the glycosylation sites on hantavirus infection and hopefully aid researchers in finding an effective vaccine in the future.

FRI-487

TWO-HYBRID ANALYSIS OF PAC1P INTERACTIONS WITH BINDING PROTEINS

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The mitotic spindle is the cytoskeletal machinery that separates genetic information stored in chromosomes from the mother cell to the daughter cells during cell division. The positioning of the mitotic spindle is dependent on microtubule lengths and orientation. In the model organism *Saccharomyces cerevisiae*, the protein Pac1 helps in the localization of dynein to the plus end of the microtubule. The recruitment of dynein to the plus end of the microtubule is necessary for the sliding of microtubules along the bud cortex, and it has been shown that there is no microtubule sliding in cells lacking Pac1p. Pac1p interacts with the small ubiquitin-like modifier (SUMO), and ubiquitin itself. SUMO is an important post-translational modification of proteins in the cell that regulates many critical cellular processes, including nuclear transport, transcription, chromosome segregation, and DNA repair. It is not known how the attachment of SUMO to Pac1p alters its function or the function of dynein. Our lab has identified 2 sites of Pac1p modification, 2KàR mutants. Using 2-hybrid analysis, we have identified changes in protein-protein interaction in the 2KàR mutants compared to wild type.

FRI-495

MID1/MID2-DEPENDENT REGULATION OF P100 PROTEIN LEVELS

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Cell division is an essential step for cancer cell proliferation and cancer progression. Through understanding cell division, targeted therapeutics can be developed to help in the treatment of cancer. The MID1 and MID2 ubiquitin E3 ligases have been implicated as regulators of cell division. However, the mitotic proteins that they ubiquitinate remain unknown. Recently, we determined that MID1 and MID2 bind to p100, a well-known microtubule bundling protein, during mitosis. This led us to hypothesize that MID1/MID2 act to target p100 for degradation during mitosis. Here, we show that MID1/MID2 immunoprecipitate with p100. Using immunofluorescence microscopy we determined that MID1/MID2 colocalize with p100 to the cytokinetic bridge during cytokinesis. Depletion of MID1/MID2 by siRNA treatment led to the stabilization of p100 protein levels, indicating that MID1/MID2 are involved in regulating the levels of p100. Additionally, MID1/MID2 were found to ubiquitinate p100 in in vitro ubiquitination assays. These data are consistent with a model where MID1 and MID2 regulate p100 protein levels by ubiquitinating and targeting it for degradation by the proteasome. P100 degradation then allows for cell abscission to be completed and the release of microtubule bundling that is not required during interphase of the cell cycle. Our studies have increased our understanding of the molecular mechanisms by which MID1/MID2 are critical for cancer cell division and highlight the possibility of developing small molecule inhibitors to MID1/MID2 to inhibit cancer cell division.

SAT-477

COLD-INDUCIBLE RNA BINDING PROTEIN IN THE DEVELOPMENT OF BREAST CANCER

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Cold-inducible RNA binding protein (CIRP) moves from the nucleus to the cytoplasm in response to stress, where it regulates cellular proliferation. CIRP is overexpressed in 30% of 33 breast tumors examined and is overexpressed in breast cancer cells in vitro. The goals of this study are to determine if CIRP expression is elevated in breast tumors compared to matched normal tissue, differs among breast cancer subtypes, and correlates with proliferation. Indirect immunofluorescence analysis was performed for CIRP and Ki67, a proliferation marker, in 6 breast tissue microarrays. Microarrays included 25 tumors and their matched normal tissue for three cancer subtypes. The subtypes were based on the expression of estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factor receptor 2 (HER2). ER+PR+HER2- tumors are least aggressive, ER-HER2+ tumors are more aggressive, and ER-PR-HER2- tumors are most aggressive. CIRP and Ki67 were assessed and results show that ER+PR+HER2- and ER-PR-HER2- tumors have significantly higher nuclear CIRP compared to matched normal tissue, while ER-HER2+ tumors have significantly lower cytoplasmic CIRP than matched normal tissue. The ratio of nuclear versus cytoplasmic CIRP in ER+PR+HER2- and ER-HER2+ tumors was significantly higher than their matched normal pairs. Both

nuclear and cytoplasmic CIRP differed among the cancer subtypes, with ER+PR+HER2- having the highest and ER-HER2+ having the lowest levels. Linear regression analysis of CIRP and Ki67 showed no correlation between Ki67 and CIRP expression, suggesting that CIRP may not regulate proliferation in vivo. Results also suggest that CIRP expression may correlate with HER2 receptor status.

SAT-507

THE ROLE OF SMAD6 AND SMAD7 IN CARIOGENESIS

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In the cardiovascular system, the aorta serves as the passageway between the heart and body. Critical to its development are bone morphogenic protein (BMP) and transforming growth factor B (TGF-B) signaling pathways. Within these pathways, inhibitory Smad6 and Smad7 (iSmads) function as downstream signal attenuators that fine tune the cells' response to extracellular receptor activation. Previous experiments show that global knockout of Smad6 and Smad7 results in outflow tract malformations and other cardiac defects. What remains unknown is the role iSmads play in cardiac progenitor survival, migration, and differentiation. We hypothesized that phenotypic defects linked to iSmad knockout are associated with the role these molecules play in the progenitor cells of the second heart field (SHF), which give rise to the outflow tract, among other parts of the heart. Assessment of Smad6 knockout mice revealed previously unobserved defects, including double outlet right ventricle. Additionally, in situ hybridization of Smad6 and SHF marker Isl1 in E.10.5 embryos revealed that these molecules were expressed in the same anatomic regions, suggesting that iSmads may be expressed in the SHF. Conclusions from this project will lead to a better understanding of the role Smad6 and Smad7 play in aortic development. Given that developmental gene programs are often reactivated during disease, our studies may give insight into the progression of congenital heart defects, specifically aortic diseases.

SAT-515

DEVELOPMENT OF A BACTERIAL CHEMOTAXIS ASSAY TO STUDY *V. EISENIA* MOTILITY REQUIREMENTS FOR EARLY COLONIZATION OF ITS SYMBIOTIC HOST

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A symbiotic system has been discovered between the lumbricid earthworm *Eiseniae fetida* and the bacterial species *Verminephrobacter eiseniae*, which colonizes the excretory organs of the earthworm. *V. eiseniae* has been successfully cultivated and its genome sequenced. The earthworms do not acquire bacteria from the soil after hatching but must be colonized during development by bacteria deposited in the egg capsule. Past research has shown that both bacterial flagella and type IV pili are required for motility used in early colonization of embryonic earthworms. During these studies of bacterial migration into the embryo, it appeared the bacteria are directed into the embryo. In our study, we are exploring the requirement for bacterial chemotaxis during successful colonization of the host worm. The methyl-accepting chemotaxis protein (MCP), a transmembrane sensor protein in bacteria, 2 of which have been discovered in the *V. eiseniae* genome, detect specific molecules in the extracellular matrix and this ligand binding produces a signal transduction that allows the flagella to commence tumbling and flagellar mechanisms. In this experiment, we develop methods to produce a viable chemotaxis assay to study possible molecular attractants necessary for localized colonization of the earthworm host by bacterial symbionts.

SAT-494

THE PURINERGIC RECEPTOR P2Y1 IS SORTED TO LYSOSOMAL DEGRADATION VIA A UBIQUITIN-INDEPENDENT PATHWAY

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As part of the G-protein coupled receptor (GPCR) family, the purinergic P_2Y_1 receptor transmits signals from extracellular stimuli and activates signal transduction inside the cell. Degradation of GPCRs by endocytosis and sorting to lysosomes following agonist stimulation is important for regulating receptor signaling. Most GPCRs are modified with ubiquitin, a protein that acts as a targeting signal for the lysosome. A mutant of P_2Y_1 that cannot be ubiquitinated is degraded with the same kinetics as a wild-type receptor. We discovered a novel lysosomal sorting motif, YPX_nL within the second intracellular loop of P_2Y_1 , where X is any amino acid. We predict that mutation of the YPX_nL motif will block ubiquitin-independent degradation of P_2Y_1 . To disrupt the YPX_nL motif, we generated a P_2Y_1

Y155A mutant using a site-directed PCR mutagenesis. Interestingly, we found out that this mutation causes a block in agonist-induced degradation. As a control, we analyzed the internalization of P₂Y₁ WT, and P₂Y₁ Y155A mutant. The P₂Y₁ Y155A mutant does not affect internalization, suggesting that the mutation inhibits trafficking within the endosomal system. YPX_nL motifs are binding sites for the endocytic adaptor protein ALIX, which is known to facilitate ubiquitin-independent lysosomal sorting of another GPCR, protease-activated receptor 1. We predict that ALIX and its binding partner ARRDC3 are required for the lysosomal degradation of the P2Y1 receptor. Experimentation on the purinergic P₂Y₁ receptor has extended our knowledge of endosomal sorting pathways and the roles of various proteins within those pathways in mammalian cells.

SAT-513

ROLE OF *PCH-2* IN THE SPINDLE ASSEMBLY CHECKPOINT IN *CAENORHABDITIS ELEGANS*

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The gene *mdf-1* is a component of the spindle assembly checkpoint in mitosis and has been identified as a component of a meiotic prophase checkpoint that monitors chromosome interactions, suggesting it plays multiple roles to maintain genomic integrity. Another gene, *pch-2*, is also a component of the meiotic prophase checkpoint, and we want to test if *pch-2* is also required for the spindle assembly checkpoint. The spindle assembly checkpoint is activated by a mutated *zyg-1* gene in which the cells arrest in metaphase of mitosis. This arrest is dependent on genes such as *mdf-1*. The testing of *zyg-1;pch-2* double mutants will help determine if *pch-2* is required for the spindle assembly checkpoint. If the double mutant arrests in metaphase, unlike a *zyg-1;mdf-1* double mutant, it is not required for the spindle assembly checkpoint. If it does not arrest in metaphase, like a *zyg-1;mdf-1* double mutant, *pch-2* is required for the spindle assembly checkpoint. Thus, these experiments will help determine if *pch-2* is a newly identified component of the spindle assembly checkpoint.

SAT-484

SCREENING SYNTHETIC ANALOGUES OF MARINE NATURAL PRODUCTS FOR THEIR CYTOTOXICITY AND MECHANISM OF CELL DEATH

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Cancer is a collection of diseases hallmarked by uncontrolled cell division. Cancer treatment involves varying combinations of surgery, radiation, chemotherapy, and hormone therapy. Chemotherapy employs the use of drugs that kill the rapidly dividing cells (characteristic of cancer cells). Various chemotherapeutic drugs such as paclitaxel and vinblastine interrupt cell division by binding to tubulin, a protein responsible for spindle formation which is a critical step in cell division. For more than 50 years, tubulin-binding drugs have been used to treat cancer. Scientists are still in search of novel anti-cancer compounds targeting tubulin for 2 reasons: 1) patients develop resistance to existing drugs, and 2) tubulin is one of the most validated targets for cancer treatment. A series of synthetic analogues of marine natural products were evaluated for their cytotoxic effects on 3 different cancer cell lines. Our initial screen identified three compounds (BA-2, BA-3, and BH-6) that caused 50% cell death at concentrations less than 10 µM. BA-2, BA-3, and BH-6 cause cell death via apoptotic mechanism when investigated for the mechanism of cell death using DNA fragmentation as marker. The compounds are currently being analyzed for their IC₅₀ on various cancer cell lines.

FRI-483

THE ROLE OF OXIDATIVE STRESS RESPONSE GENES DURING ETHANOL EXPOSURE

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We use *Drosophila melanogaster* as a genetic model to study the relationship between ethanol exposure and developmental defects such as developmental delay, lowered survival, and behavioral changes including increased resistance to ethanol sedation and reduced development of tolerance. Recent studies have linked oxidative stress to the onset of ethanol-induced developmental abnormalities. Nearly all species experience oxidative stress, caused by an unbalance of the cell's redox state. We have shown that developmental exposure to either paraquat or hydrogen peroxide, two well-established inducers of oxidative stress, phenocopies ethanol-induced phenotypes; in addition, hydrogen peroxide and ethanol act synergistically to cause developmental defects. We therefore hypothesize that oxidative stress resulting from developmental ethanol exposure explains a subset of the developmental defects we

observe. We have used genetic, molecular, and biochemical approaches to characterize the roles of antioxidant genes such as catalase (cat), superoxide dismutase (sod), and glutathione synthetase (gs) in the cellular response to developmental ethanol exposure. We show that ubiquitous upregulation of cat can rescue ethanol-induced developmental lethality, as can neuron-specific upregulation of sod. Additionally, gs loss of function enhanced ethanol's deleterious effects. We will show that developmental ethanol exposure leads to increased expression of both cat and gs. Finally, we will present the results of ethanol-induced sedation and tolerance conducted on gs, sod, and cat mutants. In closing, our research will help elucidate the relationship between oxidative stress and developmental ethanol exposure.

SAT-478

REGULATION OF C-JUN N-TERMINAL KINASE BY LETHAL GIANT LARVAE IN GLIOMA TUMOR PROPAGATING CELLS

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Gliomas are the most common primary brain tumors. Their aggressive and highly invasive nature makes them a leading cause of cancer-related deaths by central nervous system tumors. Increased self-renewal and impaired differentiation capacities characterize both human tumor propagating cells and murine cells of origin in glioma. Recent evidence suggests the WD40 protein lethal giant larvae (LGL) and C-Jun N-terminal kinases (JNK) may play an important role in regulating these properties. We hypothesize that LGL represses JNK activity such that loss of LGL results in JNK activation and phenotypes associated with malignancy such as increased self-renewal in glioma precursors. To test this model, neuroblasts isolated from adult *Lgl^{loxP/loxP}* mice are treated with AD-CRE GFP and assayed for neurosphere formation, measurable increase in JNK activity, and increased anchorage-independent growth in soft agar. Preliminary evidence shows increased neurosphere formation in *Lgl^{-/-}* cells that is suppressed by the addition of the pharmacological JNK inhibitor SP600125. Understanding the relationship between JNK, LGL, and tumorigenicity in gliomas will provide valuable insight into the properties and treatment of these tumors.

FRI-497

SPERM CHROMATIN-ENRICHED PROTEINS IN C. ELEGANS MAY PLAY A ROLE IN FERTILITY

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During spermatogenesis, DNA is compacted into a highly condensed structure for delivery to the oocyte. In most animals, sperm-specific small nuclear basic proteins, called protamines, replace histones and are responsible for sperm DNA compaction. Problems occurring with the packaging of DNA, including differences in protamine expression, have been correlated with male infertility in humans. However, the precise function of protamines remains unclear. Through proteomic analysis, three nearly identical, small, highly basic, sperm chromatin-enriched proteins (SPCH-1, 2, and 3) were identified in *C. elegans*. Based on molecular characteristics and localization data, we hypothesize that SPCH proteins function as protamines. To determine SPCH function, we observed mutant populations of each gene individually by looking at their phenotypic expression. However, populations with the same *spch-1* deletion allele display different phenotypes. One population is showing a previously unobserved "twitching" while the other population shows no apparent defect. To determine whether the "twitching" is related to the *spch-1* mutation or, if it was from a background mutation, we are backcrossing each mutant strain to the wild type. If unrelated to the mutation, we would expect to see both strains "un-twitch" after the backcross. Then, by doing progeny counts, we will determine the effect of *spch-1* on fertility. We will then use cytology to view the localization of the two additional SPCH proteins in *spch-1*. The results of these studies of SPCH proteins in *C. elegans* may give insight into the function of protamines and their specific role in fertility.

FRI-503

INVESTIGATING THE ROLE(S) OF ION TRANSPORTERS IN MUCOCILIARY DEVELOPMENT, HOMEOSTASIS, AND DISEASE

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Mucociliary epithelia consist of mucus-secreting goblet cells, ciliated cells, and transmembrane proton/ion transporters that regulate homeostasis and gene expression. Certain respiratory diseases such as cystic fibrosis are caused by

the accumulation of thick viscous mucus in the airway epithelium due to a recessive mutation of the cystic fibrosis transmembrane conductance regulator gene family (CFTRs). These genes regulate the concentrations of chloride and sodium ions across the airway epithelium, leading to infections of the carriers. Recently, it has been discovered that the ciliated epidermis of *Xenopus laevis* embryos can be used as a model system to study and understand the mechanisms of mucociliary epithelial homeostasis and development. Thus, this model organism can be used for research to find novel therapeutic treatments for diseases such as cystic fibrosis. Transmembrane proton regulators, e.g., ATP4 and ATP6, interact with the Wnt signaling pathway, which is required for development and function of mucociliary epithelia. In this study, we are cloning ion pumps and transporters (namely Duox1, Hvcn1, CFTR7, NHE1, NHE2, NHE3, and NHE4) for the first time in the frog *Xenopus laevis*. We want to analyze their expression in *Xenopus laevis* embryos and investigate their potential role in pH homeostasis of the ciliated skin epithelium and/or interaction with the Wnt signaling pathway. The long-term goal of these experiments is to gain a better understanding of proton/ion secretion across ciliated epithelia and the mechanisms involved in human airway diseases.

SAT-501

THE EFFECTS OF Cu^{2+} BINDING ON THE GLOBAL STRUCTURE OF THE PRION PROTEIN

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Prion diseases, or transmissible spongiform encephalopathies, are fatal, neurodegenerative diseases of animals and humans and include mad cow disease (BSE) and Creutzfeldt-Jakob disease (CJD). Prion diseases arise from a misfolded form of the prion protein (PrP^{C}), a membrane-anchored protein found in the central nervous system of all mammals. PrP^{C} contains four conserved octarepeat sequences (PHGGGWGQ) at the N-terminal domain that specifically bind Cu^{2+} ions. Although the specific coordination features of PrP Cu^{2+} -binding have been well characterized, the effects of metal binding on the global structure of PrP , and how these metals contribute to PrP function and prion disease are not known. The objective of this study is to determine the global structure of the prion protein upon binding of Cu^{2+} to the octarepeats and study the structural rearrangements. Preliminary data suggests that PrP undergoes a conformational change when bound to Cu^{2+} in which the Cu^{2+} -bound octarepeat domain interacts with the structured C-terminal domain. Using site-directed spin labeling combined with electron paramagnetic resonance (EPR) and double electron electron resonance (DEER) spectroscopy, we seek to characterize this global structural change. Specifically, we will measure intramolecular distances between nitroxide spin labels and natively bound Cu^{2+} ions. The results should hopefully provide a better understanding of the effects of metal binding on PrP structure and misfolding during prion disease. Having new insights on the effects of metal ions on PrP structure may lead to the discovery of drugs that will target these untreatable neurological diseases.

SAT-489

CHARACTERIZATION OF ZNF217 AND ITS ROLE IN BREAST CANCER USING BIOINFORMATICS

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Aberrant gene expression is a distinct characteristic of disease. Regulating gene expression is a complex and very specific process in which transcription factors, epigenetic mechanisms, and histone modification play essential roles. Zinc finger domain-containing proteins (ZNFs) represent the single largest family of transcription factors encoded in mammalian genomes. However, their functions and genomic targets have remained poorly characterized. In this project we will attempt to define the function of ZNF217 in association with breast cancer by mining available genomic datasets. We aim to identify the ZNF217 DNA binding sites using motif-searching tools and to identify ZNF217 gene targets and colocalizing epigenetic marks. Overall, by using publically available datasets, genomic tools, and hypothesis-driven questions, we will begin to address the role of this transcription factor in breast cancer development.

ECOLOGY

SAT-520

PATTERNS OF CRYPTIC AND APOSEMATIC COLORATION IN COSTA RICAN MOTHSVicky Giese¹, Ross Miller².¹California Polytechnic University, Santa Maria, CA, ²University of Guam, Mangilao, GU.

Cryptic patterns and aposematic coloration in moths was examined at 2 biological research stations in Costa Rica: 2 locations within Las Cruces and 1 in Las Alturas. In recent years, moths have become a focus of interest as a bioindicator species. Las Cruces is located in one of the most deforested counties in Costa Rica and is virtually a forest island consisting of 250 hectares (ha) and surrounded by mixed-use agriculture. In contrast, Las Alturas is located in a 10,000 ha preserve that has received minimal disturbance and is mostly primary rainforest. The purpose of this study was to see if there were differences in moth types between sites. Moths were attracted using a black light suspended in front of a white cotton sheet at each location. The black light was turned on at dusk and off at day break. Moths were collected and photographed at each location every evening at 8:00 p.m. and each morning at 6:00 a.m. Photographic images of moths were sorted into categories based on shape and color. Thirty different categories of moth types were designated in this study based on similarities, each representing a family. Species accumulation curves displayed the number of new moth types collected over time at each location to determine when sampling was adequate. Differences between the numbers of moth types in the categories and between collection sites were tested using chi-square analysis and were statistically significant at $P < 0.05$. Statistical differences were expected because of variations in habitat at each location.

SAT-519

ECOLOGICAL CONSIDERATIONS OF PREDATOR AND PREY POPULATION DYNAMICS DESCRIBED BY A MATHEMATICAL MODELHasan Sumdani, Matthew Le, Martin Tran, Samuel Frickle, Hristo Kojouharov.*University of Texas at Arlington, Arlington, TX.*

The purpose of this study is to represent the dynamical patterns of a protist preying on living and deceased bacteria using a mathematical model. Three differential equations are used to represent the numbers of protists, living bacteria, and deceased bacteria in the system. The model takes into account parameters that affect both the rate at which live bacteria and dead bacteria are consumed and how this consumed material aids in the protist's growth. Parameters in this model include an encounter rate between the prey and predator and the rate of consumption of the prey by the predator. The encounter rate can be derived from the speed that both organisms move. The faster they move, the more likely they are to encounter one another. Another important parameter in this model is the conversion constant, which describes how much a protist can reproduce with each bacterium ingested. The results show that changing the different parameters can lead to different, biologically meaningful scenarios, such as an overall decrease in the protist population despite a high consumption rate. The different scenarios that this model can predict show it is an effective predator/prey model for microbial systems. The simplicity of the model makes it a valid starting point for more complicated predator prey systems.

FRI-518

INFLUENCE OF AN INVASIVE PLANT ON MESOPREDATOR FORAGING ACTIVITY IN THE COASTAL DUNES OF NORTHERN CALIFORNIAYvan Delgado de la Flor, Dr. Matthew Johnson.*Humboldt State University, Arcata, CA.*

In the coastal dunes of northern California, the ecosystem has been altered by the presence of the invasive plant European beachgrass, and mesopredators and rodents experience the impact in their local habitats. We hypothesize that mesopredators spend more time foraging in areas where the invasive beachgrass is present and therefore rodents are more abundant. The aim of this study is to quantify the foraging activity of mesopredators and record their occurrence in two different habitats: dunes with beachgrass and dunes with no beachgrass. We are interested in the frequency of detection of mesopredators in the dunes and comparing their detection rate in the two different habitats. Also, we will be looking for the species richness in the two areas. We deployed a total of 20 night-vision Bushnell cameras in a line transect with 10 video cameras placed in an area with beachgrass and another 10 cameras in an area without the invasive beachgrass. Each camera was mounted on a pole (one meter sunk in the sand and one meter above the sand) with a distance of 100 meters between each camera. Data collection started the last week of

March and will continue for six consecutive days every month from March until November. We will have 80% of our data collected before the SACNAS National Conference. Wildlife managers do not yet have a good understanding of mesopredators' foraging activity in invaded or restored dune habitats, and this project will provide us with a better understanding of how invasive plants affect ecosystems.

SAT-518

MAGELLANIC WOODPECKER (*CAMPEPHILUS MAGELLANICUS*) BEHAVIOR WHEN APPROACHED BY HUMANS IN THE CONTEXT OF ECOTOURISM

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The Cape Horn Biosphere Reserve in southern Chile has increasingly drawn the attention of tourists. Ecotourism is an important activity of the region with various potentially detrimental ecological impacts. Since 2005, the Magellanic Woodpecker (*Campephilus magellanicus*) has been considered the emblematic species of this region. This bird is one that many people want to get a chance to see when visiting the Sub-Antarctic forests. This study assesses impacts of ecotourism on the Magellanic Woodpecker by experimentally recording this bird's behavior when exposed to a motionless observer as opposed to tourists' movements trying to observe birds closely. We compared the woodpecker's foraging behavior and space use under these two settings and tested the hypothesis that woodpeckers get accustomed to people being close on repeated exposure. We found that disturbed woodpeckers significantly use higher parts of trees, forage on more substrates per hour, continuously move away from the observer, fly further apart when switching trees, and peck less on trees, thus decreasing feeding rate, compared to undisturbed individuals. Repeated exposure to ecotourists can accustom woodpeckers to people and soften behavioral differences between these two contexts. Results indicate that under the proper conditions, woodpeckers can tolerate human behaviors that could have been initially disturbing. Our findings demonstrate that uncontrolled ecotourism affects Magellanic Woodpeckers negatively by lowering their energy input (i.e., fitness) when followed and continuously observed. Results also suggest that woodpecker ecotourism is an activity that can be sustainable if ecotourists are told how to behave when observing Magellanic Woodpeckers.

FRI-517

SIZE-FREQUENCY DISTRIBUTIONS OF JUVENILE COHO SALMON (*ONCORHYNCHUS KISTUCH*) IN STREAMS OF VARYING THERMAL REGIMES IN THE COPPER RIVER DELTA, ALASKA

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The Copper River Delta (CRD) in Alaska is the largest contiguous wetland on the Pacific Coast and supports strong populations of Coho salmon. Coho salmon sustainability depends in part on freshwater production of juveniles and is driven primarily by three factors: water temperature, body size, and food intake. Coho in the CRD use diverse streams representing thermal heterogeneity and potential patterns of food availability. Complex issues arise in explaining size-frequency distributions at large spatial scales and temperature regimes because of increased biotic and abiotic geographical complexities. We sought to determine if the size-frequency distribution of juvenile Coho salmon in the CRD differed between streams with contrasting thermal regimes. Young-of-year Coho salmon were collected and measured in two streams representing different thermal regimes. Gastric lavage and invertebrate sampling was performed for diet analysis. Streams included strong (25-Mile Creek) or weaker (18-Mile Creek) groundwater influences. Thermal regimes quantified across 2010 - 2011 indicated 18-Mile Creek was colder in the winter yet warmer in summer (range = 0 – 14 °C) relative to 25-Mile Creek (range = 2 – 6 °C), where groundwater presumably moderates seasonal thermal variability. Results indicate juvenile Coho in 18-Mile Creek were significantly smaller (33 mm fork length +/- 0.2) relative to fish in 25-Mile Creek (38 mm +/- 0.4). The smaller mean length of juvenile Coho in 18-Mile Creek is strongly associated with the contrasting thermal regimes. This study is part of a larger effort to evaluate the effects of global climate change on food availability, local physical habitat conditions, and timing of reproduction in streams of the CRD.

FRI-520

A LATITUDINAL EXAMINATION OF *METACARCINUS MAGISTER* (DUNGENESS CRAB) MEGALOPAE AND SETTLER RECRUITMENT ON THE CENTRAL CALIFORNIA COAST THROUGH TIME-SERIES ANALYSIS

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The mechanisms that drive population variability in marine systems are a prime research area for ecologists. In particular, understanding the impact variation in larval recruitment on marine populations can enhance our basic understanding of how populations are regulated and in turn can be used to inform the management of ecologically important marine species. In this study, a time-series analysis of megalopae and settler recruitment was conducted at Moss Landing, California, beginning in early March 2013 to assess abundance of larval *Metacarcinus magister* to inform fishery management. Light traps were used to collect crab megalopae and settlers daily within the Moss Landing harbor to examine expected fluctuations in recruitment numbers. Tidal, wind, and temperature data were collected and used to test for possible correlations with megalopae and settler abundance. Fluctuations in megalopae-settler ratio were observed from early March through June and were consistent with the *M. magister* larval cycle. Specimens were collected and sorted to ensure proper identification and then placed in ethanol for preservation for California Department of Fish and Wildlife records. Similar studies were conducted in three other California sites: Bodega Bay, Fort Bragg, and Eureka. Based on a time-series analysis at different latitudinal sites, we predict that megalopae-settler landings at the four sites will exhibit spatial dependence in their relationship to local environmental processes. Results will be used by the California Department of Fish and Wildlife to assess latitudinal variations in recruitment and to inform *M. magister* fishery management for the 2013/14 season.

SAT-516

MORPHOLOGICAL CHARACTERIZATION OF SOUTHERN CALIFORNIA PIPEFISH (FAMILY SYNGNATHIDAE)

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Many teleost fish populations, such as the pipefishes (family Syngnathidae) are dependent on seagrass beds for all or part of their life cycle. Many pipefish species are morphologically similar, which makes identification extremely challenging in the field. Additionally, the only dichotomous key available for species identification, developed in 1972, does not include all species found along the California coast. We hypothesize that external morphological characteristics and measurements can be used to positively identify pipefish species. The specific objectives of this study are to survey California seagrass beds to gain a better understanding of species presence and distribution and establish morphological characteristics to accurately identify and differentiate between pipefish species. Preliminary data were collected on three pipefish species: bay pipefish, *Syngnathus leptorhynchus* (n = 24); kelp pipefish, *Syngnathus californiensis* (n = 30); and snubnose pipefish, *Cosmocampus arctus* (n = 4). This data indicated that the head-length to snout-width ratio is significantly different ($p < 0.0001$) among all species. Additionally, the bay pipefish has two dark spots at the base of the operculum, the kelp pipefish has the longest snout examined thus far, and the snubnose pipefish has a truncated snout. In order to conclusively characterize pipefish species, future work will focus on collecting additional pipefishes from multiple locations and developing molecular fingerprints for each species that can be positively correlated with morphological characteristics. The results from this study will be used to update the Miller and Lea dichotomous key, which will be beneficial to fishery biologists in the field by aiding the quick and accurate identification of California pipefishes.

SAT-517

RATTLESNAKE ENCOUNTERS ALTER VIGILANCE BEHAVIOR OF THE CALIFORNIA GROUND SQUIRREL

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In the California ground squirrel (*Otospermophilus beecheyi*), evolutionary persistence theory is used to explain stereotyped responses towards their primary predator, the northern pacific rattlesnake (*Crotalus oreganus*). At the onset of snake recognition, ground squirrels comprising virtually every extent of phylogenetic sympatry with rattlesnakes invariably respond with elongated postures, close-range inspection, and communicative displays such as tail flags. After an encounter, squirrels readily treat their environment, particularly the snake's location, with elevated caution. This heightened vigilant state may last even after the snake abandons its ambush site, evidently as a snake-induced wariness of potential predators in the area. However, insufficient evidence exists to demonstrate the efficacy of heightened vigilance in identifying predators during subsequent environmental interactions. If squirrels that

encounter rattlesnakes maintain elevated vigilance, they should increase antisnake behavior toward even nonsnake objects in the area. Adult ground squirrels from the Diablo Mountain range in San Jose, California, were shown live northern pacific rattlesnakes, plaster rattlesnake models, and novel objects. We quantitatively described degrees of vigilance as indicated by antisnake behavior during natural field interactions. Rattlesnakes significantly increased ground squirrel vigilance behavior compared to snake models and novel objects. Only squirrels that had previously interacted with a rattlesnake exhibited significantly higher responses towards novel objects. Additionally, the response to snake models and novelties after rattlesnake encounters was only marginally lower than responses to rattlesnakes alone. These results demonstrate that ground squirrels can generalize their vigilance behavior throughout the vicinity of a snake encounter, possibly functioning to decrease the latency in discovering nearby predators.

FRI-516

DEVELOPING A SEED COLLECTION METHOD FOR LONG-TERM STORAGE AND TESTING VIABILITY OF THE FEDERALLY ENDANGERED PLANT *ERIASTRUM DENSIFOLIUM* SPP *SANCTORUM*

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The Santa Ana River woolly star, *Eriastrum densifolium* spp. *sanctorum*, is a federally listed, endangered plant species native to the Santa Ana River floodplain in Redlands, California. A major cause for its protection is the lack of occasional flooding from the Santa Ana River due to regional flood control measures. The woolly star has a specific habitat preference for sand deposits near rivers that experience flooding every few years. This habitat type is limited and only supports small populations of woolly stars. The goals of this project were to develop a consistent seed collection protocol and to collect seeds for long-term storage and woolly star habitat mitigation. Seeds were collected from 4 field sites in San Bernardino County, California and filtered through a series of sieves (No.14 and No. 25 standard soil sieves) to minimize the debris retained and maximize seeds recovered within a sample. Seed-to-mass regressions were created by weighing subsamples across five increments between approximately 0.1 - 0.2 g (up to 0.9 g) and manually counting the number of visibly potentially viable seeds within each sample. These regressions were used to estimate the amount of potentially viable seeds collected for each site. Weekly collections from September 13 to November 4, 2012, amassed 57,000 seeds. Across sites, there was some variability among the regressions' slopes (mass to viable seeds ratio) that is not clearly understood, suggesting more testing may be necessary. This method produced 47% to 79% successfully viable seeds with an average of 62% with only 87.5 man-hours total.

FRI-519

TANAGERS AND AVIAN MALARIA: ARE FEMALES DIFFERENTIALLY SUSCEPTIBLE IN DIMORPHIC SPECIES

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Avian malaria parasites (Haemosporidia) are widespread, common, and diverse. However, almost nothing is known about avian malaria in the Amazon and the Andes where the world's most diverse bird communities occur. We surveyed birds for avian malaria throughout several seasons from 2007 to 2010. Birds were surveyed across a steep elevation gradient at different sites, and blood smears were collected. The blood smears were screened for malaria parasites (*Parahaemoproteus* and *Plasmodium*) by microscopy. Higher infection rates were found to correlate with the breeding season later in the year. As of yet, it is unknown whether females are more susceptible to infections due to being more involved in parental care than males in dimorphic species. Infected females may serve as malaria reservoirs to nestlings.

ECOLOGY/EVOLUTION

SAT-526

INTERSPECIFIC COMPETITION AND SOCIAL HIERARCHIES IN FRUGIVOROUS NEOTROPICAL BIRDS OF COSTA RICA

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Dominance hierarchies have long been observed in nature across many different species. Through agonistic behaviors, animals are able to compete for resources while minimizing their physical conflict and energy expense. Understanding of these interactions is important in determining which factors contribute to community structure. Costa Rica is home to a plethora of bird species, about 400 of which are found at Las Cruces Biological Station, our study site. The object of this study was to examine which frugivorous Neotropical birds are dominant in interspecific interactions at feeding stations, and whether elements such as diet or size influenced their relative success in gaining the best access to resources. We predicted that birds with a higher weight would be more dominant and thus more successful in obtaining greater access during interspecific resource partitioning. To test our hypothesis, we observed 10 feeding stations spaced at least 50 m apart in garden habitat, where we observed and recorded dominance patterns. The feeding stations were baited with a banana and were placed within 50 cm of escape vegetation, in order to provide cover from predators. In addition to recording all aggressive and supplanting behaviors we recorded species, diet, body weight (g) and body length (cm). Preliminary data suggests that weight is an important factor in influencing success in the social hierarchies of frugivorous Neotropical birds. This result suggests that size may create a linear dominance pattern, which can provide insight into which species will be most threatened as resources become more scarce.

FRI-532

DIFFERENTIAL DEFENSE OF MALE AND FEMALE *CECROPIA OBTUSIFOLIA* TREES

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Decisions about resource allocation may differ among sexes when males and females invest unequally in their offspring. Typically, females invest more in each offspring than males, particularly in plants where females invest in fruits and seeds, whereas males invest only in pollen. *Cecropia* is a neotropical genus of tree comprised of approximately 60 species, all of which are dioecious. Flowers of both sexes are small but female fruits are much larger than male inflorescence. The purpose of this study is to examine resource allocation to defense in *Cecropia obtusifolia*. The expectation is that the females will defend their investment at a higher level than males. Research was conducted at the Las Cruces Biological Station, Coto Brus County, Costa Rica. Leaves of *C. obtusifolia* were collected and a suite of defensive characteristics were measured, including trichome density, leaf toughness, ant species present, trichilium area, and herbivory of sexually mature plants. Results of this study will be presented and the implications discussed. This project will provide new insights in the understanding of resource allocation and evolution of plant phenotypes.

FRI-530

THE IMPACT OF DESERT ROADS ON PLANT GROWTH AND SUBSEQUENT EFFECTS ON ANIMAL DISTRIBUTION

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Water runoff from desert roads can increase roadside plant growth. Increased plant resources attract animals to roadsides, but cars on these roads pose additional risks that may vary among species with different life histories. Negative effects of roads tend to be greater for vagile, long-lived species. Thus desert roads could alter distributions of animal populations. We investigated whether the density and volume of creosote bushes (*Larrea tridentata*) and the number of desert tortoise (*Gopherus agassizii*) and desert rabbit (*Sylvilagus audubonii* and *Lepus californicus*) signs differed between 0 m and 400 m from Kelbaker Road in the Mojave National Preserve, California. We hypothesized that creosote bush density and volume and the number of rabbit signs would be lower and the number of desert tortoise signs would be higher at 400 m than at 0 m from the road. We used transects to survey animal signs and

quadrats to sample rabbit scat and bushes. Creosote bush volume was significantly greater near the road, while bush density was not significantly different. There was no significant difference in desert tortoise signs, rabbit signs, or rabbit scat abundance between the two distances. The abundance of rabbit signs was negatively correlated with creosote bush density and positively correlated with creosote bush volume. Because our results do not agree with those of similar studies, they suggest that the impact of desert roads may depend on road-specific characteristics such as traffic volume or road orientation within landscapes and emphasize the importance of recognizing variation among road effects for conservation efforts.

SAT-533

BEHAVIORAL PATTERNS OF DIFFERENT SPECIES OF HUMMINGBIRDS (TROCHILIDAE) IN TEMPORAL NICHES WHILE MANIPULATING *HELICONIA TORTUOSA* NECTAR CONCENTRATION

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Resource partitioning defines how species coexist with each other in the various niches available. Physical traits, such as bill length in hummingbirds, are widely examined but may not be the only influence on how organisms coexist. Behavioral traits, such as time of daily feeding, can also be mechanisms for resource partitioning. Las Cruces Biological Field Station, Costa Rica is home to over 30 species of hummingbirds and presents an opportunity to investigate if the temporal niches are important in resource partitioning in this species complex. We hypothesized that the smaller Rufous-tailed Hummingbird (*Amazilia tzacatl*) would occupy *Heliconia tortuosa* patches during early morning hours. Then, during the mid to late morning, the larger Green Hermit (*Phaethornis guy*) would displace *A. tzacatl*. To test this hypothesis, we recorded hummingbird behavior in 2 separate patches of *H. tortuosa* in 20-minute periods, comparing early morning, mid-morning, and late morning. Then, we recorded hummingbird behavior in the same 2 separate patches of *H. tortuosa* in 20-minute periods, comparing afternoon, mid-afternoon, and late afternoon. Behavioral recordings included interspecific and intraspecific displacing, chasing, perching, and calling. We also recorded the proportion of time spent in the *H. tortuosa* patch for each species. Finally, we manipulated nectar concentrations in the *H. tortuosa* patches to determine if there were changes in hummingbird behavior. We expected that increasing concentrations of *H. tortuosa* nectar would increase displacing and chasing behaviors. Evolution of temporal niches in closely related species may explain how species with similar morphology and general ecological requirements coexist.

SAT-523

EGG PRODUCTION IN THE RACCOON ROUNDWORM, *BAYLISASCARIS PROCYONIS*

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The raccoon roundworm, *Baylisascaris procyonis*, is a parasitic nematode that matures in raccoons (*Procyon lotor*). The larval stage of this parasite is capable of infecting humans, causing a potentially fatal disease known as baylisascariasis, which has recently been recognized as an emerging zoonosis. In raccoons, individual worms can produce extraordinary quantities of eggs and it is these eggs that are infectious to humans and other wildlife. A variety of factors may lead to variation in the number of eggs produced by an individual worm. The purpose of this research is to determine the relationship between female *B. procyonis* size, uterus size and egg production. Worms were removed from the intestines of raccoons and measured. Then, the uteri were removed from the worms and measured as well. The uteri were homogenized in a known quantity of water and filtered. We then counted the number of eggs in a one milliliter aliquot of well-mixed solution and used this value to calculate the total number of eggs per worm. Our work shows that there is a correlation between female *B. procyonis* size, uterus size, and egg quantities produced. Understanding the factors that control egg production in this parasite will help determine the potential for roundworm infection among animals as well as humans and ultimately increase our understanding of transmission and spillover of zoonotic disease agents.

SAT-529

THE IMPACT OF THE INVASIVE PLANT *DELAIREA ODORATA* ON CARBON CYCLING

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Cape Ivy (*Delairea odorata*) is an invasive plant from South Africa, introduced to the United States in the mid-1800s. The vine out-competes native species and has created large monocultures along California's central coast,

replacing native coastal sage scrub. The purpose of our project is to assess the effect of *Delairea* on carbon cycling. Above-ground biomass (AGB) can be used to estimate net primary productivity and nutrient cycling potential of an ecosystem. Dead and living vegetation were collected from randomized 0.25 m² areas in test and control plots. AGB and moisture content were determined by comparing wet and dry weights. A nondestructive calculation based on diameter was used to estimate AGB in large shrubs and trees. Our preliminary results show that *Delairea* and coastal scrub areas have similar AGB (84.6 g/m² ± 1.8). However, coastal scrub has a (130%) higher carbon stock stored in dead AGB. We are measuring soil respiration in the study plots to assess carbon mineralization. Results thus far suggest that *Delairea* abundance may have pervasive effects. The high carbon stock in coastal scrub suggests it may help remove CO₂ from the atmosphere. Therefore, the low carbon stock in *Delairea* represents a change from negative CO₂ flux as well as loss of habitat and nutrition for soil animals. Better understanding of the impacts of *Delairea* will help develop effective restoration measures.

SAT-528

ASSESSING LONG-TERM CHANGES IN ESTUARINE BIVALVE COMMUNITIES OF SOUTHERN CALIFORNIA, UNITED STATES AND NORTHERN BAJA CALIFORNIA, MEXICO

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Sporadic studies of the estuarine bivalve communities of California and northern Baja California over the past 50 years indicate dramatic localized changes in community structure that likely result in reductions in the ecosystem functions that these species provide (e.g., water filtration, bioturbation, substrate provision). In order to predict further changes in these communities and their functions, we need to better understand the causes of those changes throughout the region. Our project, therefore, uses a combination of historical data and newly collected data to examine the local and regional patterns and likely controls on bivalve community structure over the past 50 years. Despite differences in local community structure related to wetland tidal prism and flow energy, we see regional patterns of fluctuations in total bivalve abundances and taxonomic diversity. We also note continued declines in large, edible species and in native surface dwelling taxa related to booms and busts of introduced species, changing substrate types, and water quality. Understanding the patterns and processes behind shifts in bivalve community structure can inform ecosystem restoration plans and climate change adaptation plans by reducing the uncertainty in bivalve community outcomes.

SAT-536

UTILIZING THE MITOCHONDRIAL *NDI* GENE TO SHOW SPECIATION WITHIN THE SPRINGSNAIL POPULATION ON THE GILA RIVER IN NEW MEXICO

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The small springsnail, *Pyrgulopsis gilae*, is currently recognized as a sensitive species by the United States Forest Service and as a threatened species by the State of New Mexico. This species can be found along forks of the upper Gila River. A previous study used the mitochondrial *NDI* gene to show previously unknown lineages within the *Pyrgulopsis gilae* species. However, despite redesign, 2 sample populations did not replicate. We suggest that with the design of more specific *NDI* primers, sequencing of the 2 populations would reveal 2 more distinct lineages of the *Pyrgulopsis* species. This study offers evidence that with the redesign of current *NDI* primers, the 2 previously unsequenced *Pyrgulopsis gilae* populations can be successfully sequenced, which may warrant the continuation of study into the possibility of 2 new taxonomically significant species.

SAT-535

DEVELOPING A SOLUTION TO REDUCE BYCATCH IN SMALL-SCALE, COMMERCIAL GILLNET FISHERIES

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Bycatch in gillnet fisheries has resulted in population declines, ecosystem impacts, and economic loss, but few bycatch reduction strategies exist. Identifying strategies to increase selectivity in gillnets is a global fisheries-management priority. Our previous work examined illuminated nets as visual alerts to reduce sea turtle bycatch in gillnets. Green and ultraviolet LED-illuminated nets were tested as bycatch deterrents. Ultraviolet illumination also

affected catch rates of target and bycatch fish species. However, the effects of orange illumination are unknown. Understanding how different wavelengths of light affect catch composition can potentially improve selectivity in gillnets. Sound cues may also potentially affect sea turtle behavior. Acoustic deterrent devices have not been tested with sea turtles but could improve gillnet selectivity. In this study we test the effects of orange LED-illumination on green sea turtle catch rates and on fish species in a coastal gillnet fishery. We pilot test the effects of auditory deterrents on green sea turtle catch rates and survey fishermen to obtain perceptions of viability. Green and ultraviolet illuminated nets reduced sea turtle catch rates up to 60% with no effect on overall target fish catch. Ultraviolet illumination increased halibut catch, a valuable target species, by 45% and reduced shark bycatch by 41%. Results from tests of orange illumination will provide fishermen and managers a “toolbox” of options to improve selectivity for gillnet fisheries. These techniques can be transferred to global gillnet fisheries to potentially reduce sea turtle and shark bycatch.

FRI-525

USING RAD MARKERS TO GENERATE A SURFPERCH PHYLOGENY WITHIN THE MARINE FISH FAMILY EMBIOTOCIDAE

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Restriction-site associated DNA (RAD) markers are short fragments of DNA that are obtained by sequencing flanking regions of genome-wide restriction sites. RAD sequences thus provide a reduced representation of an entire genome and are evolutionarily conserved within species and among closely related taxonomic groups. This allows for comprehensive comparative analyses without the burden of data-heavy whole genomes. Our project will use an illumina-platform sequenced RAD library from 35 individuals to build a phylogeny for the marine fish family Embiotocidae (surfperch). To accomplish this goal, we will use custom Perl scripts and the software program Stacks v. 1.02 to identify informative markers that contain single nucleotide polymorphisms (SNPs). RAD markers containing SNPs are distributed randomly throughout the genome, resulting in markers from many independent loci. These genome-wide SNPs should allow for robust phylogenetic inference into the evolutionary history of surfperches. Additionally, we will then repeat this project with UCLUST v. 1.2.22, which will cluster RAD sequences into putative orthologous sequences based on percent similarity. These clusters will then be filtered so that any one species is not over-represented in a cluster and then aligned and concatenated into a supermatrix for phylogenetic analysis. Lastly, we will compare the Stacks and UCLUST methods for building an Embiotocids phylogeny using RAD markers. This study will represent a significant portion of the ongoing project to build a robust surfperch phylogeny and will add insight into the usefulness of RAD markers for phylogenetic inference.

FRI-528

ACOUSTIC SIGNALING IN A NEW SPECIES OF SHRUB FROG FROM NEW BRITAIN ISLAND

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We studied the acoustic advertisement call of a new species of shrub frog from New Britain Island. Together with the data from morphology and DNA sequences, the study of the new species' mating call informs us of the primary mate-recognition differences between the species. The purpose of this research is to determine whether call characters are similar or different among closely related species of frogs. The advertisement call of the new species is compared to the advertisement call of a closely related species, *Platymantis macrosceles*. We performed the acoustic analysis using prerecorded calls from 5 different individuals of the new species and 2 recording segments of *P. macrosceles*. The new species possesses unique advertisement call characteristics that distinguish them from *P. macrosceles*. The defining characteristics of the advertisement call of the new species are the high frequency, slower rate of note repetition, and lack of a rapid introductory pulse series. Our study of the advertisement call of this new species of shrub frog reinforces data from morphology and DNA sequences and confirms the validity of the new taxon because acoustic signals are the primary mechanism for mate recognition in anurans.

SAT-525

WATER STRESS IN *QUERCUS AGRIFOLIA* (COASTAL LIVE OAK) IN RELATION TO DISTANCE AND ELEVATION FROM A STREAMBED IN THE SUMMER

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Investigations of plant water stress during the arid summer in a Mediterranean climate provide information on patterns and mechanisms of drought resistance. We examined how deeply-rooted, evergreen, California-coast live oak trees (*Quercus agrifolia*) respond to varying access to water during the summer. We hypothesized that increasing distance and elevation from a streambed would increase water stress on individual trees. We used 4 different measures (leaf water potential, wood water content, leaf vein density, and sap flow) as indicators of water stress and compared them across three sites (0 m, 14 m and 36 m above the streambed). Leaf water potential indicates the amount of water available to a plant, wood water content estimates the volumetric water content stored in wood, total leaf vein density correlates with leaf hydraulic conductance, and sap flow indicates the rate at which sap is moving through the plant. Leaf water potentials were higher during predawn than during the day and trees at 0 m above streambed had significantly higher water potential than the other two sites at predawn and midday. A nocturnal increase in wood water content was observed only at 0 m and not at higher elevations. There was no significant difference in leaf vein density among the sites. *Q. agrifolia* farther from the streambed were more water conservative and potentially more vulnerable to drought than trees next to the streambed.

FRI-523

IDENTIFYING GENES UNDER SELECTION IN THE INVASIVE GREEN CRAB, *CARCINUS MAENAS*

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Dramatic changes in ocean temperatures are likely to alter marine ecosystems in the near future. As such, there is a large effort to understand how sea creatures will respond to their shifting environments. The globally invasive European green crab, *Carcinus maenas*, has been closely monitored because of its ecological and economic impacts but is a useful species with which to study thermal adaptation. Previous physiological work has concluded that different populations within the species may be locally adapted to their thermal environments. To better understand this adaptation, this project examines genes that appear to be under selection between sites with different thermal conditions. By sampling crabs from 5 populations within the North American invasive range, we identified 279 single nucleotide polymorphisms (SNPs) in 203 contiguous sequences as potentially under selection from a total of 8,718 SNPs identified by a previous study. This list was further narrowed to 9 sequences, each with at least 3 SNPs and annotations with functional descriptions in the GenBank database. These 9 sequences closely matched genes involved in cell respiration, immune response, protein destruction, muscle tissue construction, solute transportation, and circulatory control during stress. To verify these patterns, we directly sequenced several genes of interest in an expanded sample set. With these data and our knowledge of the species' invasion history, we can explore the timescale as well as some the genetic mechanisms for adaptive evolution in *C. maenas*.

FRI-526

INTRASPECIFIC RESOURCE COMPETITION WITHIN A TROPICAL BIRD SPECIES (*RAMPHOCELUS COSTARICENSIS*)

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Food availability can drive competition and dominance aggression among individuals. In the Neotropics, fruit resources are distributed patchily so competition among frugivores can be intense. Even within a single species, there may be competition and dominance hierarchies among different age and sex classes. Many tropical bird species are monomorphic in plumage, but the Cherrie's Tanager (*Ramphocelus costaricensis*) shows strong sexual dichromatism and presents an opportunity to examine intraspecific competition because sex and age classes can be distinguished by plumage. Initial observations led us to hypothesize that among *R. costaricensis*, there is a dominance hierarchy at food sources in which males displace females and juveniles because of their size. To test our hypothesis, we set up 10 banana feeding stations throughout the Wilson Botanic Garden of Las Cruces, Costa Rica. Feeding stations were set up near trees that provided refuge from predators. Each time an *R. costaricensis* visited the feeding station, we recorded its sex and age class based on plumage and its food intake. For intraspecific interactions we recorded

distance between individuals, agonistic behaviors, displacement, and the time until displacement. Fierce competition for food arises between individuals even if they are the same species. In frugivores, intraspecific competition may make it difficult to get an accurate assessment of the amount of food resources needed to sustain a particular species. Additionally, intraspecific competition may result in fine scale resource portioning between age and sex classes.

SAT-534

EXPLORING HOW FLIGHT MORPHOLOGY VARIES WITH DEGREE OF HABITAT DISTURBANCE IN NEOTROPICAL BATS

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Bats make up the second most specious groups of mammals, and display a diverse range of characteristics which enable them to live in almost any habitat type. Within Costa Rica, bats make-up around half the known mammal species, with at least 108 known species. However bats are closely adapted to their habitat type and their morphology and echolocation characteristics vary considerably depending on the habitat type. Here, we explore how bat morphometrics vary with the degree of clutter in the environment; how parameters of both the wing (aspect ratio, wing-loading, etc.) and call vary with the degree of disturbance in the environment; and what characteristics may enable some species to inhabit many different habitat types, whereas others may be limited to a narrower selection. The study was conducted in Las Cruces Biological Reserve in Costa Rica, using mistnets to explore how the community varied in areas with different degrees of clutter and disturbance. Once captured, numerous parameters for each individual bat were taken before each bat was released. Our analysis found that species that were found across environment types had the ability to alter wing-shape, whereas those in either open or closed environments had wing morphometrics that might be expected with the degree of clutter in the environment.

SAT-531

LEAF ANATOMICAL TRAITS LINKED TO DROUGHT TOLERANCE IN THE LOS ANGELES URBAN ECOSYSTEM

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Tree canopy cover in urban areas has economic, social, and environmental benefits, but in order to maintain green space, we need to take into consideration how much water is needed to irrigate trees in urban areas such as Los Angeles. Los Angeles is an arid region characterized by environmental stresses including low precipitation, low relative humidity, and high summer temperature. Thus, it is necessary to understand relationships between leaf functional traits and water use and drought tolerance. In this study we address how leaf traits such as leaf thickness, leaf dry-mass per area, stomatal density and size, and venation architecture contribute to drought tolerance inferred through measurements of osmotic potential at turgor loss point. We hypothesize that across species these functional traits will correlate with stress tolerance. To test this hypothesis we will sample leaves from 50 common urban tree species and measure osmotic potential at turgor loss point, leaf thickness, area and dry mass, stomatal density and individual dimensions, and major and minor vein length per area. The results will give us species specific differences in stress tolerance strategies and provide a better mechanistic understanding of leaf resistance to hydraulic decline in street trees.

FRI-535

DIVERSITY AND EVOLUTION OF INNATE IMMUNITY GENES IN SEA URCHINS

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In all invertebrates, the innate immune system is the sole line of defense against pathogens. Unlike the well-studied major histocompatibility complex (MHC) genes in vertebrates, very little is known about the evolution of genes functioning in the innate immune system in any marine invertebrate. In sea urchins, there are over 600 genes associated with 3 super families of immune-related genes: toll-like receptors (TLRs), NACHT domain-leucine-rich repeat proteins (NLRs), and scavenger receptor cysteine-rich proteins (SRCRs). Our goal is to study the diversification of these 3 gene families in the complete genomes of 9 species of sea urchins belonging to the family Strongylocentrotidae. Using the genome sequence of the purple sea urchin as a reference, we will examine the rates of expansion and contraction of these gene families and test for the action of natural selection caused by the dynamic

interactions with pathogens. Understanding the diversification of innate immunity genes can provide new insights into the nature and importance of host-parasite interactions in the world's oceans.

SAT-527

THE EFFECTS OF NATIVE VS. NONNATIVE LEAF LITTER ON MACROINVERTEBRATE COMMUNITIES

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Introduced species are becoming a concern for numerous ecological communities around the world. With the possibility of becoming invasive, nonnative species greatly disrupt ecosystem function and native communities. This study investigates the effects that nonnative leaf litter may have on decomposition dynamics within a premontane, tropical wet forest. In particular, detritivore community composition and leaf-litter mass loss are compared within litterbags containing leaves from a native riparian tree (*Miconia appendiculata*) and an invasive bamboo (*Phyllostachys makinoi*). Research plots were selected along the Río Java at the Las Cruces Biological Station in Costa Rica. Two 5-gram bags of each species and a mixture of the 2 species will be placed at 5 different sites along the river and subsamples will be collected after 10 and 20 d instream to investigate macroinvertebrate colonization. Chemical characterization of stream water (e.g., dissolved oxygen, pH, temperature, nitrate tests, and phosphate tests) will be conducted daily. We predict that the native leaf litter will have a greater decomposition rate and a more diverse community of macroinvertebrates due to coevolutionary relationships with native leaf litter. Findings from this study will also better our understanding of how detritivore communities in tropical wet forest streams function in the breakdown of different types of leaf litter.

SAT-532

THE BOVIDAE OF GLADYSVALE CAVE AND THE ENVIRONMENTAL IMPLICATIONS IN THE CONTEXT OF OTHER FOSSIL-BEARING LOCALITIES IN THE NORTHERN TRANSVAAL REGION, SOUTH AFRICA

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In 1947, Charles Camp and Frank Peabody from the Museum of Paleontology at the University of California, Berkeley (UCMP), undertook a South African expedition in search of fossils. The sites explored were largely in the northern Transvaal and Cape Province regions and date roughly from the early Pleistocene to the Holocene. This work yielded more than 2,500 vertebrate fossils, including at least 43 species. Some of the sites, notably Taung, were known to have yielded fossil material of early human ancestors, including the *Australopithecus africanus* type-specimen found in 1924. At the close of the expedition, the material was shipped to the UCMP, where a significant amount of material from this expedition remained to be catalogued and more specifically identified to taxonomic group. We undertook this endeavor to further the knowledge available on South African fauna of the Pleistocene. Our specific focus was to study and identify the Bovidae from Gladysvale Cave, a cave in the northern Transvaal, making identifications to tribe when possible. The bovidae assemblage from the cave consisted of 230 specimens that had to be analyzed, identified, and systematically sorted. An analysis of tribe percentages and their context provides insight into the paleoecology of the region. Our method for fossil identification involved a comparative analysis with modern bovid skeletal specimens from the University of California, Berkeley, Museum of Vertebrate Zoology, and from published literature. Our results will be presented in the context of reconstructing the paleoecology of this locality and the evolution of South African environments.

FRI-524

IMPACTS OF INDIVIDUAL VARIATION IN INFECTIOUSNESS ON DISEASE PERSISTENCE

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Mathematical models of infectious diseases can provide insights into the interplay between epidemiological and population processes such as individual infectiousness and pathogen persistence. Evidence from previous research shows that individuals in a population exhibit different degrees of infectiousness; some individuals do not infect others, while others are highly infectious. However, it is not known how this variability affects the persistence of pathogen circulation within populations or how this persistence depends on population size. Here, we explore variability in individual infectiousness using a stochastic, discrete time model. By incorporating different distributions for infectiousness, we can characterize the relationship between pathogen persistence, individual variation in infectiousness, and population size. We expect that in smaller populations, with greater variation among individuals,

the disease will exhibit greater fluctuations, and therefore will not persist as long. This variation can also affect the frequency of fade-outs and reintroduction of disease. However, for large populations, the variation in individual infectiousness will have less impact, and persistence times should look similar to models that use the same value of infectivity for the entire population. By comparing the new model that incorporates individual variability to the homogeneous model, we can identify when individual variation has a significant impact on disease persistence.

FRI-534

ECOLOGICAL SORTING AND EVOLUTIONARY SPECIALIZATION IN *CECROPIA*–*AZTECA* INTERACTIONS

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A fundamental question in ecology is why species would limit themselves to the number of hosts they use. Limiting the number of hosts also limits the resources available to them. Several species of ants in the arboreal genus *Azteca* are only found in *Cecropia* trees. *Cecropia* is a Neotropical genus of pioneer tree that grows rapidly and colonizes disturbed habitats. *Azteca* ants frequently colonize their hollow trunks and protect the trees from herbivores and encroaching vegetation. Eleven species of *Azteca* specialize on *Cecropia* and are found nowhere else. At Las Cruces Biological Station, Costa Rica, the *Cecropia*–*Azteca* association seems to occur in a highly specialized, one-to-one relationship. *Cecropia insignis* is common in the forest and associates with *Azteca xanthachroa*, while *Cecropia obtusifolia* is common in the meadow and associates with *Azteca alfari*. However, it is uncertain whether host associations are linked to habitat preference or host preference. The focus of this research is to address this question by collecting *Azteca* species and *Cecropia* species in places the trees are not commonly found: *C. insignis* in the meadow and *C. obtusifolia* in the forest. If ants are sorting by habitat, then they should be found in the forest or meadow regardless of host plant availability. The results of this work will provide insights into the ecology and evolution of host choice in plant ants.

SAT-524

AN ANALYSIS OF *STRUTHIO* SP EGGSHELLS FROM THE MIDDLE AND LATE STONE AGE OF THE TRANSVAAL, SOUTH AFRICA

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After the type specimen for *Australopithecus africanus*, the Taung child, was discovered in the Buxton Limeworks in 1924, the search for hominids was directed to Africa. From 1947 to 1948, Charles Camp from the University of California's Museum of Paleontology led a series of cave and travertine excavations along the Transvaal and Cape Provinces of South Africa in search of hominids and collected a variety of specimens. More than 2,800 vertebrate fossils were collected from approximately 41 sites, including everything from dinosaurs of the Permo-Triassic to *Homo sapiens* from the Pleistocene. These specimens have not been thoroughly studied to date. Among the specimens collected are approximately 370 avian fossils pertaining to the Pleistocene. The specimens collected in the Black Earth Caves can be dated back to the Middle and Late Stone Ages based on faunal assemblage and human-modified artifacts. Two decorated ostrich eggshell fragments have been associated with the Wilton Culture of the Late Stone Age. Pore morphology, pore density and distribution, and eggshell thickness of 111 pieces of fossilized struthionid eggshell were examined across 5 sites. Ostriches are useful bioindicators and reveal information about the environment of the site. The variation in ostrich eggshell morphology at the Black Earth Caves will be presented in the context of what is known about the evolution of South African environments. Implications for the evolution of *Struthio* sp. and other fauna will be discussed.

FRI-522

USING ECTOPARASITES FROM SMALL MAMMAL HOSTS TO INVESTIGATE PROTECTED AREA EFFECTIVENESS

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Over the past three decades, the amount of protected area around the world has quadrupled from 3.2% of the world's land surface area to greater than 12.2%. Protected areas not only foster biological diversity but also exploitative interactions such as parasites on their hosts. Some of these parasites are vectors for zoonotic diseases that harm human populations. We evaluated Ghana's largest protected area, Mole National Park. We collected ectoparasites from live-trapped small mammals to explore ectoparasite prevalence and composition inside and outside the park

boundary. In 2012, 66 small mammals were collected inside Mole and 33 outside, totaling 99 individuals. We found that prevalence of ectoparasites was higher for small mammals collected inside (49%) than outside the park (42%). We collected 203 ectoparasites in total with 151 (74%) from individuals sampled inside and 52 (26%) outside. Of the 151 total inside, 141 were mites (93%), 8 were fleas (5%), and 2 were ticks (1%). Of the 52 total outside, 38 were mites (73%) and 14 were ticks (26%). Of the 32 small mammals inside with ectoparasites, 30 (94%) had mites, 2 (6%) had fleas, and 2 (6%) had ticks. One individual had both ticks and mites, and another had both fleas and mites. Of the 14 small mammals with ectoparasites collected outside, 13 (93%) had mites and 2 (14%) had ticks. Only 1 had both mites and ticks. The overall prevalence and composition of ectoparasites was greater inside the park than outside. This warrants future investigation of disease dynamics and public health interests in protected areas.

FRI-531

MYCORRHIZAL FUNGI TARGETED BY TWO CLOSELY RELATED MYCOHETEROTROPHIC ORCHIDS

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Nongreen, mycoheterotrophic plants, unlike most plants that are autotrophic, obtain carbon energy through a symbiotic relationship formed with fungi. Some species of orchid are highly specialized in parasitizing particular species of fungi. These associations are known to be supported by surrounding green vegetation, which are capable of fixing carbon by photosynthesis. Roots of the green vegetation are colonized by mycorrhizal fungi that in turn are parasitized by the mycoheterotrophic orchid *Corallorhiza*. We investigated the mycorrhizal community which grows near two species of nonphotosynthetic orchids: *Corallorhiza maculata* and *Corallorhiza wisteriana*. A quantitative and morphological analysis of the mycorrhizal fungal community that grows adjacent to *Corallorhiza* in collected soil samples can inform us about the specificity *Corallorhiza* has toward its prey and the community context in which they grow. Ten samples of *Corallorhiza* were collected in the San Pedro Wilderness of New Mexico. Out of the 3,623 root tips collected, 16.70% of the 2,635 tips from 7 *C. maculata* samples belong to species of *Russula*; 17.81% of the 988 tips from 3 *C. wisteriana* samples belong to putative species of *Tomentella*, the genus targeted by this orchid. Molecular analyses of the 10 samples is still in process in order to determine the species of fungi, trees, and *Corallorhiza* genotypes sampled. The results to date suggest that in a small area where nearly 20 different species of fungi live, these two orchids target mycorrhizae that are more abundant than others.

FRI-521

FROM BIRDS TO WHALE SHARKS: ASSESSING THE IMPORTANCE OF ORNITHOGENIC NUTRIENTS TO THE COASTAL OCEAN

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Seemingly distinct habitats are often deeply interconnected through the provision of food resources or nutrients across habitat boundaries. These connections, known as trophic spatial subsidies, can often be the dominant force structuring communities in these connected systems. This study examined the potential spatial subsidies between islands used by birds and the surrounding coastal waters. We used nutrient analysis of surface waters and GIS to map the spatial distribution of nutrients around islands with varying levels of bird use to better understand the potential for ornithogenic nutrients to link the terrestrial and aquatic ecosystems in Bahía de los Angeles, Baja California, Mexico. Preliminary results suggest islands exhibit a plume of nutrient enrichment extending from the heavily guano-covered islands, which may in part account for the relatively high abundance of phytoplankton and zooplankton in the waters of Bahía de los Angeles. Further study will focus on examining the phytoplankton and nekton communities in the bay, where we can use stable isotope analysis techniques in an effort to complete the chain of relationships between ornithogenic nutrients and large grazer populations in Bahía de los Angeles.

FRI-527

EFFECTS OF ORGANIC FERTILIZER ON ARTHROPOD COMMUNITIES OF TANK BROMELIAD IN LAS CRUCES, COSTA RICA

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Introduction of excess nutrients into aquatic environments, caused by fertilizer runoff from farmlands, can be detrimental to the point of creating dead zones. These dead zones are areas of low oxygen caused by the respiration of huge algal blooms. Tank bromeliads are great study systems that can simulate these stresses in microcosm. We

designed 2 complementary methods to understand the effects of eutrophication on arthropod communities in tank bromeliads (*Guzmania wittmackii*) in southern Costa Rica. The first method used 15 natural bromeliads: 5 were used as a baseline for arthropod diversity living within them and 10 had 1 mL of 70% diluted organic fertilizer made at the Las Cruces Biological Station added every 4 days and were collected on days 7 and 14 to determine the progression of said communities. The other method uses 15 artificially simulated bromeliads filled with 25 mL of filtered bromeliad water and 25 mL of diluted rainwater. Five of these 15 were controls; the other 10 were fertilized with 1 mL of 70% diluted organic fertilizer added every 4 days and were harvested in the same manner as the previous method. The expected result is an increase in species richness as result of algal production and the arrival of primary consumers, which will attract a greater number of predator species. By adding these nutrients, algal production should increase but not so much that dead zones occur because of the appearance of primary consumers that limit the growth of algae populations in these tank bromeliads.

SAT-521

THE EFFECT OF LOW TIDE EXPOSURE ON THE HEALTH OF *SACCHARINA SESSILIS*

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Intertidal, marine seaweeds experience different environmental conditions during high and low tides. Low tide conditions may be stressful for seaweeds because desiccation and extreme light levels may impact their ability to photosynthesize. We examined the effect of low tide exposure on the photosynthetic health of the canopy-forming seaweed *Saccharina sessilis* in the field and lab. Field studies assessed the health of marked individuals on days with varying environmental conditions, while lab studies separated the effects of those different conditions. We hypothesized that the seaweed's photosynthetic health depended on weather. We predicted that health would decline over a single stressful low tide (high light, high wind, and high temperature), but not over a benign low tide (low light, low wind, and moderate temperature). We assessed health in multiple ways. First, we measured dark-adapted maximum quantum yield (MQY) via pulse-amplitude-modulated (PAM) fluorometry, which assesses the photosynthetic ability of photosystem II. Second, because we observed that the seaweed changes color following intense stress, we evaluated tissue damage by quantifying the proportion of blade area in 5 color categories. A single stressful low tide can reduce MQY readings to 5% of preexposure values and damage 61% of a blade's area. Individuals in benign conditions had MQY values of 97% of preexposure values and only 1% of blade area damage. Over the long term, damage from low-tide exposure may limit growth and reproductive output. Understanding how individuals and populations respond to daily stresses will aid in understanding their responses over longer time scales.

SAT-522

GLOBAL PATTERNS OF CHYTRIDIOMYCOSIS INFECTION: LINKING AMPHIBIAN EXTINCTIONS TO CARRIER SPECIES, BIOGEOGRAPHY, AND NATURAL HISTORY

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One third of amphibian species are at risk of extinction. A common, swift, and dramatic cause for their decline is the infectious fungal disease chytridiomycosis, which is caused by the aquatic fungal pathogen *Batrachochytrium dendrobatidis* (Bd). Although there are many studies documenting the disease and its spread across the globe, a comprehensive database of all species affected by Bd has yet to be compiled. This study aims at creating a GIS-compatible database of species with known Bd infections, species Bd susceptibility status, and species ranges to allow us to determine which species have been extirpated and which are susceptible to Bd but do not develop chytridiomycosis (pathogen reservoir species). Carriers of Bd are believed to play a large role in the spread of Bd into naïve host populations, resulting in massive die offs. This study will also allow us to study patterns in taxonomy, biogeography, and natural history of those species that are susceptible to Bd infections. Such information can allow us to predict species that might be affected in the future, making the allocation of already limited conservation resources more efficient. This information will also be integrated into AmphibiaWeb, which is used by students and researchers worldwide.

FRI-533

ASSESSMENT OF THE EFFECTS OF THE INTRODUCTION OF NON-NATIVE ECHINACEA SPECIES IN THE POLLINATION OF NATIVE *ECHINACEA ANGUSTIFOLIA* IN WESTERN MINNESOTADayvis Blasini¹, Stuart Wagenius².¹Northeastern Illinois University, Chicago, IL, ²Institute for Plant Conservation, Chicago Botanic Garden, Glencoe, IL.

The narrow-leaved purple coneflower *Echinacea angustifolia* (Asteraceae) is the only native echinacea species found in Minnesota tallgrass prairies. Due to high levels of habitat fragmentation in this area, many restoration projects have been developed in these tallgrass prairies recently. Some of these restoration efforts have introduced non-native echinacea species (*Echinacea pallida* and *Echinacea purpurea*). These species could potentially have detrimental effects on the native echinacea species as well as on the arthropod communities that depend on this plant. A specific concern is the invasion by hybridization between native and non-native echinacea species. Last year we successfully tested the likelihood of hybridization between *Echinacea pallida* and *Echinacea angustifolia* using artificial crosses and demonstrated that each species accepts interspecific pollen and seedling results. Because we still do not have any evidence that such hybridization occurs in nature, we will identify and contrast the pollinator species that visit each echinacea species to determine the ultimate possibility of hybridization among these plant species. Simultaneously, we will study echinacea plants in the field to quantify synchrony in the time of flowering between the local and the introduced species. We will observe, record, and collect pollinators for later identification using high-resolution cameras and an existing reference pollinator collection. Because both species are visited by generalist pollinators, we hypothesize that the introduced species are very likely to hybridize and may displace the native species in nature. The information we gather from this research will indicate how important it is to use local flora in restoration projects.

FRI-529

ALLELOPATHY AND BIOTOXICITY OF CAPE IVY (*DELAIREA ODORATA*)Alyssa Koszis, Christine Case.

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Cape ivy (*Delairea odorata*), a plant from South Africa, has become a serious problem along the central California coast, dominating coastal scrub and riparian communities. It grows thickly over shrubs and trees, creating vast areas of monocultures. To the best of our knowledge, this work is the first attempt to identify bioactive metabolites in cape ivy that give it a selective advantage over native vegetation. Our aim is to investigate the biotoxicity and allelopathic effects of cape ivy and the cape ivy rhizosphere. Water or rhizosphere soil gathered from a nearby native ecosystem were used as controls. The effects of aqueous plant extracts and rhizosphere soil extracts on angiosperm seed germination, plant growth, and aquatic arthropod growth were evaluated using US Environmental Protection Agency bioassays. Rhizosphere soil from cape ivy monocultures and cape-ivy leaf extract inhibit lettuce seed germination. After 5 days, 55% fewer seeds germinated. Germinating seeds had 84% shorter roots in 0.1 - 0.4 g/mL cape ivy extract compared to the water control. Lettuce seeds grown in cape ivy rhizosphere soil also had 12.5% less germination compared to native subsoil. Leaf extract (10%) decreased *Lemna minor* growth by 72% \pm 0.2. *Lemna* showed strong adverse effects (chlorosis and necrosis) to (1 - 10%) leaf extract. We are currently determining toxicity of Cape ivy to aquatic arthropods and characterizing the toxic and allelopathic chemicals. Identifying bioactive compounds in the cape ivy rhizosphere is of fundamental importance to understanding cape ivy's dominance and may lead to effective control methods.

ENVIRONMENTAL SCIENCE/STUDIES

SAT-172

EFFORTS TO CHARACTERIZE (ICP FLUORIMENTRY TGA/DSC, SURFACE ANALYSIS) MATERIALS AND SORPTION FOR URANIUM ABATEMENTBeau Badonie, Antonio S. Lara.

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Globally, contaminated water is consumed at epidemic levels; limited access and resources to potable water affects many people adversely, especially Third World populations. The United States is no exception, particularly Native American reservations. The Navajo (Diné) reservation has problems with uranium contamination from uranium mine tailings resulting from the Cold War era and the nuclear arms race. Adhering to Native American philosophy, Mother

Earth heals, and natural materials offer a solution: soils. Soils are ubiquitous and have the ability to sorb heavy metal contaminants. Natural soils provide a cradle-to-grave solution (inexpensive, simple, and universal availability) that abates uranium, thus providing potable water. The immediate objective of this study is to characterize the sorption process and the materials. Characterization involved thermal gravimetric analysis with simultaneous scanning calorimetry (TGA-DSC), surface area analysis, inductively coupled plasma-optical emission spectrometry (ICP-OES), and fluorimetry. We investigated changes in mass with associated thermodynamic properties, surface area, and porosity to enhance sorption, uranium abatement for quality assurance, and modeling the abatement process, respectively. All soils sorbed uranium from solution, albeit some better than others. Characterization helped us produce a model for uranium sorption: optimize the abatement process in an iterative fashion; design porosity to enhance sorption; verify that carbonates in the natural materials affected sorption; choose ICP as the method of choice to verify abatement at ppb levels (30 ppb accepted standard); and use real time monitoring to build a sorption model. This uranium abatement practice belongs on the Navajo reservation with its own unique soils, thus the methods described above are essential.

FRI-162

DETERMINING THE EFFECTS OF LIVESTOCK GRAZING AND DROUGHT ON STREAM WATER QUALITY IN THE SACRAMENTO MOUNTAIN FOREST

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The Sacramento National Forest is managed in part for livestock grazing. Water quality in riparian habitats can be highly impacted, the effects of which may extend to adjacent aquatic habitats and may reduce the ability of resident aquatic organisms to process organic matter and cycle nutrients. Nutrients influence the algal community with the most common limiting nutrients in aquatic ecosystems being nitrogen (N) or phosphorus (P). The objective of this study was to monitor algal biomass, water flow, dissolved organic carbon (DOC), and nutrient limitation along a gradient of land uses in the Sacramento Mountains. To determine nutrient limitation of algal primary producers, we used nutrient-diffusing substrates (NDS) to measure periphyton response to known quantities of N, P, and NP over a 3 week period. Data from summer 2012 suggest algal growth in streams of the Sacramento Mountains is not often nutrient limited, especially in early summer. However, it was limited by N at the end of the summer in one of our highly grazed sites. While N and P may occasionally be high at the cattle-impacted sites, algal biomass remained relatively low. This suggests that impacts by cattle are not on nutrient levels, but may be due to physical disturbances that limit algal growth. Future studies will analyze DOC concentrations. We suggest that low level agricultural grazing is not compromising water quality in the streams of this national forest.

FRI-168

ESTIMATING NORTH ATLANTIC SPERM WHALE (*PHYSETER MACROCEPHALUS*) ABUNDANCE IN THE SOUTHEAST UNITED STATES FROM A SHIP-BASED PASSIVE ACOUSTIC SURVEY

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Sperm whales (*Physeter macrocephalus*) are high trophic level predators that play a vital role in pelagic marine ecosystems. They provide nutrients for primary production, cleanse the air through carbon absorption, and contribute to maintaining a balanced food web. Sperm whales rely on acoustic-click production for foraging, navigating, and maintaining a matrilineal social structure. Due to their deep diving habits and complex social behavior, obtaining population estimations solely by visual surveying can be problematic. In this study, passive acoustic data from the NOAA Atlantic Marine Assessment Program for Protected Species (AMAPPS) survey will be analyzed to estimate the abundance of a population of sperm whale off the southeast United States. Based on frequency and intervals between clicks, 4 categories of sounds will be assigned: usual clicks, slow clicks, creaks, and codas. Clicks will be localized, and detection distances and group counts will be determined. These data will be input into line-transect abundance equations and compared with estimates developed from visual survey data. Ecological factors such as temporal and geographical distribution of call type information will be investigated to further understand population dynamics in this region. It is hypothesized that estimates will be improved over visual survey data through improved accuracy by detecting submerged whales and improved precision due to more detection due to increased detection range of acoustics and additional nighttime survey time. Acoustic analyses of call types may allow us to gain a unique perspective of sperm whale population dynamics.

SAT-167

THE FUNCTIONAL RESPONSE OF CHIHUAHUA DESERT SOIL MICROBES TO ARTIFICIAL REHYDRATIONYolanda Olivarez, Anna Ortiz, Vanessa L. Loughheed.*University of Texas at El Paso, El Paso, TX.*

Precipitation in deserts is characterized by sporadic events, followed by large periods of small amounts of rain or no rain. In the Chihuahuan Desert, increased variability in precipitation patterns as a result of changes in climate is predicted and will likely affect ecosystem function, particularly soil microbial community composition. This study aims to measure the microbial functional diversity in Chihuahuan Desert soils to further comprehend microbial change and response to precipitation events. Summer late-monsoon soil samples were collected from the Jornada Experimental Range (JER), located in the Northern Chihuahuan Desert, from soil beneath the canopy of honey mesquite (*Prosopis glandulosa*). Samples were rehydrated until completely saturated and placed in artificial conditions simulating summer temperatures. Subsamples of rehydrated soil were collected at 24, 48, 72, and 120 hours, with a final collection once soil was completely dry. Community-level physiological profiling (CLPP) with EcoBIOLLOG plates was used to measure microbial functional diversity. Preliminary results from the field site indicate that significantly higher respiration occurs after precipitation events, opposed to prior precipitation events, (58.4 mg/m²/hr CO₂ and 29.5 mg/m²/hr CO₂, respectively). A principal components analysis (PCA) demonstrated functional diversity changes between samples. Water content in soils affects microbial community's composition and functional diversity. Changes in composition might help explain changes in carbon efflux with precipitation events. Further analyses on microbial activation time will help determine the speed of response to rehydration. Future experiments on soils from different plant locations will help define Chihuahuan Desert shrubland microbial responses to precipitation events.

FRI-172

LIFE HISTORY AND TAXONOMIC STUDIES OF DEEP-SEA CHONDRICHTHYANSJustin Cordova¹, Paul Clerkin², David Ebert².¹California State University, Monterey Bay, Norwalk, CA, ²Moss Landing Marine Laboratories, Moss Landing, CA.

A survey of deep-sea chondrichthyans from the Southern Madagascar Ridge, South Indian Ocean, has provided information on the faunal biodiversity in this little known region. The data gathered is being used to find critical information on the reproductive biology of these poorly known species. The survey was conducted between February and April of 2012 aboard the F/V Will Watch. The chondrichthyans collected were retained by catch during the fishing operations. Each specimen was photographed and measured, with representatives of each species transported to Moss Landing Marine Laboratories for further examination. Over 2,000 specimens were examined for maturity status and reproductive measurements; oviducal gland width, inner clasper length, presence of pups, and oocyte count were collected for 13 genera of chondrichthyans. In addition, over 700 tissue samples were collected from the collected specimens, as a part of the broader Tree of Life project being conducted through the College of Charleston, South Carolina. Vertebrae and dorsal fin spines were collected for age and growth studies, and diet data was opportunistically collected. The reproductive data gathered is being analyzed to determine length at first and 50% maturity, and fecundity is being estimated. Future studies will include combined age and growth estimates for these species to determine the age and length at maturity for these little known deep-sea chondrichthyans. The genetic samples will provide insight into the phylogeny of chondrichthyans and assist in identifying species. (Funding for this project is being provided through the National Science Foundation, entitled *Assembling the Tree of Life*.)

SAT-170

CREATING SOIL GEOCHEMISTRY FINGERPRINTS OF TEXAS HILL COUNTRY SYRAH VINEYARDSRebecca Barbosa¹, Liz Amaro¹, Lisa Morano¹, Kenneth Johnson¹, Jay Neal², Aaron Corsi².¹University of Houston: Downtown, Houston, TX, ²University of Houston, Houston, TX.

Characteristics of wine can be influenced by the variety and location of where the grapes were grown. Winemakers have noticed differences in wine taste that can be directly related to the soil. The Rocks to Wine project, funded by the USDA, focuses on the connections between the soil and how the grapevines are grown and also the wine flavor and aroma profiles that are created. The goal of this experiment is to produce and identify fingerprints of different soils collected from six different vineyards from the Texas Hill Country growing the Syrah variety. We used a grinding aid (shatter box) to pulverize selected soil from different vineyards and depths (30 cm and 60 cm). The elemental components of the soil will be determined with a technique called inductively coupled plasma-optical emission spectroscopy (ICP-OES). Specifically, we will measure 10 major element oxides and 12 trace elements. The results of the ICP-OES will be used to identify patterns of macro- and micro-nutrients between the soil samples from each

vineyard and the location of the vineyard relative to geological features of the area. We will then make wines and check for their basic chemical characteristics such as color, pH, and acidity. Using multivariable statistics, the results of this experiment will ultimately be used to make correlations between the elements that are in the soil and how these elements allow the vine to create different aromas and flavors in the wine.

FRI-164

EFFECTS OF TRICLOSAN-CONTAMINATED IRRIGATION WATER ON TOMATO PLANT GROWTH, TRICLOSAN ACCUMULATION, AND SOIL BACTERIA

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Triclosan, an antimicrobial that is used in a variety of products such as plastics and toothpastes, can be found in freshwater streams used for irrigation water. In this study, the objective was to determine the potential effects of Triclosan on tomato plant growth, Triclosan accumulation in plant tissues, and heterotrophic bacterial counts. In a greenhouse study, 12 tomato plants were grown for 14 weeks and irrigated weekly with the following concentrations of Triclosan: 0.00, 0.015, 0.15, and 1.5 µg/l. Harvested plants were sectioned into roots, shoots, leaves, and fruits before drying to obtain biomass and then pulverized prior to a solid phase extraction using a 1:1 methanol-to-acetone solution. Extractants were concentrated prior to GC-MS analysis. Both rhizosphere and bulk soil bacteria were enumerated by serial dilution plating on R2A. Total plant biomass showed a decreasing trend with increasing Triclosan concentrations, but was not significant ($p > 0.05$). Initial extractions indicate an increase in Triclosan concentrations with treatment concentrations. Rhizosphere bacterial counts were not significantly different ($p = 0.4552$) between treatments with an overall mean of 3.8×10^8 CFU/g dry soil. However, bulk soil heterotrophic bacterial counts were significantly higher ($p = 0.0002$) in the higher Triclosan treatments (0.15 and 1.5 µg/l) with 3.7×10^7 and 4.1×10^7 CFU/g dry soil, respectively. These data indicate that Triclosan may potentially decrease plant growth while increasing Triclosan contamination of a crop plant. Additionally, Triclosan may be selecting for resistant soil bacteria while not affecting rhizobacteria due to a plant-microbe interaction.

SAT-163

EXAMINING THE EFFECTS OF WARMING ON POPULATION DENSITIES OF *DAPHNIA PULEX*

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With warming in the Arctic, more nutrients are being released from thawing permafrost into Arctic aquatic ecosystems. The impact of these changes on aquatic food webs is largely unknown. Zooplankton are abundant in Arctic tundra ponds; recent studies have indicated changes in these communities as ponds warm and become more nutrient rich. This study was done to examine the effects of nutrient enrichment and warming on algal community structure and consequently on *Daphnia pulex* reproduction. *Daphnia pulex*, an organism commonly found in the Arctic and generally used to determine the quality of water for living organisms, was grown at 2 different temperatures (21 and 25 °C) in arctic algae cultures. Reproduction, mortality, and growth rates of *Daphnia*, as well as gross taxonomic algal composition were measured. We hypothesized that nutrient enrichment and warming would produce a cascading effect on aquatic organisms. Preliminary results show distinct differences among treatments. *Daphnia* kept at 21 °C, did not increase in numbers although algae abundances increased substantially. Warmer cultures, however, had inconsistent numbers throughout the experiment. Populations of *Daphnia* tripled within days then suddenly dropped the numbers to zero while algae also declined in numbers. Preliminary results from nutrient enrichment indicated phosphorus as a limiting factor for algal growth, having a direct impact on *D. pulex* growth and reproduction. These results support field observations where increased nutrient levels and algal biomass in Arctic tundra ponds lead to changes at higher trophic levels. Future studies will look at both warming and nutrient effects in a factorial experimental design.

SAT-169

USE OF SOIL BACILLI FOR BIOCONTROL OF CHILI FUNGAL PATHOGENS

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Phytophthora capsici and *Verticillium dahlia* are some of the leading causes of loss in chili pepper production in the Southwest. *Phytophthora capsici* is part of the genus *Oomycetes* (water mold) and which causes huge economic loss on crops worldwide, along with *Verticillium dahlia*. The absence of natural resistance to these pathogens as well as

limited chemical and cultural controls that are applied to chili pepper production makes these 2 pathogens severe diseases for chili farmers. Biocontrol has shown potential for providing safe and economical control in other similar plant pathogens. This research is focused on using different bacterial *Bacillus* spp. as biocontrol agents for chili fungal pathogens. Bacteria cultures are grown up from soil samples taken from regional chili fields. The bacteria cultures are used to coat seeds for plant protection assays. The supernatant is collected from centrifuged bacteria cultures to use in plate inhibition assays. Both assays are used to test the ability of the different collected bacilli to inhibit the fungi infections. We have tested about 100 plants grown from *Bacillus* coated seeds and about 300 supernatants in plate assays. We have observed good fungal inhibition and plant protection with several of the *Bacillus* bacterial cultures. These results are promising for the use of bacilli biocontrol agents for chili fungal pathogens.

FRI-169

BIOACCUMULATION OF SYNTHETIC MUSK FRAGRANCES IN NORTHERN DIAMONDBACK TERRAPINS (*MALACLEMYS TERRAPIN*) OF JAMAICA BAY, NEW YORK, UNITED STATES

Lisa McBride¹, Andrew Heyes², Christopher Rowe², Russell Burke³, Cheryl Clark².

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Synthetic musk fragrances are found in almost all scented personal care products. They have been measured in water, air, sewage sludge, and various biota from all over the world. However, no studies have measured synthetic musks accumulated by parents and transferred to offspring. Because coastal cities release treated and sometimes untreated sewage effluent "to tide," research on the impact of personal care products on resident and especially long-lived organisms which may accumulate the compounds over long periods of exposure is needed. We selected the diamondback terrapin because it is long lived and inhabits the entire eastern seaboard of the United States across a wide salinity gradient. In this preliminary study, we have targeted 1 nitro musk (musk xylene, [MX]) and 1 polycyclic musk (galaxolide [HHCB]), and are assessing their presence in the eggs of northern diamondback terrapins inhabiting a contaminated site (Jamaica Bay, New York) compared to a less-impacted site in the Patuxent River, Maryland. We have developed a method using gas chromatography-mass spectrometry for analysis of these parent compounds in terrapin eggs. This field based study will be the first step in assessing the degree of exposure of terrapin embryos to synthetic musks accumulated by the parents.

SAT-168

THE EFFECTS OF CAPE IVY ON SOIL MICROBIAL POPULATIONS

Keefah Khalil, Christine Case.

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Cape ivy (*Delairea odorata*) was introduced from South Africa to the United States in the 1850s and is now the primary threat to biodiversity along the central California coast. Although the decrease in plant diversity following cape ivy infestation has been documented, there is no published research on the effect of cape ivy on soil productivity. Soil microbes provide essential ecosystem services such as nutrient mineralization. Therefore, the purpose of our study is to determine whether cape ivy disrupts soil microbial ecology. We hypothesize that cape ivy is disrupting microbial populations, which disables native species or gives cape ivy a selective advantage. We are comparing soil microbial activity of cape ivy infested areas with the native coastal scrub community. Soil samples were collected from depths of 0 to 30.5 cm. Community-level physiological profiling employing Biolog Ecoplates was used to compare catabolic activity in the microbial community in cape ivy infested areas with that of the native coastal scrub community. Our preliminary results show that cape ivy does affect the function of soil microbial communities. At 12 cm, catabolic capabilities of the cape ivy associated microbial communities are 7% greater than those of the coastal-scrub associated community. Functional diversity in cape ivy soil is 91.4%±7.0 compared to 82.8%±2.1 in the coastal-scrub soil at 12 cm. We are examining activities of nitrifying and denitrifying bacteria in the different soil samples. Our results and analysis of functional traits will contribute to understanding the mechanisms by which cape ivy maintains dominance and may help achieve long-term restoration goals.

SAT-164

EVALUATING THE EFFECTS OF CLIMATE-MEDIATED TEMPERATURE CHANGES ON THE BEHAVIOR AND PHYSIOLOGY OF YELLOW-BELLIED MARMOTS (*MARMOTA FLAVIVENTRIS*)

Stephen Morris, Erin Lehmer.

Fort Lewis College, Durango, CO.

Increased global temperatures are predicted to have significant impacts on a number of plant and animal species and these impacts are expected to be most profound for species living in extreme environments. Yellow-bellied marmots (*Marmota flaviventris*) are hibernating mammals that live at high elevations in Colorado and depend heavily on cold winter temperatures to complete their annual life history events. Our research is focused on evaluating how increased winter temperatures will impact foraging behavior, physiological health, and allostatic loads of marmots living at both high (10,800 ft) and low (7,500 ft) elevations within their geographic ranges. As part of this research, we are sampling marmots in early and late summer to determine their body masses, growth rates, and physical health. We will also collect blood samples to run an assortment of lab-based analyses intended to determine allostatic load, including estimates of C-reactive protein, glucocorticoid levels, and innate immunity. We will conduct extensive soil and vegetation inventories to determine soil moisture and pH, vegetation biomass and nutrient content, and the timing of plant phenology. This information will be used to determine the extent to which habitat quality differs between marmots at high and low elevation. Finally, we are using temperature-sensitive data loggers to indirectly monitor foraging time, as marmots living in low-quality habitats would presumably spend more time per day foraging compared to their counterparts living in high-quality habitats. Results of this research will provide important information about how climate change impacts plant and animal community dynamics.

FRI-167

METHOD DEVELOPMENT FOR BISPHENOL-A ANALYSIS IN MILK USING STIR BAR SORPTIVE-EXTRACTION THERMAL-DESORPTION GAS CHROMATOGRAPHY/MASS SPECTROMETRY

Suzanne Apodaca, Wen-Yee Lee.

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Bisphenol A (BPA) is a man-made environmental contaminant of emerging concern possessing controversial endocrine disruption properties. An increased interest has been seen in its accurate determination in various media order to estimate the exposure to BPA and the associated health risk. The goal of this study was to develop an environmentally friendly (green), sensitive, and efficient method to analyze bisphenol A (BPA) in liquid milk samples. The technique uses stir bar sorptive extraction (SBSE) and thermal desorption accompanied with gas chromatography and mass spectrometry (GC/MS). For SBSE sample preparation, sodium carbonate served as a pH adjustment agent, acetic acid anhydride as a derivatization agent, mirex as the internal standard, and a preconditioned stir bar were added to a 20 mL volume of sample. After 2 hours of stirring, the stir bar was desorbed in a thermal desorption unit and BPA was analyzed by GC/MS. BPA-spiked, whole-fat milk was used as the model sample matrix. BPA with a concentration range from 0.01 to 10 ug/L (ppb) was added to the milk sample to study the linearity and limit of detection. Different solvent systems (such as methanol) and additive effects were investigated with the SBSE process to determine BPA recovery in milk samples.

SAT-162

A CHARACTERIZATION OF MARSH SEDIMENT AT PRAIRIE WOLF SLOUGH WETLAND

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Prairie Wolf Slough (PWS) is a restored, farmed wetland in northeastern Illinois that was created to improve the water quality of stormwater runoff entering the North Branch of the Chicago River. Past research has shown that concentrations of soluble reactive and total phosphorous in water that discharges from PWS are higher than the phosphorous concentrations in water entering the wetland. It is important to delineate the various sources of phosphorous in PWS in order to develop a comprehensive phosphorous budget. This project assessed the contribution of phosphorous from sediment/soil being deposited in the marsh. Sediment/soil samples were collected and measured for Mehlich-3 soil test phosphorous, carbon-nitrogen ratio, and particle size. Sediment traps placed in the marsh measured monthly sedimentation rate. Incremental soil samples were taken at 15-cm increments to a total depth of 90 cm from a subset of points along a transect through the center of the wetland; these were analyzed for nitrates, free iron oxides, and soil test phosphorous. Correlation analysis shows weak associations between soil

test phosphorous and percent silt, sand, and clay. While this does provide a greater understanding of sediment/soil dynamics within the marsh, it does not give a reason for such high phosphorous loads in PWS water.

FRI-165

THE EFFECT OF NONSTEROIDAL ANTI-INFLAMMATORY DRUGS ON THE CELLULAR COMMUNICATION OF A *VIBRIO* BACTERIUM

Cindy Barrientos, Teresa Palos.

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Pharmaceuticals provide relief from disease signs and symptoms. However, substances that are meant to help people could also be harming the environment. The US Geological Survey has sampled water from 139 streams and found traces of nonprescription drugs in concentrations as high as 17.4 micrograms per liter. It is important to understand the impact of nonprescription drug presence in water-based habitats. This is especially true considering rising pharmaceutical consumption. According to the Consumer Healthcare Products Association, over-the-counter drug retail sales increased to \$17.4 billion in 2011. This study investigated the use of *Vibrio harveyi*, a marine bacterium, as a biological indicator for the impact of over-the-counter drugs. *V. harveyi* relies on quorum sensing, a form of cell-to-cell communication, that uses chemical autoinducers to transmit signals to entire bacterial populations for the control of behavior. A high concentration of the autoinducer triggers bacterial bioluminescence. Bioluminescence generation and changes in bacterial culture brightness were evaluated when exposed to nonsteroidal anti-inflammatory drugs (NSAIDs). The results suggest that ibuprofen had the most detrimental effect, but only when the bacteria were exposed prior to the generation of bioluminescence and not after it had been produced. Both ibuprofen and naproxen had toxic effects at concentrations as little as .054 mg/ml. Aspirin had no effect on bioluminescence or bacterial growth. Additional work should be performed to further study NSAID environmental impact and programs developed to decrease their presence.

SAT-165

ENVIRONMENTAL CAUSES OF INCREASING DISSOLVED ORGANIC CARBON (DOC) IN ARCTIC TUNDRA PONDS OVER THE PAST 40 YEARS

Gabriela Contreras, Vanessa L. Lougheed.

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The active layer is used to describe the uppermost layer of soil that thaws each summer in the Arctic. With a warming Arctic, permafrost is expected to thaw and active layer depth to increase. The Arctic tundra ponds at the International Biological Program (IBP) site in Barrow, Alaska, studied for the first time in the 1970s, represent one of the very few locations in the Arctic where long-term data are available on freshwater ecosystem structure and function. The objective of this study was to determine whether dissolved organic carbon (DOC) concentrations in Arctic tundra ponds had changed over time and how thaw depth, temperature, and UV radiation have impacted DOC quantity (mg/L) and quality (SUVA₂₅₄). Over the summers of 2010 through 2012, we collected water samples and measured thaw depth from 5 IBP ponds and compared these with 1970s data. On average, ponds were 2 °C warmer in the 2000s compared to the 1970s. Maximum thaw depth was 13 to 19 cm deeper, which affects the infiltration of surface water into the ground. Permafrost is very sensitive to temperature changes and deeper active layers likely released organic (e.g., DOC) and inorganic compounds. The exposure of the ponds to UV radiation can cause an impact on the chemistry of the water that can result in a decrease or increase of carbon uptake from the plants and organism. This study will add to our understanding of the changes that warmer temperatures and environmental variables bring to the Arctic.

FRI-173

WETLAND SOILS

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Our research focuses on the comparison of soil properties from 6 wetlands sites in an effort to better understand the geography of wetland/hydric soils, and the impacts that various management practices, past land use, water alkalinity, and surrounding vegetation and wildlife may or may not have on hydric soil properties. As a part of this study, we collected 18 soil samples from Squaw Creek National Wildlife Refuge near Mound City, Missouri; wetlands located in the southwest corner and the northwest corner of Clinton Lake in Douglas County, Kansas; Baker Wetlands located in Lawrence, Kansas; and Quivira National Wildlife Refuge and Cheyenne Bottoms Wetlands near Great Bend, Kansas.

The sampled soils were then tested to determine soil composition; field, air-dried, and oven-dried moisture content; particle size distribution and density; and soil bulk density and porosity. The next steps in this project are to test for pH, phosphorous, nitrogen, and saline concentrations; hydraulic conductivity; and electrical conductivity of the soils. We are also focusing on the historical aspects of the Squaw Creek area by analyzing the change across time using satellite and aerial imagery. Our research will culminate in a paper and poster discussing the results of the soil tests and drawing insightful conclusions for the similarities and differences found in the soils of wetland environments.

FRI-170

ANALYZING IMPACT OF ANIMAL RUNOFF IN MAUNALUA BAY, HAWAII

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The purpose of this research is to analyze the ecological effects of feral cat (*Felis catus*) waste runoff in the Hawaii Kai area and the Maunalua Bay. The cat colony being tested is located at the Hawaii Kai Park and Ride on Keahole Street. Feral cats are believed to have been brought via Europeans to O'ahu by the 1840s, but it is possible they were introduced during Cook's many voyages in the 1700s. By 1866, the cats in Honolulu were so populous that Mark Twain remarked that there were "regiments of cats, armies of cats, multitudes of cats, millions of cats." The focus of this project is to study the impact of a feral cat population on the Kuapa Pond inlet as well as possible contamination of the Maunalua Bay. We hypothesize that the high population of feral cats will lead to a decrease in water quality. The water from the inlet leads directly out into the Maunalua Bay, a severely degraded fishery, and also flows near the Paiko Lagoon Wildlife Sanctuary. Data will be collected from 2 testing sites, one upstream of the cat population and the other downstream using a YSI meter to check oxygen, salinity, conductivity, and temperature levels as well as ammonia and nitrate content using a LaMotte spectrophotometer. To determine water quality, the data from the upstream site will be compared against the downstream site taking into consideration rainfall, tidal interaction, and weather.

SAT-171

ANALYZING THE EFFECTS OF USING ALTERNATIVE PRESERVATION METHODS BY ISOLATING RNA, DNA, AND PROTEIN FROM THE CORAL *MONTIPORA CAPITATA*

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Coral reefs are important to the environment because they offer protection from natural disasters, are an essential habitat for numerous marine fauna and flora, and play an important role in coastal societies as a source of food. Although coral reefs play an important role in the environment, they are under world-wide decline due to various factors such as land-based pollution, coral bleaching, and coastal construction. In order to improve coral reef health, researchers have focused on implementing genetic analyses of coral as a tool to indicate and quantify stress. Preservation of coral samples from *Montipora capitata* in the field is generally achieved using liquid nitrogen. However it is expensive, can cause skin irritation, and is hard to transport to remote areas. In this study, RNA later, Allprotect, Ribozol, and DMSO were tested to analyze their efficacy in RNA, DNA, and protein preservation of tissues from the coral *Montipora capitata* stored at room temperature versus in liquid nitrogen. Samples were preserved at 0 days, 3 days, 5 days, and 7 days after collection with 5 replicates for each preservative. The extraction of RNA, DNA, and protein will be evaluated and analyzed to measure gene expression using PCR and western blots. The outcome of this project will provide researchers with alternative methods for the inexpensive transportation of samples and the extension of work time in the field.

SAT-166

RELATIONSHIP BETWEEN PHOTOSYSTEM PHYSIOLOGY, PHENOLOGY, REFLECTANCE, AND CO₂ FLUX IN A CHIHUAHUA DESERT ECOSYSTEM

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Limited resources are available in desert ecosystems, which are highly susceptible to anthropogenic impacts such as climate change and overgrazing. Desertification and climate change are issues that hit close to the El Paso region and, in an effort to understand what is happening in our Chihuahuan Desert ecosystem, we are attempting to find new ways to monitor its progress. Although substantial progress has been made over the past decade, few studies have simultaneously examined how plant stress can constrain larger scale phenomena and how large-scale

phenomena can impact relatively small scale processes. By using a lightweight instrument called a Mini-PAM (pulse amplitude modulation) we have analyzed the photosynthetic efficiency of four common Chihuahuan Desert species at the Jornada Experimental Range in Las Cruces, New Mexico. Overall, electron transport rate (ETR) was higher and peaked earlier, late August to mid September, for deciduous shrub species: *Prosopis glandulosa*, *Flourensia cernua*, followed by the evergreen shrub *Larrea tridentata*, which peaked mid to late September. ETR was lowest for the graminoid *Muhlenbergia porteri*, which peaked early September. Peaks in ETR reflect relative lag responses to a series of rainfall events in August and early September. ETR declined with air temperature for all species, but the response was slowest for *Larrea tridentata*. Further analysis is critical to fully understand how small- and large-scale measurements can be used to efficiently address and mitigate environmental changes.

FRI-166

COMPARISON OF POPULATION RESPONSES TO PHARMACEUTICALS AND PERSONAL CARE PRODUCTS

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Pharmaceuticals and personal care products (PPCP) are chemicals of emerging concern present in our nation's waterways, including important rivers like the Rio Grande which borders the US and Mexico. The river receives pollutants from industrial, urban, and agricultural returns, but little is understood about their impacts on aquatic life. A rotifer population from an urban location, El Paso, Texas, (EP) and one from a remote location south of Big Bend National Park, Texas, (BB) were tested for acute and chronic toxicity from 4 PPCPs: caffeine, acetamidophenol, triclosan, and fluoxetine. Results of 48 hr LC₅₀ tests did not correspond to locality. For example, acetamidophenol BB: 319 mg/L, EP: 121 mg/L; fluoxetine BB: 0.06 mg/L, EP: 0.19 mg/L. In 6 d chronic exposures, GLMM analyses showed significant decreases in growth rates among treatments for caffeine, acetamidophenol, and triclosan, but not for fluoxetine, for both populations. An additional chronic exposure was conducted using 6 compounds at environmentally relevant concentrations. GLMM analysis did not show significant decreases in population growth for either population for this exposure. Sublethal effects were noted in chronic exposures; for example, even low concentrations of acetamidophenol (10 - 20 mg/L) resulted in the production of unviable eggs and, thus, negative growth rates. Our results provide insight into how these compounds impact aquatic invertebrates and data to better protect aquatic ecosystems.

FRI-171

MANGANESE EXPOSURE AND ALTERATION OF NEURONAL MORPHOLOGY IN THE PREFRONTAL CORTEX AND STRIATUM ASSOCIATED WITH DEFICITS IN COGNITIVE AND BEHAVIORAL FUNCTION

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Observational studies have shown that early exposure to manganese (Mn) impairs cognitive and behavioral functions in children. While these effects also have been shown in animal model studies, the molecular and cellular mechanisms underlying these deficits are not well known. The objective of this study is to determine whether elevated Mn exposure during peak periods of neurogenesis alters the morphology of striatal neurons in the prefrontal cortex (PFC) and striatum of adult rats using Golgi-Cox staining and unbiased stereology techniques. Long-Evans male neonate rats (n = 9/ treatment) were exposed daily to oral Mn at levels of 0 or 50 mg Mn/Kg/d from postnatal days (PND) 1 to 145. Whole brains were perfused *in situ* and then prepared using Golgi-Cox staining for neural morphology analysis following the manufactures recommendations (FD Neurotechnologies, Inc.). Our next steps will be to section brains (150 mm) and quantify neuronal morphology including dendritic branching, spine density, dendritic length, and number of synaptic spines along a dendrite in the PFC and striatum using light microscopy and Neurolucida software. We hypothesize that Mn exposure will produce reductions in dendritic length, branching, and spine density based on reports that neonatal Mn exposure causes hypofunctioning of striatal dopamine activity in the adult animal brain. These results will help fill an important knowledge gap in the mechanisms of how early-life Mn exposure causes learning and behavioral deficits in children.

FRI-163

COMPARING AGE AND GROWTH RATES OF RED SNAPPER (*LUTJANUS CAMPECHANUS*) AMONG VARIOUS ARTIFICIAL REEF SITES

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Red snapper, *Lutjanus campechanus*, is a large, predatory reef fish belonging to the family Lutjanidae. The species is found throughout the shelf waters of the Gulf of Mexico (GOM) and supports economically valuable recreational and commercial fisheries. Regardless of these attributes, the GOM's red-snapper population is considered overfished and has been in this condition since at least 1994. Although some enhancement efforts like artificial reef development have been conducted, the overall effects that artificial reefs may have on productivity and ecosystem function, particularly on red snapper populations, remains unknown. Specifically, the question of whether artificial reefs actually increase production, or in this case, increase growth rates of this species, needs to be addressed. This study was designed to compare age and growth rates of red snapper among different artificial reef types. These structures vary from cut-off pile jackets to liberty ships. Sagittal otoliths were extracted and aged using annular rings. Findings from this study will provide new age and growth data for red snapper from various artificial reef structure types. This information can help fishery managers understand the role of artificial habitats in the life history of red snapper, enabling better conservation for this important fishery.

FOOD SCIENCES/TECHNOLOGY

SAT-540

INVESTIGATION OF SOIL IMPACT ON THE CHEMICAL COMPOSITION AND AROMA FLAVOR PROFILES OF TEXAS HILL COUNTRY SYRAH WINES

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Terroir refers to the climate, soil type, and topography's effect on the flavor profiles of harvested crops. As part of the USDA-funded project Rocks to Wine, soil samples were collected from 6 Texas Hill Country vineyards to investigate the soils' effects on Syrah grapes and the wine flavor profiles. Four replicate Syrah vines per vineyard were flagged, and soils were collected at depths of 30 cm and 50 cm. Inductively coupled plasma optical emission spectroscopy will be used to determine the geochemistry of each soil for each of 24 vines. Soil texture will also be analyzed to determine the percent sand, silt, and clay for each location. From August to September, 24 batches of Syrah wine will be made, one from each vine, to compare the flavor and aroma profiles to the soil information at each individual location. Wine chemical composition such as total anthocyanins, tannins, pH, and percent alcohol will be determined. We will also score the aroma and taste of the wines using sensory analysis for over 10 flavor and aroma characteristics such as strawberry, black pepper, etc. We will use multivariate statistics to investigate trends in soils' effects on the characteristics of the Syrah wines to try to unravel the connection between terroir and fruit flavor.

SAT-541

EFFECT OF TANNIN STRUCTURE ON THE ANTIFUNGAL PROPERTIES OF TANNIN-CHITOSAN BIOPOLYMERS

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Food spoilage accounts for billions of dollars in lost revenue for the food industry. Fruit rot alone accounts for approximately 10% of food spoilage. Additionally, economies that depend on soft-fruit exports suffer in agricultural returns from fruit rot. The most common agent of fruit rot is *Colletotrichum acutatum*, a fungal pathogen that infects soft fruits through bruised regions on the skin. We have developed a biopolymer composed of tannins and chitosan, derived from specific plant sources and shrimp shells, respectively. Our preliminary studies indicate that tannin-chitosan biopolymers inhibit the growth of *C. acutatum*. However, tannins are complex polyphenolic compounds with large structural heterogeneity that confers a large diversity in biological properties. We will examine how specific structural features of tannins affect the antifungal properties of tannin-chitosan biopolymers. The study focuses on three distinct features: A-type linkages, from cranberry; B-type linkages, from grape seed; and hydrolysable tannins, from pomegranate. Tannins will be extracted from the sources and characterized by MALDI TOF mass spectrometry. Three tannin-chitosan biopolymers will be synthesized from the three tannin sources, and their ability to inhibit the

growth of *C. acutatum* on potato-dextrose media will be evaluated. We will also determine whether the biopolymers need to be applied at a specific fungal growth stage to be effective. Understanding the structure-function relationship of tannins in the biopolymer is critical for developing products that can remediate loss of soft fruits to fungal pathogens. Biopolymer products will offer a biodegradable, nontoxic and economically viable solution against *C. acutatum*.

FRI-542

SOIL TEXTURE, VINE VIGOR, AND THEIR IMPACTS ON THE CHARACTERISTICS OF SYRAH WINES FROM THE TEXAS HILL COUNTRY

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Terror is the set of characteristics such as geography, geology, and climate, of a certain place and how those characteristics impact crops growing there. Terror has been hypothesized to impact wine quality. This study focuses on the analysis of soil texture characteristics to investigate the connection between soil texture and viticulture parameters such as stem weight. We will analyze soil texture from 24 individual vine locations: 4 replicate Syrah vines from 6 different vineyards in the Texas Hill Country. We obtained soil samples at two different depths (30 cm and 50 cm), and analyzed the soil textures of the samples to determine the concentration of sand, silt, and clay. Preliminary data collected last year suggest that a higher percent composition of clay in the soil correlates with heavier stem weights of the grapevine. We will make wines from each of the vines in this year's study. We will describe wine quality by analyzing characteristics such as aroma, pH, level of anthocyanins, Brix (concentration of sugar), phenols, and tannins. These characteristics will not only help define our wine quality, but also assist us in determining the interaction between wine quality and soil texture. Our goal is to determine if soil texture indirectly affects wine quality and flavor by impacting the vigor of our vines.

FRI-541

EFFECT OF UV-B LIGHT ON SOLUBLE PHENOLIC CONTENT AND ANTIOXIDANT CAPACITY OF CARROT SLICES

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Activation of phenylalanine ammonia-lyase and chalcone synthase through abiotic stress caused by UV-B treatment provides the basis for a novel value-added processing method that can enhance the nutrient content of specialty crops. This process increases the synthesis of secondary metabolites including terpenes, polyphenolic compounds, and nitrogen-containing compounds. We will evaluate the application of wounding followed by mild UV-B exposure to enhance the nutrient content of sliced carrots by stimulating the synthesis of secondary metabolites before cold storage. Recently harvested commercial, orange carrots will be sliced at 3 mm thickness. Both top and bottom sliced surfaces will be exposed to three different total energy doses and a bimodal peak UV-B irradiance of 20 mW/cm². The slices will then be incubated at 15 °C for 3 days to allow for a biological response to the stresses followed by storage at 2 °C for 15 days. The change in total soluble phenolic contents (TSP) in response to the treatment conditions will be assessed using the Folin-Ciocalteu assay, and the resulting antioxidant capacity (AC) will be assessed by the 1,1-diphenyl-2-picrylhydrazyl radical method. Wounding stress from slicing and UV-B exposure at 60, 90, and 120 mJ/cm² are expected to increase the TSP and AC of carrot slices at least 2-fold after 15 days of storage at 2 °C, compared to whole carrot controls under similar storage conditions. Our results may suggest that UV-B light exposure could be used as an additional industrial processing step on fresh-cut carrot slices to enhance their nutritional value.

FORESTRY SCIENCES

SAT-542

DEFINING REFERENCE CONDITIONS FOR RESTORATION OF FIRE-PRONE FOREST ECOSYSTEMS

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The Tapash Sustainable Forest Collaborative is a project to restore ecosystem health in eastern Washington. The collaborative involves the US Forest Service, Washington State DNR and FWS, the Yakama Indian Nation, TNC, and private owners. This project analyzes the changes from 1992 through 2009 in forest species composition, cover, structure, and correlated management along the riparian areas of sampled watersheds. The initial change analysis was performed from 1949 through 1994 using historical, aerial photography and GIS. The objective of this project is to analyze the vegetation changes from 1994 through 2009 by using recent aerial photography available from the USDA NAIP. The vegetation found in these transitional areas between aquatic and terrestrial environments serves to reduce soil and nutrient loss due to stream runoff, serves as a form of flood control, and furthermore, dictates forest fire severity. ArcGIS will then be used to create vegetation layers to quantify the types of vegetation surrounding riparian areas in the Tapash area and to calculate vegetation coverage. Information found through this study will be used to determine fire prevention strategies and help define future reference conditions for landscape restoration among these fire-prone ecosystems.

FRI-543

DISEASE PROGRESSION MONITORING AND ANALYSIS OF SUDDEN OAK DEATH IN TILDEN PARK

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Phytophthora ramorum, an oomycete plant pathogen, was introduced to California approximately 2 decades ago. *P. ramorum* causes sudden oak death throughout coastal forests of central and northern California. Coast live oak (*Quercus agrifolia*), a native California species, is highly susceptible to *P. ramorum*, and infections have led to high mortality rates. The goal of this study is to determine the severity and location of Sudden Oak Death in coast live oak populations throughout Tilden Park. To estimate the proportion of trees infected by the pathogen, both the point centered quarter (PCQ) population density estimation method and complete inventory plots were used. Sampling nodes were established across transects at 40 meter intervals, and one coast live oak was selected for analysis in each cardinal direction (N, S, E, and W). Because the disease follows a reproducible sequence of symptom expression, we can rate the severity of the disease on each sample tree from 1 to 5 where 1 is asymptomatic and 5 is dead with symptoms of the disease. Data collected will be used in the development of models to monitor the disease through time by updating data collected on the infection and mortality in 2009. Models are intended to predict the advancement of the disease in the East Bay Park District and will be used to better understand the long-term effects of this epidemic on California's coastal forests. Although very little is known about the ecology of this pathogen, its long-term negative effects are likely to be highly significant.

GENETICS



FRI-549

IDENTIFYING MUTATIONS IN THE DNA BINDING DOMAIN OF *FOXF1* IN PATIENTS WITH ALVEOLAR CAPILLARY DYSPLASIA WITH MISALIGNMENT OF PULMONARY VEINS (ACD/MPV)

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Alveolar capillary dysplasia with misalignment of pulmonary veins (ACD/MPV; OMIM#265380) is a lethal genetic disease that affects the lungs during development. Diagnosis is done mostly by post-mortem autopsy, but some biopsies have also been done. The key characteristics are immature lungs, misalignment of pulmonary veins, and drastic lack of normally positioned alveolar capillaries which lead to hypertension and respiratory failure. A very high percentage (>85%) of patients with ACD/MPV also present with anomalies of the gastrointestinal, cardiovascular, and genitourinary systems. Mutations in the *FOXF1* gene cause ACD/MPV. While most of the cases are sporadic, some (~10%) of the samples in our cohort of over 100 patients have been identified as familial. We hypothesized that the DNA binding domain of *FOXF1* is important for its function as a transcription factor. To investigate the mutations, DNA from patients and immediate family members were isolated to carry out polymerase chain reaction (PCR). Amplification of the coding sequence of *FOXF1* was done using specific primers. The amplicons were visualized on agarose gel by electrophoresis and were purified using sephadex columns. The wild type DNA and the mutant DNA were sequenced using an Applied Biosystems ABI3130XL genetic analyzer. The mutations identified were located on the DNA binding domain of the protein (*FOXF1*), thereby supporting our hypothesis. We will use this data to further investigate the role of the specific amino acids in the DNA binding domain of *FOXF1* in accomplishing its function as a transcription factor.

SAT-551

A ROLE OF TATA BINDING PROTEIN ASSOCIATED FACTOR 3 IN HUMAN ERYTHROPOIESIS

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Though heritability for red blood cell traits is high, their genetic determinants remain largely unknown. Several single nucleotide polymorphisms (SNPs) are associated with high mean corpuscular hemoglobin concentration (MCHC), an RBC trait indicating abnormal erythropoiesis where RBCs become spherocytes instead of normal bi-concave disks. A recent genome-wide association study (GWAS) showed that an intronic SNP of TATA-binding protein associated factor 3 (TAF3) has a particularly strong statistical correlation to the SNPs associated with high MCHC. It has also been shown that TAF3 is specifically required for proper erythropoiesis in zebrafish and mice, although the same requirement in human erythropoiesis has not been demonstrated. Our goal was to determine if there is a similar relationship between TAF3 and high MCHC, as suggested by the GWAS data. We hypothesized that TAF3 is a key transcriptional regulator of the genes encoding major proteins of the erythrocyte cytoskeleton (namely Ankyrin and α -Spectrin) thereby causing elevation in MCHC. We performed chromatin immunoprecipitation to determine occupancy of TAF3 in the gene promoters and found recruitment relatively high. We knocked down TAF3 in K562 cells (pro-erythrocytes) using shRNAs, and quantified gene expression of Ankyrin and α -Spectrin using QRT-PCR. Our results conclusively indicated TAF3 knockdown downregulates α -Spectrin but not Ankyrin. In future studies, we aim to elucidate the mechanisms underlying this phenomenon by investigating epigenetic mechanisms such as histone modifications and chromatin crosstalk. This potentially novel role of TAF3 in human erythropoiesis may aid our understanding of the genetic determinants underlying RBC traits indicative of RBC membrane diseases.

SAT-553

A GOOD NIGHT'S REST: GENETICS OF SLEEP IN A MOUSE MODEL

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In recent decades, sleep deprivation has been linked to physical and behavioral diseases, particularly obesity. Studies have identified a relationship between sleep deprivation and obesity, but the intricacies of this relationship remain unknown. We have set out to identify individual genes that regulate sleep traits and relate these genes to

metabolic disorder and obesity in order to further our understanding of the mechanisms underlying sleep and its effect on our bodies. We conducted quantitative trait locus (QTL) analysis on data from sleep-deprived mice with 28,054 gene expression traits from the hypothalamus, thalamus, and anterior cortex as well as various sleep-wake traits. We narrowed down a gene list from 28,054 to 7 candidate gene regulators of sleep. We identified *Snca*, *Ssr1*, *Psmg4*, *Adarb2*, *Spock1*, *Elmo1*, and *Txndc5* as genes related to sleep in addition to having relationships with body homeostasis, various neurodegenerative diseases, metabolism, and body weight. These candidate gene regulators have the potential for use in knockout models for elucidating the function of sleep and its relation to disease.

FRI-544

IDENTIFICATION OF PHOSPHORYLATION SITES OF THE TRANSCRIPTION FACTOR MEF2 *IN VIVO*

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Phosphorylation status of a protein is important for activation of signaling pathways and affects many aspects of gene expression. The transcription factor myocyte enhancer factor 2 (MEF2) is known to have a complex phosphorylation pattern *in vitro*. This protein plays a vital role in activation of genes responsible for patterning of the sarcomeric muscle and is one of the components required for myogenesis. Although the phosphorylation status of MEF2 is thought to be a crucial determinant of its tissue specific function, there is little known about how this protein is modified *in vivo*. To better understand the phosphorylation pattern *in vivo*, we used tandem affinity purification along with western blotting, cell culture, and mass spectrometry to analyze MEF2 protein extracts from *Drosophila melanogaster* embryos. Initial work identified a modified residue at serine 98, with other potential sites of phosphorylation within close proximity. Further investigation will include determination if phosphorylation of this residue is necessary for MEF2 function *in vivo*, generation of an S98 phosphomimetic mutant and analysis of its function in tissue culture, work to assess the effects of activating various signaling pathways upon MEF2 function, and comparison of phosphorylation patterns from adult tissues. By studying such patterns, we hope to gain insight into the factors that influence MEF2 regulation and ultimately affect the control of gene expression in muscle cells.

FRI-555

DIFFERENT SUBCELLULAR LOCALIZATION OF A MUTANT FORM OF ANKRD11 IS ASSOCIATED WITH KBG SYNDROME

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KBG syndrome is a rare, autosomal-dominant, and heterogeneous disorder. It is characterized by macrodontia of upper central incisors, learning disabilities, developmental delay, seizures, short stature, and skeletal and craniofacial abnormalities. Recently, it was reported several ankyrin repeat domain 11 protein (ANKRD11) mutations are responsible for KBG syndrome. We have characterized a mouse model with a spontaneous Ankrd11 missense mutation p.E2502K in the C-terminal. It recapitulated several phenotypic findings presented in human patients. Primary culture of heterozygous mouse fibroblast revealed an accumulation of Ankrd11- mutated protein in the nucleolus while in the wild type, Ankrd11 protein localized in other regions of the nucleus. Most human mutations produce C-terminal truncated forms of ANKRD11. Thus, we expressed truncated forms of ANKRD11 in N2A cell lines to see if they have mislocalization. We found distinct localization of the proteins and higher expression when compared to wild type. This suggests a lack of proper proteolysis for the mutant proteins. Moreover, the missense mutation in the mouse is close to a putative D-box destruction domain which acts as a signal for the proteasome. This could explain the accumulation of the mutant protein in the nucleolus. Overall, our findings suggest mislocalization of Ankrd11 mutants in the nucleus is related to KBG syndrome. Furthermore, we are in the process of studying if this mutation affects the neuronal development in the mutant mouse which will explain the learning disability phenotype found in patients.

SAT-549

IDENTIFYING REGULATORY ELEMENTS IN THE TPNC41C PROMOTER RESPONSIBLE FOR MUSCLE-SPECIFIC EXPRESSION IN *DROSOPHILA MELANOGASTER*

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Troponin C is one of three regulatory proteins that comprise the troponin complex, which plays an integral role in the execution of proper muscle contraction for all muscle types. In *Drosophila melanogaster*, 5 genes coding Troponin

C have been identified, and their expression is tissue-specific. The Troponin C at 41C gene (TpnC41C) encodes a protein that is expressed mostly in the thoraces of adult *Drosophila*. Particularly, this gene is expressed in tergal depressor of the trochanter muscles (TDT) or jump muscles, which are responsible for the motions associated with jumping prior to flight takeoff. In this work, we are focused on identification of the regulatory elements in the promoter of the TpnC41C gene that direct its tissue-specific expression. We developed 2 reporter plasmids with mutant forms of the TpnC41C promoter placed upstream of the *LacZ* gene. Flies containing genomic insertion of these plasmids were examined for expression of the reporter protein β -galactosidase. The results of this experiment will indicate whether the mutated regions of the TpnC41C promoter contain regulatory sequences that are essential for specific expression of the gene in jump muscles. These findings could potentially identify specific binding sequences for transcription factors that regulate gene expression in TDT muscles. Understanding the mechanisms of gene expression in model organisms such as *Drosophila melanogaster* provides us with knowledge of evolutionary-conserved regulatory pathways of muscle formation in all animals, including mammals, and could be applied towards the development of new medical approaches for treating muscle diseases.

FRI-550

CHARACTERIZING THE EFFECTS THAT TIN2 MUTATIONS HAVE ON TELOMERASE ACTIVITY: AMPLIFICATION AND SEQUENCE ANALYSIS OF ENDOGENOUS AND ENGINEERED TIN2

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Patients with dyskeratosis congenita (DC) are at high risk for developing bone marrow failure and multiple types of cancer. All DC patients have extremely short telomeres, regions of repetitive sequence at eukaryotic chromosome ends. The telomeres of highly proliferative cells are elongated by telomerase. Telomerase access to the telomeres is regulated by the telomere-binding shelterin protein complex. Mutations within the subunits of telomerase have been found in some patients with DC. Recently, however, heterozygous mutations within the shelterin component TIN2 have been discovered in DC patients that do not have telomerase mutations. It is unclear why the mutations within TIN2 lead to short telomeres in DC patients. We hypothesize that the TIN2 mutations affect telomerase function resulting in short telomeres. Previously, it was determined that the TIN2 mutations do not function in a dominant negative manner. To test if the TIN2 mutations are haploinsufficient, human cell lines with heterozygous TIN2 mutations were created by gene editing. Polymerase chain reaction (PCR) was performed to amplify both the endogenous TIN2 allele and the edited mutant or wild-type TIN2 allele. The TIN2 sequence was then analyzed to verify that there were no additional mutations. Thus far, the sequences for six wild-type and two mutant clones have been confirmed with no other mutations than the one we engineered. After verifying the TIN2 sequence, we plan to compare telomere length and telomerase activity of the mutant and wild-type clones to gain insight into the mechanism by which TIN2 mutations lead to short telomeres.

FRI-554

THE IMPACT OF HEAT STRESS ON POLLEN TUBE GROWTH IN TOMATO

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In the summer of 2012, many farmers tended cornfields that failed to produce a crop because of extremely high temperatures during the 2 week period when the plants reproduce. Corn kernels and other critical seed crops including rice and wheat are produced when a pollen tube grows through floral tissue to deliver sperm to female gametes. If fertilization fails, so does the harvest. Fertilization in plants is thought to be highly temperature sensitive but little is known about how the pollen tube responds to increases in temperature. We are using tomato as a model system to understand the impact of high temperature on pollen tube function and gene expression. Our first goal is to define optimal pollen tube growth temperatures in multiple, genetically distinct tomato varieties including a series of heat-tolerant tomatoes known to naturally produce fruit at high temperatures. Our experiments suggest that tomato pollen tubes can tolerate mild temperature increases but pollen tube growth fails above a critical threshold. We are also analyzing the expression of critical, heat-responsive genes during tomato pollen-tube growth to determine whether heat tolerant varieties have a different response. Our long-term goals include defining the pollen tube's response to high temperature using genomics and defining individual genes that confer thermal tolerance to tomato pollen-tube growth.

SAT-554

CRISPR/CAS9-MEDIATED GENE TARGETING IN MAMMALIAN FIBROBLASTS

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The CRISPR (clustered regularly interspaced short palindromic repeats)/Cas systems are adaptive immune systems which are found in bacteria and archaea. These systems provide acquired immunity against bacteriophages by targeting nucleic acid in a sequence specific manner. Cas9 encodes an RNA-guided nuclease and together with an engineered RNA with 20 bases that match a target gene, will result in small deletions. Genome editing by CRISPR has been shown effective in many model organisms such as mouse, but little has been done in other mammalian species. The purpose of our study is to open up new genome editing mutagenesis methods in species that are not currently amenable to targeted gene manipulation. We hypothesize that the CRISPR/Cas9 system can induce a targeted mutation in a specific locus in fibroblasts derived from various mammalian species. Here, we coexpressed Cas9 and a chimeric guide RNA with which to target the *HPRT* locus in cultured mammalian cells from diverse species. Oligonucleotides were designed based on the target-site sequence and inserted into the CRISPR/Cas9 plasmid. The plasmid was introduced into the appropriate mammalian cells and HPRT-deficient cells were selected in medium using 6-thioguanine. Our studies will determine the feasibility of genome editing in diverse mammalian species.

SAT-550

IDENTIFYING DIFFERENTIALLY EXPRESSED GENES IN SLEEP-DEPRIVED MICE

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Sleep is an incredibly complex behavior that remains a largely unexplained mystery. Sleep renders organisms vulnerable for extended periods of time, yet evidence suggests that sleep is evolutionarily conserved across species from worms to animals and thus must have an important function. It is clear that sleep is under genetic control, but the mechanisms behind this control are still the subject of inquiry. Understanding these mechanisms is increasingly important as sleep has been linked to diseases such as obesity or metabolic syndrome. We endeavor to find genes that will explain the genetic mechanisms underlying sleep and its function. We will identify genes with significant expression differences in the hypothalamus and cerebral cortex of sleep-deprived and control mice, which of these genes are upregulated or downregulated, and which share biological processes or functions. Preliminary studies show that a large amount of genes have significant expression differences in both the hypothalamus and the cerebral cortex. Identifying these genes will further our understanding of sleep and its relation to brain plasticity, metabolism, and biosynthesis. Understanding these relationships will lead to better treatments for sleep disorders and other sleep-related diseases.

SAT-543

CHARACTERIZATION OF A FIELD ISOLATE OF TOMATO YELLOW LEAF CURL VIRUS - CLONING

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Tomato yellow leaf curl virus (TYLCV) is a geminivirus and a major tomato pathogen, causing extensive crop loss. The main controlling agent is the use of insecticides to limit the whitefly vector. Tomatoes are one of the leading fresh and processed vegetable crops worldwide, demonstrating the extreme importance for understanding mechanisms of TYLCV pathogenesis. This project involves the characterization of a strain of TYLCV that was shown to be present in plants showing symptoms of an infection in regions near San Antonio, Texas. The goals of the project are to clone and sequence the TYLCV strain and then perform infectivity studies in different hosts, including tomato. Rolling circle amplification was performed on DNA samples isolated from plants exhibiting symptoms typical of a TYLCV infection. Following restriction of the RCA products, a unit-length genomic fragment of the viral genome was cloned into a pUC-based cloning vector. The entire genome was sequenced and was confirmed to be TYLCV. Infectious clones are being constructed that comprise tandem dimers of the TYLCV genome. We propose to analyze viral transcripts produced during infection and perform mutagenesis to determine the function of the 6 genes present in the viral genome. The replication kinetics of TYLCV will be determined using a protoplast system. The outcome of these experiments will increase our knowledge concerning transcription and replication in TYLCV and form the basis for the

development of novel strategies for control of TYLCV based on disruption of interactions between the virus and host. (Partially funded by NIH/NIGMS/MBRS-GM060655.)

FRI-547

TELOMERE LENGTHS IN INDIVIDUALS WITH IDIOPATHIC PULMONARY FIBROSIS

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Idiopathic pulmonary fibrosis (IPF) is an interstitial lung disease characterized by fibroblast and collagen deposition and irreversible lung destruction. There is a genetic contribution to the development of IPF, including telomere-related genes. Moreover, the development of IPF has been correlated with a shorter telomere length compared to reference populations without IPF. We investigated the telomere lengths of individuals with IPF with the hypothesis that heterogeneity in telomere length will inform genetic discovery in IPF. We extracted DNA from 180 individuals with IPF. The DNA samples were plated with a total volume of 50 μ L per sample, which consisted of a diluted 1 ng/mL DNA sample and 20 ng/mL of total yeast RNA with water. The samples were then analyzed using a monochrome multiplex quantitative PCR (MMQPCR) producing a high abundance of tandem repeats (T) and low abundance of single copy genes (S). The ratio of (T/S) represents an average telomere length per cell. The average telomere length of the 180 individuals with IPF is 0.826 ± 0.182 . Due to our interest in small telomere length, we conducted preliminary analysis of the data in the lowest 25%, which consisted of the 40 smallest values with an average telomere length of 0.604 ± 0.078 . There is a large telomere length spectrum (0.397 to 1.38), which indicates the samples are heterogeneous in telomere length. Shorter telomere lengths may suggest a pathology that is related to telomere biology. Investigation of this group may lead to discovery of genetic contributions to IPF and telomere length regulation.

SAT-548

IDENTIFYING THE ENHANCER REGION FOR *SINGLES BAR* EXPRESSION IN *DROSOPHILA MELANOGASTER* MYOBLASTS

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In *Drosophila melanogaster*, *singles bar* (*sing*) codes for a MARVEL domain trans-membrane protein found in all myoblasts that is essential for myoblast fusion. Myoblast fusion is critical for proper muscle formation and is conserved between flies and humans. Studying *singles bar* and other genes that control myoblast fusion in flies therefore has broad applications to humans. During myoblast fusion, myoblasts come together to form a prefusion complex. The myoblasts later fuse together to form a syncytial myofiber. Without *sing* expression, however, progression does not occur past the prefusion complex. Preliminary data have shown that *sing* is downregulated in myocyte enhancer factor 2 (MEF2) knockdown flies. MEF2 is a transcription factor with many target genes involved in muscle development. This study has demonstrated that MEF2 is a direct regulator of *singles bar* and provided a novel mechanism by which MEF2 regulates myoblast fusion. By creating a transgenic line of flies using an enhancer region of *sing-lacZ* fusion construct, we have illustrated mesoderm-specific *lacZ* expression. The β -galactocidase produced by *lacZ* was visualized via antibody and DAB staining of *Drosophila* embryos. Moreover, we have shown that MEF2 is capable of binding to the enhancer region of *singles bar* via gel mobility shift assays. These studies enhance our understanding of how *sing* expression and myoblast fusion are controlled in flies and will likely have applications for treating heart disease and muscular diseases in humans.

FRI-545

CHARACTERIZATION OF ROOT UV-B SENSITIVE2 PROMOTER IN *ARABIDOPSIS THALIANA*

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Ultraviolet B light (UV-B, 280 to 320 nm) can either harm or help organisms depending on its fluence level. Low fluence levels serve as signals for plant morphogenesis, while high fluence levels can increase mutation and damage macromolecules such as DNA, RNA, and protein. Thus far, little is known about how low-fluence UV-B regulates plant growth and development. Our lab has discovered an *Arabidopsis* mutant, called *rus2* (*root uv-b sensitive2*), that is hypersensitive to very low-fluence (VLF) UV-B. Under VLF UV-B, *rus2* is stunted and pale, suggesting *RUS2* plays important roles in early seedling UV-B response. To understand how *RUS2* functions, we studied *RUS2* promoter activities at various developmental stages. The *RUS2* promoter region was PCR amplified from *Arabidopsis* genomic DNA, cloned in a pGEM vector and confirmed by sequencing. This fragment was then fused to the reporter gene

beta-glucuronidase (*GUS*) to create a *RUS2::GUS* construct, then ligated into the pBI101 transformation vector. We are placing the confirmed plasmid into *Agrobacterium tumefaciens* to transform wild-type *Arabidopsis*. *RUS2* promoter activities will be analyzed by incubating transgenic plants with X-Gluc, a colorless substrate converted by *GUS* to a blue product. The amount of *GUS* activities found in *Arabidopsis* seedlings is a direct reflection of *RUS2* promoter activity. *RUS2::GUS* transgenic seedlings of various ages will be subjected to various treatments (with or without stresses related to UV-B, osmotic, drought, and temperature), and *RUS2::GUS* activities will be assayed. We expect to obtain a detailed *RUS2* expression profile, providing important insights to how *RUS2* functions in early seedling UV-B responses.

SAT-545

IDENTIFYING GENES THAT MODULATE VIRAL REPLICATION IN *C. ELEGANS*

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Defense against viruses is an important human health problem. We are using the nematode *C. elegans* as a model to study host-virus interactions. We have previously shown that the flock house virus (FHV), a (+)-strand RNA virus, can replicate in *C. elegans*, although this is not its natural host. Normal FHV carries two RNAs: RNA1 encodes and RNA-dependent RNA polymerase (RdRP) that copies the RNA and the B2 protein, which suppresses host RNA interference (RNAi). RNA2 encodes the viral capsid. We are working with a *C. elegans* strain that we have engineered to express FHV RNA1, in which the B2 coding region is replaced with that of GFP. When this transgene is induced by heat shock, GFP expression indicates viral replication. Using chemical mutagenesis and RNA interference, we have identified genes that, when mutated or silenced by RNAi, enhance or suppress replication of FHV in *C. elegans*. Many of the genes found by RNAi-mediated knockdown play roles in lipid storage and autophagy. While previous studies have shown a relationship between these pathways and longevity in *C. elegans*, we now have good evidence that autophagy and lipid storage also play roles in regulating a defense response against viral replication.

FRI-551

HR REPAIR PROTEIN SILENCING AND HETEROCHROMATIN FORMATION

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Nearly all diseases have a genetic component to them and many diseases arise due to failure in an organism's ability to repair and maintain its DNA. With this in mind, it is evident there is a need to better understand the proteins and functions of DNA repair and maintenance. Our research investigates the interactions between DNA repair proteins and heterochromatin formation in the budding yeast, *Saccharomyces cerevisiae*. To investigate this relationship we created a reporter strain with nonfunctional silencers flanking a reporter gene. Specific repair proteins can be recruited to the silencers via tethering to sequence specific DNA binding proteins and the reporter gene can be assayed for silencing. We created additional strains with gene knockouts in repair proteins, using site-directed homologous recombination and crossing. This allows us to better determine the pathway that repair proteins are using to silence genes and form heterochromatin. We have determined that some homologous recombination (HR) repair proteins are sufficient for silencing the reporter gene and that the HR proteins require Sir3, a heterochromatin protein for silencing. We have also determined that HR proteins are sufficient in tethering a locus to the nuclear periphery where silencing occurs. With the results from this research it is believed that we can not only better understand how *S. cerevisiae* ensures genome integrity and thus create more elaborate experiments for further research, but also that these results may be used as groundwork in design of therapies and medications for diseases.

SAT-544

***BRACHYPODIUM DISTACHYON*: AN ANALYSIS OF QUANTITATIVE TRAITS**

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Brachypodium distachyon is a cereal from the temperate regions and is widely used as a genomic model for economically important grasses such as maize, wheat, barley, etc. It is a relatively practical model due to its small genome and feasibility for experimental manipulation. Using a recombinant inbred-line (RIL) population grown under common greenhouse conditions (BD3-1 x BD21), we explored the quantitative genetics underlying a series of economically important traits including flowering time, physiology, and seed shattering. In addition, we used quantitative trait loci (QTL) mapping to localize regions of chromosomes associated with these traits. Preliminary

results indicate that flowering time exhibits significant genetic variance and is associated with a QTL on chromosome 4. Here, individuals with the BD3-1 background had decreased flowering time relative to BD21. We will further explore complex QTL-QTL interactions in these traits as well as implement binary-trait QTL models to search for loci associated with seed shattering. Understanding the locations of interactions between and the additive effect patterns of QTL for quantitative traits provides insight into the underlying genetic architecture of complex traits. Ultimately, this understanding can be used to find candidate loci, clone genes, or implement marker-assisted selection regimes to increase yield and efficiency in important food crops.

FRI-546

A MUTAGENESIS SCREEN TO IDENTIFY GENES REQUIRED FOR DEVELOPMENTAL ETHANOL RESPONSE IN *DROSOPHILA*

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Fetal alcohol syndrome (FAS) is a spectrum disorder brought on by maternal alcohol consumption during pregnancy. While it has been clear for over 2 decades that genetic factors are involved in the susceptibility to and severity of FAS, no genes mediating these effects have been identified. In addition, very little is known about the targets of ethanol during fetal development. *Drosophila* larvae reared in ethanol mirror the detrimental effects of FAS; we are therefore using flies as a genetic model to identify developmental ethanol targets. In order to identify the genes involved in larval response to ethanol exposure in an unbiased fashion, we generated approximately 1,000 novel transposon-induced mutations and screened them for altered survival and development time when reared in ethanol. Analysis is ongoing, but based on our current data, we expect to recover approximately 30 new mutations. We will discuss the genes identified as well as their ethanol-induced phenotypes. Additionally, we will show the expression patterns of a subset of the identified genes and how expression is affected by developmental ethanol exposure. Finally, mutants will be tested for changes in sedation and tolerance behaviors to ethanol relative to the wild-type *Drosophila*. The genes we identify will help us understand the molecular and cellular changes that underlie the deleterious effects of developmental ethanol exposure and, ultimately, may provide targets for the treatment of FAS.

SAT-552

GENETIC VARIATION OF THE *ASSIMINEA INFIMA*, AN ENDANGERED MOLLUSK OF THE RIO GRANDE REGION

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The goal of this project is to evaluate the species status of the North American *Assiminea infima* species in the Death Valley of the lower Colorado River. Twenty-three total snails were collected from 3 sites from Blue Point Spring, Saratogo Spring, and Kings Pool in the Death Valley. DNA was extracted from each individual snail using the CTAB method. Two mitochondrial genes, cytochrome c oxidase subunit I and 16S ribosomal RNA, were sequenced. The molecular data suggest that the Blue Point Spring population is divergent from all other assimineid populations, suggesting it should be described as a new species.

FRI-552

FINDING THE ANCESTRAL LINK AMONG WOMEN WITH TRIPLE-NEGATIVE BREAST CANCER

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Triple negative breast cancers (TNBC) are characterized by the absence of estrogen receptor, progesterone receptor, and HER-2 expression, making them especially deadly. This is because these receptors are the targets for highly successful treatments for breast cancer, and their absence makes it difficult to treat TNBC. TNBC is found in 15% of US women, with African-American women having the highest incidence. In Sub-Saharan Africa, the rate of TNBC appears to be much higher. A recent study of 75 breast cancer patients in Ghana found that 82% had TNBC. The high rates of TNBC in African-American and Ghanaian women suggest it may have a genetic ancestral component. The purpose of this study is to determine the mtDNA type of 100 Latinas with and without TNBC to determine if an ancestral link exists among patients diagnosed with this form of cancer. Latinas are a human subpopulation having European, Native American, and African ancestry. The ancestral nature of their maternal lineage can be determined by mtDNA typing. Therefore, the mtDNA type of 100 Latinas, 31 with TNBC, 34 with triple positive breast

cancer, and 35 unaffected controls will be determined. Preliminary results show that a TNBC cell line has an mtDNA type indicative of African ancestry. A triple-positive cell line has an mtDNA type indicative of European ancestry. Consequently, we predict that TNBC samples will display greater African ancestry. The identification of an ancestral link among women with TNBC may allow for development of methods for its early detection and treatment.

SAT-546

DOES THE GENETICS OF PARAQUAT RESISTANCE IN MOUSE STEM CELLS PREDICT INCREASED LIFE EXPECTANCY IN NEMATODES

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There is a well-established correlation between stress resistance and life extension across diverse species. This correlation has been used in the past to discover long-lived strains of invertebrates by selecting for mutants resistant to environmental stress such as heat or reactive oxidants. Here, we tested whether mutations in mouse genes that convey paraquat resistance have functional homologs in the nematode *Caenorhabditis elegans* that convey similar paraquat resistance and also life extension. We obtained worm strains mutant for genes that modulated paraquat resistance in mouse embryonic stem cells. Each strain of worms was tested for paraquat resistance as well as life span. We found that some of the genes previously discovered to provide paraquat resistance in mice do in fact also modulate paraquat resistance in worms, but only a minority of the worm mutants tested also display increased longevity. We conclude there is partial conservation of the relationship between paraquat resistance and life span across mice and nematodes.

SAT-547

ELUCIDATING THE MECHANISM OF MTDNA PURIFYING SELECTION IN THE GERMLINE USING *C. ELEGANS*

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Inheriting healthy mitochondrial DNA (mtDNA) from the maternal line is necessary for proper energy metabolism, growth, and organismal viability. The mechanism of purifying selection, a process by which favorable mtDNA molecules are preferentially inherited while the mutated are degraded, is not completely understood yet is an essential check against accumulation of defective mitochondria. In this project, we are investigating the germline apoptotic hypothesis as a mechanism for purifying selection in *C. elegans*. Specifically, this involves transferring mitochondria from laboratory WT strain N2 into a strain called LB138, which carries complementary mtDNA deletions (*uaDf5* and *w46*). Then, through a screened selection condition that we are currently developing, we will select for the progeny that have successfully incorporated the N2 mitochondria. Preliminary data suggests Chloramphenicol as a promising candidate for this selection condition. Using qPCR, we can then quantify the efficiency at which subsequent generations preferentially incorporate the N2 mitochondria and, thus, the rate at which purifying selection occurs. In addition, we are developing apoptotic mutant strains (*ced-3*, *ced-13*) to test the proteins involved for a more complete understanding of the mechanism using a similar method. If purifying selection is occurring as hypothesized, we should observe greater N2 mitochondrial DNA qPCR signal more quickly for the LB138 strain than the *ced-3* or *ced-13* mutants, suggesting the necessity of these apoptotic proteins in purifying selection and, specifically, suggesting apoptosis in the germline as a key regulator of mtDNA inheritance. These results will show tremendous promise towards the understanding, treatment, and cure of mitochondrial myopathies.

FRI-553

THE GENETICS OF DYSLEXIA

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Evidence supports the belief that dyslexia has a genetic basis. However, the factors in the human genome that contribute to the disorder such as common DNA variants and/or rare mutations have not yet been identified with certainty. Genetic alterations that cause amino acid changes have been found in some affected individuals, but the implications are unclear. This project seeks to find genetic contributors to component phenotypes of dyslexia, for example, spelling ability, by studying whole families. Using the genotypes of 1,200 members of 357 families, we have been able to identify and refine candidate regions on several different chromosomes that may contain these genetic risk factors. We will use statistical genetics approaches to narrow these regions further and target for more detailed analysis variants in the genes that lie within these regions.

FRI-548

IDENTIFICATION OF AN ENHANCER REGION OF AN ALKALINE PHOSPHOTASE ORTHOLOG EXPRESSED IN THE *DROSOPHILA* HEARTDalea Nodal¹, Gloriana Trujillo², Richard Cripps¹.¹*University of New Mexico, Albuquerque, NM*, ²*San Francisco State University, San Francisco, CA*.

The dorsal vessel in *Drosophila melanogaster* is similar to the vertebrate heart in early embryonic development. In *Drosophila*, there are several genes necessary for the development of the dorsal vessel that are homologous to vertebrate genes. These common elements between *Drosophila* and vertebrates allow knowledge from studying the dorsal vessel to further our understanding of vertebrate heart development. Currently, we are trying to find the enhancer region of an alkaline phosphatase ortholog that we hypothesize is involved in the formation of ostia, which are inflow tracts that allow for hemolymph to enter the heart. We have identified possible enhancer regions for this gene and, by using a *lacZ* reporter, we have created enhancer-reporter constructs. These constructs are then injected into *Drosophila* embryos to create transgenic flies. At this point, we have found that 5 of the regions do not exhibit enhancer activity for the ortholog, and 2 other regions are still being tested. Identifying the enhancer region will lead to more information on the genetic control of ostia formation and provide insight into vertebrate heart development.

MARINE SCIENCES

FRI-559

IMPACTS OF URBAN RUNOFF ON ROCKY INTERTIDAL ORGANISMS AT LITTLE CORONA MARINE LIFE REFUGE, CALIFORNIAMatthew Scanlon, Velvet L. Park, Alexis Bueno Correa, Frank Campos, Emily Sanchez, William Hoese, Kristy Forsgren.*California State University, Fullerton, Fullerton, CA*.

Rocky, intertidal organisms withstand a variety of abiotic stresses associated with tidal change including wave shock at high tide and ultraviolet radiation and desiccation at low tide. An emerging concern is the influence of freshwater urban runoff which varies in pH and temperature compared to ocean water and may contain harmful compounds. We investigated the effects of runoff on intertidal species richness at Little Corona Marine Life Refuge at 3 sites: not influenced, indirectly influenced, and directly influenced by freshwater runoff. We hypothesized that sites with runoff would have lower species richness and salinity, as well as higher ammonia and nitrate levels. Thirty meter transects were placed in low, mid, and high intertidal zones at each site. Species richness was measured in three 1 m² quadrats at 5 distances along each transect. Water quality was measured at 3 points along each transect. Species richness was not significantly different across sites. Ammonia, nitrate, and pH levels were higher while salinity was lower at sites influenced by runoff compared to the no-runoff site. Lower abundances of focal species were observed at sites influenced by runoff compared to the no-runoff site. Prevalence of crustacean and limpet species was also lower at runoff sites. Algae prevalence was higher at runoff sites than the no-runoff sites. Freshwater containing high nitrate and ammonia levels may affect rocky intertidal community structure in urban runoff-influenced areas where organisms are under stress; thus rocky intertidal communities may be used as indicators of habitat health.

FRI-561

EXPLORING NEW WATERS: BIOGEOGRAPHY AND OCEANOGRAPHIC CONTROLS OF THE SOUTHERN CALIFORNIA CURRENT MIDWATER FISH COMMUNITYXochitl Rojas-Rocha, Peter Davison, Ana Lara-Lopez, Tais Castellano, J. Anthony Koslow.*Scripps Institution of Oceanography, University of California, San Diego, La Jolla, CA*.

The midwater fish community of the southern California Current (CC) is abundant, diverse, and forms a key link between primary productivity and higher trophic organisms such as marine mammals and seabirds. Despite its major role in oceanic foodwebs, this fish community remains largely understudied. Our study examined samples of the southern CC's midwater fish community to enhance understanding of the community's structure and response to seasonal cycles and climate events such as El Niño and La Niña. Trawl samples were collected on quarterly California Cooperative Fisheries Investigation (CalCOFI) research cruises from 2010 to 2012. We studied the species composition and abundance of the midwater fish assemblage in the southern CC and its spatial and temporal variability relative to oceanographic conditions. Our findings contribute to the scientific community's understanding of

an oceanic community that plays a critical role in oceanic foodwebs and is thus important to the general public which relies on commercial fisheries economically and for food.

SAT-558

SPECIES IDENTIFICATION GUIDE FOR EUPHAUSIIDS OF THE CALIFORNIA CURRENT

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Proper species identification is necessary and fundamental to study the biogeography, ecology, trophic interactions, and changes in ecosystem health and status. Euphausiids (or krill) are among the most abundant marine organisms, critical in the transfer of energy from the phytoplankton to higher trophic levels as a major prey of many species of fishes, squids, seabirds, and baleen whales. There are 39 known species of euphausiids in the California Current Ecosystem (CCE). Many of these species are morphologically very similar, and a guide is needed to correctly identify them. The goal of this project is to develop an identification guide for marine biologists, ecologists, and oceanographers to use when analyzing zooplankton samples from the CCE. The guide includes a key, a description, and a picture of each species with relevant field marks noted. Descriptions and illustrations of the characteristics are being taken from reference materials and journal articles. The guide is being tested with each of the 39 known euphausiids of the CCE in order to ensure that each species can be correctly identified. Preliminary tests have indicated positive efficacy for the guide. The Koslow lab will use this guide to study biogeography and responses to seasonal and climatic perturbations. We plan to make it available to other researchers to further our understanding of the ecological influences that different species have on the ecosystem and the food web.

FRI-560

COMPARING THE REEF FISH COMMUNITIES OF SHALLOW AND MESOPHOTIC CORAL REEFS OF WEST MAUI, HAWAII

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Mesophotic reefs are coral ecosystems found in tropical and subtropical ocean depths of 30 m to greater than 100 m. These reefs contain corals, sponges, and algae as the dominant structural components and experience a low availability of light for photosynthesis due to their depth. The biological communities on shallow coral reefs are home to a diverse group of fish that comprise about 25% of all marine life, yet little is known about the fish communities on mesophotic reefs and how they compare to those of shallow reefs. To learn more about the fish communities on mesophotic reefs, we used unbaited and baited remote underwater stereo-videos (RUVs and BRUVs) to characterize reefs of west Maui in the Hawaiian Islands in 2012. We detail the methods used to analyze data generated by the RUVs and BRUVs and present preliminary results of fish community composition at these sites. We also compare the mesophotic reef fish communities to nearby shallow reef fish communities to determine similarities in composition. Our results will contribute to a more holistic view of coral reef ecosystems across a broader depth range and improve our understanding of the relationship between biological communities of shallow coral reefs and mesophotic reefs.

FRI-556

PRELIMINARY SPATIAL DISTRIBUTION OF COPEPODS IN THE BIOLUMINESCENT BAY OF LAGUNA GRANDE, FAJARDO, PUERTO RICO

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As far as we know, copepod dynamics have been poorly documented in tropical bioluminescent bays. Copepods are the most abundant taxa in the zooplankton community and constitute an important key in the flow of energy through marine food webs. Our objective was to carry out a preliminary assessment of the spatial distribution of copepod species *Acartia tonsa* in relation to fluctuations in water quality parameters at the bioluminescent lagoon of Laguna Grande, Fajardo, Puerto Rico. Samples from 9 stations were analyzed beginning in the ocean and continuing through the connecting channel towards the end of the lagoon. On each station, the water-quality parameters (salinity, temperature, pH, turbidity, and oxygen concentration) were measured with an YSI-6280-V2. A 200 µm plankton net was towed for 1 minute at a constant speed to collect samples. Preliminary results suggested a statistically significant decline in copepod density with increasing water turbidity, declining oxygen concentration, and declining salinity.

Higher copepod densities were located at the center of the lagoon where dissolved oxygen concentration was higher, turbidity was lower, pH was within the range of 7.8 to 7.9, and salinity was higher. Though still preliminary, these results suggest an apparent significant relationship between water quality and the status of copepod populations. Water quality across the connecting water bodies is a concern due to raw sewage effluents and sediment-laden runoff. This points out the importance of establishing a regular water quality and plankton community long-term monitoring program. This will provide critical information for the management and conservation of the bioluminescent lagoon.

FRI-558

HABITAT CHARACTERIZATION OF *ASPARAGOPSIS TAXIFORMIS* (LIMU KOHU) LINEAGES

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Limu kohu is a red alga found worldwide in warm-temperate and tropical oceans. In the Mediterranean Sea, limu kohu is considered an invasive nuisance species, while in Hawaii it is a valued food source that has disappeared from many coastlines. There are 4 known lineages (1, 2, 3, and 4) of limu kohu, and Hawai'i is the only place currently known to contain 3 out of the 4 lineages (1, 2, and 4). We wanted to characterize the habitats of the different lineages as a first step in identifying potential anthropogenic disturbances that could affect the presence of this valued resource. We hypothesize that the different limu kohu lineages occupy distinct habitats from each other, and presence of a lineage type could act as an indicator of habitat quality. Preliminary data has been collected on water quality (salinity, turbidity, pH, light levels, and temperature), water motion, and benthic community structure for areas with limu kohu populations on the southeast and east shores of O'ahu. When comparing the habitat data to the limu kohu genotype distribution within each site, the data suggests that the habitat choice amongst lineages may be linked to turbidity and water motion. Lineage 2 and 4 can persist in more turbid and still conditions while lineage 1 solely survives in clearer water with higher levels of water motion. We aim to utilize more sensitive equipment in an effort to reveal patterns with increased detail and reproducible results.

FRI-557

BODY MASS CHANGES AND EXPRESSION OF DEIODINASE TYPE 1 IN NATURAL-FASTING MALE NORTHERN ELEPHANT SEALS

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Deiodinase Type 1 (DI1) converts thyroid hormones (TH) thyroxine (T4) to triiodothyronine (T3) which are essential to mammals that undergo long term fasting. During food deprivation, DI1 activity is increased to raise the mono-deiodination of the inner ring to promote the production of reverse T3 (rT3), which suppresses cellular metabolism to protect the organism from energetic burdens imposed during periods of reduced energy intake. T3 and T4 promote basal metabolism in mammals, but its levels and functions are typically suppressed with prolonged fasting. TH plasma concentrations were measured in adult male northern elephant seals to better understand DI1 activity over a natural fasting period. To address our hypothesis that natural fasting in elephant seals promotes body mass loss and stimulates an increase in DI1, we measured body mass and plasma concentrations of rT3, free T3 (fT3), total T3 (tT3), free T4, and total T4 (tT4) in adult male elephant seals ($n = 10$) over 12 weeks of fasting. Males lost an average of 29% body mass. Fasting did not alter the concentrations of plasma thyroid hormone rT3, fT3, and tT4. However fT4 increased ($0.25 \pm 0.03\text{ng/dL}$ to $0.78 \pm 0.08\text{ng/dL}$) suggesting that there is an increased potential for TH-mediated cellular effects. Conversely, tT3 decreased ($63 \pm 5 \text{ ng/mL}$ to $50 \pm 4\text{ng/mL}$) between early and late fasting suggesting that DI2 or DI3 may be contributing to the dynamic changes in TH metabolism. Overall, these findings reveal unconventional mechanisms of TH activity regulation and metabolism associated with prolonged food deprivation in a fasting-adapted mammal.

SAT-557

ELUCIDATING THE RESPONSE OF A TOXIC DINOFLAGELLATE TO CO_2 -INDUCED PH VARIATIONS

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Harmful algal blooms (HABs) result from the rapid growth of phytoplankton that can be harmful to human or environmental health. *Alexandrium catenella* is a marine HAB dinoflagellate that produces saxitoxin, a powerful neurotoxin responsible for paralytic shellfish poisoning. Ocean acidification (OA) is the lowering of ocean pH due

to the absorption of excess anthropogenic CO₂. It is known that OA has a negative effect on calcifying organisms, though its effect on HABs, specifically dinoflagellates, is unknown. Previous studies show that a decrease in pH has a negative effect on dinoflagellate growth. It is also known that a variety of stressors increase dinoflagellate toxin production. However, no studies have investigated if pH stress will have the same effect. The main focus of this study is to determine the effect of pH on toxin production. For this study, we grew batch cultures of *A. catenella* at 7 different pH levels between 7.0 and 9.0. A continuous culture/chemostat system was used to keep the cultures at a constant pH and pCO₂ concentrations. Growth was determined using fluorometry and cell counts, and efficiency of photosystem II was measured using pulse-amplitude modulated (PAM) fluorometry. Cell stress and saxitoxin production will be measured using reactive oxygen species (ROS) assays and enzyme-linked immunosorbent assays (ELISA), respectively. Our preliminary results show that, compared to controls at both high (9.0) and low (7.0) pHs, *A. catenella* showed a lower growth rate. Also, significant variations from optimal pH have a negative effect on efficiency of photosystem II (PSII).

SAT-556

CHARACTERIZATION OF *VIBRIOPHAGE DOUGLAS 12A4* AND ITS ROLE IN THE *EUPRYMNA-VIBRIO* SYMBIOSIS

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Bacteriophages are viruses that infect bacteria, and they have a major role in microbial evolution by transferring genetic material between non-related hosts. This transfer mechanism, termed transduction, is common among free-living bacteria and their viruses, but has yet to be explored in symbiotic bacteria found in particular eukaryotic hosts. Therefore, we have used the sepiolid squid (Mollusca-Sepiolidae)-*Vibrio fischeri* mutualism as a model to investigate whether bacteriophages have a role in maintaining beneficial associations. To determine whether free-living or symbiotic *V. fischeri* are subject to phage infection, a *Vibrio*-specific bacteriophage was isolated from a water sample taken from the coast of Ipswich, Massachusetts. This bacteriophage, named *Vibriophage douglas 12A4* was found to infect free living *V. fischeri* strain 12A4. Adsorption rate, burst size, and replication time were measured to compare this particular phage to other marine bacteriophages that are common among γ-proteobacteria. Through spot plate testing, a number of symbiotic and free-living *V. fischeri* were evaluated as potential hosts for the bacteriophage. Other members of the Vibrionaceae family were also examined by spot plate assays to determine the extent of specificity of this bacteriophage. Additionally, the morphology and relative size of *Vibriophage douglas 12A4* were measured using transmission electron microscopy (TEM) to determine its family classification. Thus, by characterizing *Vibriophage douglas 12A4* and its relationship with *V. fischeri*, we can better understand what role bacteriophages have in establishing the *Euprymna-Vibrio* symbiosis.

FRI-562

SEX RATIOS OF DEEP-SEA CHONDRICHTHYANS WITH NOTES ON REPRODUCTIVE STRATEGIES AND SEXUAL MATURITY

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Chondrichthyans were collected from 500m to 1500m deep along the Madagascar Ridge, Southern Indian Ocean, on the commercial trawler F/V Will Watch, from February to April 2012. Approximately 2,400 chondrichthyan specimens were examined comprising 13 genera. Morphometric data recording for approximately 400 specimens and vertebrae centra were removed from 225 of the specimens for aging studies. Length and genetic data were collected at sea with representative examples of each species saved and returned to Moss Landing Marine Laboratories for standard morphometric data. Data were also collected on sex ratios, reproductive status, and maturity status. Males and females were identified to species with total length and sex of each individual recorded. Male maturity was estimated by clasper calcification by length, and female maturity was estimated by oviducal gland width, oocyte width, and/or whether females were gravid. Notable sex male:female ratios of species (*Apristurus* 1:1, *Etmopterus* 1:2.3, and *Dalatius* 7:133) while total length at sexual maturity and reproductive strategies were considered: i.e., oviparity seen in *Apristurus*, viviparity in various squaloids, and oophagy in *Pseudotriakis*. This study is important in understanding deep-sea organismal dynamics. It is contributing to National Science Foundation's Assembling the Tree of Life program, a collaboration with the College of Charleston, to better understand the phylogenetic relationships and origins of all organisms.

SAT-561

SPATIAL AND TEMPORAL VARIATION IN WATER QUALITY WITHIN MAJOR MARINE HABITATS OF KĀNE'ŌHE BAY, HAWAII

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Understanding the difference in water quality among various marine habitats is important in monitoring their biological populations. Marine organisms are stratified by varying water quality parameters and metabolic processes. Therefore, establishing a set of typical water quality parameters, such as temperature, pH, salinity and amount of dissolved oxygen, is a practical set of information to have when monitoring marine habitats. Diurnal changes of key water quality parameters with a focus on pH were examined in 6 coral reef communities: 1) offshore Moku O Lo'e windward reef, 2) windward shallow fore-reef, 3) leeward shallow lagoon, 4) leeward sand flat, 5) lagoon macro-algal mat, and 6) mangrove habitat. The water parameters of each habitat, and their diurnal changes, were monitored using a sonde, an environment monitoring instrument. The pH of seawater in each habitat was also determined using spectrophotometric techniques. Resulting data describe the diurnal changes resulting from physical and biological processes that influence each habitat. The offshore waters show only slight changes in pH, temperature, salinity, and dissolved oxygen. In contrast, the high metabolic rate of coral reef organisms, shallow water, and restricted water circulation resulted in extreme differences in the inshore habitats over the daily cycle. Observing the diurnal cycles of various marine habitats assists in the understanding of their basic biology. This research can be applied to marine environment conservation.

SAT-559

BENEFITS TO INTERTIDAL MARINE GASTROPODS BY CANOPY FORMING ALGAE

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Intertidal gastropods experience different threats during high and low tides. During low tide, they are at risk of damage from high temperatures and death from predation by birds. At high tide, they may encounter a sea star predator. We hypothesized that seaweed canopies provide two distinct benefits at low tide for the limpet *Lottia scutum*: shade relief from high temperatures and refugia from bird predation. We predicted that being in the shade at low tide would allow limpets to quickly escape from sea star predators when the tide came in, but that spending low tide in the sun would delay this escape response because high temperatures can inhibit physiological processes. Additionally, we predicted that limpets under the canopy at low tide would experience less bird predation than exposed limpets. To test the effect of location and low tide temperature on the response to sea star predators, we exposed limpets to a sea star after a simulated warm or cool low tide and quantified the amount of time the limpet spent in different escape response components. To test the effect of low tide location on the susceptibility to bird predation, we tethered limpets under seaweed canopies and on open rock. In preliminary studies, after cool low tides, limpets responded immediately to sea stars, but after warm low tides, the escape response was delayed by more than 5 minutes. Knowing the extent to which intertidal animals depend on seaweed canopies can potentially help us understand the effects of long-term climate change.

SAT-560

DIFFERENTIAL DEVELOPMENT OF *CASSIOPEIA XAMACHANA* UPON INFECTION WITH MULTIPLE *SYMBIODINIUM* SPECIES

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The upside-down jellyfish *Cassiopeia xamachana* establishes an endosymbiotic relationship with *Symbiodinium* during its scyphistoma life stage. This symbiotic relationship is common among cnidarians. In the case of *C. xamachana*, this symbiosis is mandatory for its development into a sexually mature medusa. However, the dinoflagellate genus *Symbiodinium* is very diverse, containing several species that can potentially have unique effects on the stages of metamorphosis. During the maturation of *C. xamachana*, scyphistomae (the sessile polyp stage) were infected with 3 species of *Symbiodinium*: *S. minutum* (culture code Mf 1.05b, clade B1) isolated from the coral *Montastrea faveolata*; *S. microadriaticum* (culture code CassKB8, clade A1) isolated from *C. xamachana*; and *Symbiodinium* sp. (culture code CassEL1, clade A3) also isolated from *C. xamachana*. The process of infection and

subsequent metamorphosis into symbiotic ephyrae (the juvenile pelagic stage) was visually represented with a photo record displaying the presence of Symbiodinium cells within the scyphistomae. Differences in rate of Symbiodinium endocytosis were observed when infected with these different species suggesting that the host preferentially selected the species it most commonly associates with, *S. microadriaticum*. Assessment of the development and metamorphosis and the study of such unique relationships could suggest the potential of the *C. xamachana* as a model organism for future research endeavors.

MICROBIOLOGY

SAT-575

ROLE OF BB0019 IN THE PATHO-PHYSIOLOGY OF *BORRELIA BURGDORFERI*

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Lyme disease is the most prevalent arthropod-borne infectious disease in the United States, with more than 30,000 new cases reported each year to the CDC. *Borrelia burgdorferi*, the causative agent of Lyme disease, is transmitted to humans following the bite of infected ticks. *B. burgdorferi* is a host-adapted pathogen and undergoes rapid metabolic and virulence adaptation while transitioning from the tick vector to a vertebrate host. Recently, our lab described the role of a regulator called *Borrelia* host adaptation regulator (BadR) in modulating adaptive gene expression specific to the tick vector or the vertebrate host. Deletion of *badR* in an infectious strain of *B. burgdorferi* resulted in several genes that were upregulated or downregulated. One such ORF is BB0019, which is downregulated in the *badR* mutant suggesting that it could play a role in the survival of the pathogen in ticks. We hypothesize that BB0019 is essential for colonization and transmission of *B. burgdorferi* from infected ticks. To test this hypothesis, we will purify recombinant BB0019 and generate antisera specific to this protein. We will delete this gene from an infectious strain of *B. burgdorferi* and analyze BB0019-deficient strain's ability to infect ticks and mouse models of Lyme disease. We anticipate that absence of BB0019 will result in a strain incapable of survival or transmission from ticks. These observations will help to identify molecular targets that can be used to block the transmission of *B. burgdorferi* from ticks and thereby develop strategies to reduce the incidence of Lyme disease in humans.

SAT-567

IDENTIFICATION OF *YERSINIA* GENES THAT INFLUENCE ACTIVATION OF HOST NFkB TRIGGERED BY THE TYPE III SECRETION SYSTEM

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Yersinia pseudotuberculosis is a human pathogen that uses a type III secretion system (T3SS) to deliver 6 effector proteins inside target host cells, disarming host innate immune defenses. The *Y. pseudotuberculosis* T3SS lacking the 6 known T3SS effector proteins retains the ability to activate the proinflammatory transcription factor NFkB in mammalian cells. We hypothesize that detection of unknown bacterial cargo injected by the T3SS activates NFkB in host cells. Since NFkB is a major regulator of the innate immune response during infection, this may be important for the ability of *Yersinia* to cause disease. To identify *Yersinia* genes required for T3SS-dependent NFkB activation, we constructed a library of 4,400 *Y. pseudotuberculosis* transposon mutants lacking the 6 known T3SS effector proteins. We infect HEK293T NFkB-luciferase reporter cells with *Y. pseudotuberculosis* mutants and measure bioluminescence corresponding to NFkB activity. We have screened approximately 2,350 mutants and identified 18 mutants triggering aberrant levels of host NFkB. One of the genes found in our genetic screen, *Sufl*, may affect expression or delivery of unknown NFkB-activating T3SS cargo. *Sufl* is thought to localize to the septal ring and is known to be a twin arginine translocation (TAT) system substrate. An additional gene identified through our genetic screen is *TatB*, an integral component of the TAT secretion system. The *Y. pseudotuberculosis* TAT secretion system was previously shown to be important for virulence, yet has not been linked to the T3SS. We are currently investigating a possible relationship between Tat secretion of *Sufl* and T3SS-induced host NFkB activation.

SAT-580

TARGETING HIV-1 GP120 GLYCOSYLATION FOR EVALUATION OF VRC01 ANTIBODY NEUTRALIZATIONDaniel Taitano¹, Wen Yuan².¹College of Natural and Applied Sciences, University of Guam, Mangilao, GU, ²University of Virginia School of Medicine, Charlottesville, VA.

The human immunodeficiency virus type 1 (HIV-1) is the most common type of the lentivirus. This infectious agent is the leading cause of the development of AIDS, an incurable disease that targets cells within the human immune system. As a result, HIV-1 is actively studied in hopes of deriving viable treatments and vaccines against the AIDS epidemic. The structure of HIV-1 generally consists of two copies of viral RNA enclosed in a capsid surrounded by a lipid membrane, where the HIV envelope glycoprotein anchors. HIV-1 envelope glycoprotein is composed of exterior and transmembrane glycoproteins gp120 and gp41 respectively. They are present on the viral surface and mediate virus infection. In addition, as the sole viral component on the virion surface, the glycoproteins serve as potential targets for HIV-1-neutralizing antibodies. In this experiment, we are studying glycosylation of gp120 and its relation to the neutralization efficiency of VRC01 antibody, a broad HIV-1-neutralizing antibody. The methodologies used in this experiment include cell culture of JC53 cell lines, preparation of pseudovirus containing luciferase and envelope glycoproteins from the prevalent HIV-1 ADA strain (SRLV), TCID₅₀ assay, and antibody neutralization assay with fixed amounts of infectious SRLV and VRC01 antibodies. We expect that the glycosylation switch on HIV-1 ADA gp120 will affect VRC01 antibody neutralization efficiency. Although there have been studies analyzing neutralization of HIV-1 by different antibodies, this project is the first to observe the difference in VRC01 neutralization efficiency related to the glycosylation switch on gp120.

FRI-563

MIF DEFICIENCY ENHANCES THE EFFICACY OF GLUCOCORTICOID TREATMENT IN EXPERIMENTAL AUTOIMMUNE MYOCARDITIS AND AMELIORATES THE PROGRESSION TO DILATED CARDIOMYOPATHYBraxton Jamison II, Rebecca A. Sosa, Thomas G. Forsthuber.*University of Texas at San Antonio, San Antonio, TX.*

Myocarditis, an inflammatory disease of the myocardium, is a major cause of sudden death and dilated cardiomyopathy (DCM). Persistent damage to the myocardium is mediated by autoreactive T lymphocytes and proinflammatory cytokines. Acute inflammation can be suppressed by glucocorticoids (GCs) in patients with autoimmune inflammatory processes; however, treatment cannot stop progression to DCM. Macrophage migration inhibitory factor (MIF) is a unique regulatory mediator that is induced by GCs and can, in turn, counter-regulate their immunosuppressive effects. MIF also triggers arrest and chemotaxis of T cells through CXCR4. In this study, dexamethasone (Dex) treatment was investigated in early and late stage experimental autoimmune myocarditis (EAM) in MIF knockout (MIF^{-/-}) Balb/c and wild-type (Wt) mice. EAM and DCM severity were determined histopathologically using hematoxylin and eosin and Masson's trichrome staining. The nature of cardiac infiltration and CXCR4 expression were analyzed using immunofluorescence (IF) staining. We found for the first time that Wt Dex-treated mice recover from EAM after peak of disease but progress to DCM with chronic fibrosis, whereas MIF^{-/-} Dex-treated mice are highly resistant to both EAM and DCM. IF staining demonstrated the absence of local inflammatory lesions and CXCR4 expression in MIF^{-/-} Dex-treated mice, showing that CXCR4-mediated T cell recruitment to the heart is inhibited in these mice. Our results indicate that MIF antagonizes the efficacy of GCs in EAM and DCM and implicates MIF inhibition in combination with GC treatment as a potential therapeutic strategy for myocarditis as well as the prevention of progression to DCM.

SAT-565

INVESTIGATING THE MICROBES OF SUBSURFACE MINERAL ENVIRONMENTSMatthew Medina¹, Diana E. Northup¹, Michael N. Spilde².¹University of New Mexico, Albuquerque, NM, ²Institute of Meteoritics, University of New Mexico, Albuquerque, NM.

The discovery of lava caves on Mars and lunar terrains has prompted the study of analogous environments on Earth to enhance our ability to detect life on extraterrestrial bodies. Such environments are the lava caves that contain secondary mineral deposits that appear nonbiological but reveal diverse microbial communities on examination. We hypothesize that secondary mineral deposits in lava caves contain a considerable number of microbial communities that can be investigated for multiple biosignatures. Our biosignature investigations of these geological phenomena involve scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDX). The mineral deposits investigated for this study are obtained from lava caves that occur in New Mexico, Mauna Loa, Hawai'i,

and the Azores. Preliminary SEM analysis revealed several iron-rich and carbonate deposits that contain putative microorganisms: filamentous, coccoid, and bacillus morphologies present in biofilms that produce an EDX signal indicating high carbon content. One Hawaiian sample from Arsia Cave suggests possible biodegradation of an iron-oxide substrate, where putative rod-shaped cells appear in biofilm and appear to be associated with a degraded surface of the substrate. Future investigations include culture-independent studies of the microbial communities observed in these mineral-biological deposits and sequence-based studies along with further investigation of secondary mineral deposits with SEM/EDX. Investigating these microbes that masquerade as minerals and the biosignatures associated with them can help in life-detection efforts on extraterrestrial bodies and expand our knowledge of the microbial communities of oligotrophic caves on Earth.

SAT-569

ANALYSIS OF ANTI-CLOSTRIDIUM DIFFICILE ACTIVITY OF PAIRED ANTIBIOTIC COMBINATIONS

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Clostridium difficile is an anaerobic intestinal bacterium that causes severe, and at times fatal, diarrhea especially among elderly patients. The annual death toll for *Clostridium difficile* infection (CDI) in the United States alone is over 14,000. The emergence of the hyper-virulent NAP1 strain of *C. difficile* causing multiple relapses of *C. difficile*-associated diarrhea has prompted research for alternative treatment options. This project investigates whether combinations of different anti-*difficile* antibiotics such as novobiocin, vancomycin, berberine chloride, metronidazole, and daptomycin could have synergistic or antagonistic effects against *C. difficile*. We have assessed the minimum inhibitory concentrations (MICs) of 11 antimicrobials singly and in paired combinations against 10 *C. difficile* clinical isolates. Based on these MICs, we have determined fractional inhibitory concentrations (FICs) and consequently, the synergistic or antagonistic properties of these antimicrobial combinations. Preliminary studies have identified novobiocin-daptomycin and metronidazole-daptomycin combinations as partially synergistic ($0.5 \leq \text{FIC} \leq 0.75$) and vancomycin-daptomycin and vancomycin-berberine chloride combinations as antagonistic ($\text{FIC} > 2.0$). Of fundamental interest in this study are the molecular pathways that could be simultaneously altered to kill *C. difficile*. This work will provide further insight into mutualistic biochemical interactions of anti-*difficile* combinations. Once such synergistic combinations are identified, future research will examine their effects on sporulation and toxin production to reduce disease recurrence and severity respectively.

SAT-576

HIGH-THROUGHPUT COMPOUND SCREENING TO IDENTIFY NOVEL INHIBITORS OF H5N1 INFLUENZA-A ENTRY

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Influenza-A viruses have RNA-based genomes that incur high rates of mutation due to a lack of a proof reading mechanism in its RNA polymerase. Due to these high mutation rates, the influenza virus can quickly acquire resistance to currently available vaccines and prophylactic therapeutics. As a result, it is imperative to develop novel inhibitors against drug resistant and newly emerging strains of influenza. Our research project is to screen a small library of drug-like compounds against H5N1 influenza using a high-throughput screening platform. To screen the compounds, A549 human lung epithelial cells were infected with H5N1 pseudovirus carrying a luciferase reporter gene together with each purified compound. Luciferase activity was measured 48 hours postinfection as an indirect measure of viral entry. Compounds that decreased luciferase activity and were not cytotoxic to target cells were chosen as lead entry inhibitors. We predict that the compounds will target either the influenza hemagglutinin (HA) glycoprotein on the surface of the virus or its receptor, sialic acid, which is found on the host cell surface. If the compounds target HA, then the inhibitors will have a direct neutralizing effect on influenza viral entry. However, if the compounds target host cell surface molecules, then these inhibitors may be useful as a universal entry inhibitor, targeting several subtypes of influenza.

SAT-571

ANTIBACTERIAL PROPERTIES OF *SYMPHORICARPOS ALBUS*

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Worldwide, microbial infectious diseases continue to be one of the leading causes of disease and death, which is exacerbated by widespread antibiotic resistance. Plants have been used for centuries by traditional healers. These plants are logical places to search for new antimicrobials because of their proven ability to treat infections. *Symphoricarpos albus* is one such plant, having been used to treat skin wounds in Native American, traditional medicine. The purpose of our work is to determine whether extracts of *Symphoricarpos albus* inhibit bacterial growth. Aqueous, ethanolic, methanolic, and acetonetic extracts (0.40 g/mL) were made from the plant's root, stem, leaf, and berry. Extracts were evaluated using a disk-diffusion assay against Gram-positive bacteria, Gram-negative bacteria, and *Candida albicans* fungus. Disks impregnated with extracting solvents were used as controls. All extracts were effective against Gram-positive bacteria (zones of inhibition = 11.9 mm \pm 1.9). Extracts were not effective against Gram-negative bacteria or fungi. We are testing the extracts against methicillin-resistant *Staphylococcus aureus* and determining the minimal inhibitory concentration and method of action. Our results validate the traditional medicinal use of this plant and provide a potential new antibiotic to combat antibiotic-resistant bacteria.

SAT-570

ATTENUATION OF ACQUIRED APLASTIC ANEMIA THROUGH TREATMENT WITH LEUKADHERINS

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Aplastic anemia (AA) is an autoimmune form of bone marrow (BM) failure, characterized by the development of self-reactive T cells. These T cells release inflammatory cytokines and trigger the apoptosis of hematopoietic stem cells (HSCs) and progenitors and mature blood cells, resulting in severe BM aplasia and pancytopenia. We hypothesized that by targeting the cells of the innate immune system with novel immunosuppressive drugs called Leukadherins (LAs), we could reduce their abilities to function as antigen presenting cells and prevent them from activating self-reactive T cells, attenuating AA. To test the efficacy of LA treatment we used a mouse model of immune-mediated BM failure, which is induced by infusing allogeneic lymph node (LN) cells. The mouse AA model is characterized by the expansion of allo-reactive donor T cells. The AA was induced in 2 groups of mice by tail vein injection of LN cells. The AA group of mice was not treated whereas the AA/LA mice were treated with 1 mg/kg of LA/mouse/day for 7 days after LN cell infusion. The control group of mice did not receive LN cells and was not treated with LA. The peripheral blood cells and the status of the hematopoiesis in control, AA and AA/LA mice were analyzed 14 days after LN cell infusion. The treatment with LA partially protected the hematopoietic progenitors and completely protected the HSCs in the BM. These results suggest that treatment with LA could attenuate AA by diminishing the damage to HSCs and hematopoietic progenitors.

SAT-582

ANALYSIS OF IMMUNE SYSTEM CELLS IN SCLEROSTIN-DEFICIENT MICE

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When sclerostin (SOST), an essential glycoprotein for proper bone formation, is absent, hyperactive bone growth occurs along with a decrease in bone marrow cavity size. Recent studies have shown that *Sost* has significant influence over developing bone marrow environments that sustain B cells, however, not much is known of its role in B cell function. We are investigating the effects of age on B cell function in *Sost*-knockout (KO) mice. Peripheral blood samples will be analyzed at set time points to observe changes in mature and immature B cell populations in *Sost*-KO and control wild-type B6 mice. We hypothesize that B cell populations will be altered in the absence of *Sost*. If this is the case, it will indicate that anti-SOST antibodies that are currently in clinical trials for treatment of osteoporosis may have unintended effects on B cell immunity. Additionally, we are testing the efficacy of zinc based fixation for flow cytometric analysis of immune cells in *Sost*-KO mice. Zinc based fixation can reduce research costs considerably if epitopes are not altered by the fixation. To study this, splenic cells were freshly obtained from a wild-type B6 mouse and quantitatively compared with previously fixed splenic cells in Z7 zinc buffer. We hypothesize that if the zinc-fixed cells express similar fluorescence intensity, then we can verify its practicality for those particular antigenic determinants. If successful, we will test antibody cocktails and apply this method to cells in the *Sost*-KO mice.

FRI-569

BIOPROSPECTING FOR BIOENERGY: BACTERIAL DEGRADATION OF LIGNOCELLULOSIC COMPOUNDS

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Oil has now become a global concern due to its high demand and political control. One of the solutions to this problem is to opt for an alternate energy source. An effective and promising proposal would be biofuel. Fuels of biological origin can replace part of the consumption in traditional fuels, such as oil or coal fossil fuels. In search of a biomass that can produce biofuel, we focus on degradation of plant residues. Our objective is to isolate bacteria capable of degrading lignocellulosic compounds. Environmental samples containing plant material were screened for putative degraders. Liquid media separately containing xylan, cellulose, and lignin was inoculated and examined daily for changes in turbidity or color. Samples of grasses and leaves reacted favorably to cellulose and lignin. Wood samples reacted positively in xylan media. Recently, these samples were inoculated in media supplemented with essential trace elements to stimulate degradation. Purification and characterization of degraders is in progress.

SAT-578

HOST MICRORNA PROFILES FOLLOWING *CHLAMYDIA TRACHOMATIS* INFECTION AND THEIR CONTRIBUTION TO GENITAL TRACT PATHOLOGY

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Chlamydia trachomatis (CT) is the leading cause of sexually transmitted bacterial infections in humans and is associated with upper reproductive tract pathologies. There is increasing evidence on the role of microRNAs (miRs) in host immune regulation. Antichlamydial protective innate and adaptive immune responses lead to collateral damage in upper genital tracts with resultant inflammation, tubal occlusion, and hydrosalpinx development. Our hypothesis in this current study is that miRs involved in early genital CT infection may contribute to development of upper genital pathologies. *C. muridarum* (murine strain of CT) elementary bodies (5×10^4 IFU) were inoculated intravaginally in wild-type (WT) C57BL/6 mice followed by analyses at early (day 30), established (day 55), and late (day 80) stages of pathology. Total RNA was extracted and SyBr-Green based miR specific PCRs (miScript miRNA PCR, Qiagen) were performed to determine modulation of miRs upon infection. We have shown previously that immunopathology-inflammation related miRs (miRs 125b-5p, 214, 16, 135a, 183 and 30e) are modulated at days 6 and 12 post *C. muridarum* challenge in WT mice and are associated with the generation of immune responses. We expect these down-selected miRs may be modulated at later stages of *C. muridarum* infection and lead to development of *C. muridarum* associated upper genital tract pathology. Host miRs associated with early *C. muridarum* genital tract infection may contribute to later development of upper genital pathologies. Results from this study could form the basis for future in-depth investigations into novel host markers for CT infection and reproductive tract pathology.

SAT-572

MECHANISMS USED BY *HELICOBACTER PYLORI* TO GENERATE HELICAL CELL SHAPE

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Helicobacter pylori is a Gram-negative, helical-shaped bacterial pathogen that chronically infects the stomachs of approximately 50% of the human population and causes gastritis, peptic ulcer disease, and stomach cancer. It is thought that *H. pylori*'s helical cell shape aids colonization. We have characterized several cell shape determining (Csd) proteins that are essential for normal morphology, which is dictated by cell wall structure. The cell wall is composed of peptidoglycan (PG), a polymer of glycan strands crosslinked by peptide chains. While many of the Csd proteins directly modify PG, our studies focus on determining the role of two Csd proteins without predicted enzymatic activity: Csd5 and CcmA. Csd5, a predicted trans-membrane periplasmic protein, possesses an SH3 domain, which can bind another Csd protein, Csd4, *in vitro*. We hypothesize that Csd5 helps localize Csd4. Thus, introducing mutations in the SH3 domain via site directed mutagenesis might disrupt the Csd4-Csd5 interaction and result in changes to *H. pylori*'s cell morphology. We also hypothesize that CcmA, a putative cytoskeletal protein, may assist localization of other Csd proteins. We will generate a fluorescent protein fusion, CcmA-Wasabi, joined by a flexible linker peptide, to determine the subcellular localization of CcmA in relation to morphological features of the

helical cell shape. Determining the mechanisms used by *H. pylori* to generate a helical shape will provide a deeper understanding of bacterial morphology and may lead to more treatment options that target this pathway.

FRI-567

INHIBITORY CONCENTRATION CURVES OF SILVER NANOPARTICLE SOLUTIONS

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Silver metal has been used for its antimicrobial effects for thousands of years. Its use declined as antibiotics developed as the primary method to target microbes. Due to the rise in antibiotic resistance, the use of silver as an antimicrobial agent has reemerged. Silver nanoparticles have been a focus for new antimicrobial treatments because of the properties that distinguish them from silver ions, particularly the capacity of silver nanoparticles to damage cellular membranes. In this study several solutions containing silver nanoparticles were tested to determine their inhibitory concentrations. Several solutions with various silver nanoparticle concentrations were made and their results were compared to control solutions containing silver ions. The inhibitory concentrations were determined for cultures of *Bacillus cereus*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Escherichia coli*, *Staphylococcus epidermis*, and *Candida albicans*. The cultures were under treatment for 24 hours then the absorbance values of the culture were determined using an OD600 method. The measured values were used to plot an inhibition curve. The curve was used to form a minimal inhibitory concentration and half-maximal inhibitory concentration table which outlines the concentration of silver necessary to kill 10% and 50% of the microbes, respectively. These results can be used to evaluate the use of silver nanoparticle solutions for antimicrobial treatment. (Research supported by NIGMS MBRS-RISE GM 60655.)

FRI-583

MUTATIONAL ANALYSIS OF H5N1 INFLUENZA HEMAGGLUTININ: EFFECTS ON VIRAL ENTRY AND PROTEIN

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Influenza A is a virus that has a broad species tropism, ranging from humans to water fowl to horses. Avian influenza subtype H5N1 (also known as bird flu) jumped the species barrier from birds to humans in 1997, resulting in the culling of millions of birds and thousands of human deaths worldwide. H5N1 avian influenza continues to reemerge and is thought to have the potential to cause the next major global influenza pandemic in humans. Though there are many factors implicated in the spread of influenza, viral entry is thought to be one of the most important. Influenza entry is mediated via binding of the viral surface glycoprotein, hemagglutinin (HA), to its receptor, sialic acid. Amino acid changes within HA have the potential to alter the receptor tropism of HA and thus, the species tropism. The purpose of our research is to generate mutations within HA and observe how each mutation affects protein expression and viral entry using a pseudotyped virus carrying a luciferase reporter gene. We used site-directed mutagenesis targeting the residues Q226L and T318I within HA. These 2 mutations were chosen based on their implications in protein stability and infection. We hypothesize that Q226L will alter the conformation of the receptor binding site, increasing entry levels in human cells by changing the species tropism from birds to humans. In addition, we hypothesize that T318I will decrease entry levels in human cells but will increase HA protein expression and stability.

SAT-577

UNFOLDING THE STRUCTURE OF CLOSTRIDIUM PERFRINGENS

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Clostridium perfringens is an anaerobic, Gram-positive bacteria typically found in the human intestinal tract. *C. perfringens* contains an enzyme called azoreductase (AzoC) which cleaves azo dyes. Azo dyes are widely used in many consumer applications, including the food and textile industries. Certain metabolic azo dye products can cause cancer, creating concern among the medical and environmental community. However, it is difficult to predict how the enzyme will react with a particular azo dye given that the actual structure of the enzyme is unknown. Determining the structure would allow for a better understanding of the physiological role of the enzyme, which could aid in medicinal practices and solving environmental problems. This study used crystallography methods to further optimize the protein crystal conditions previously determined in order to generate a 3D image of the protein. The pure protein AzoC sample was obtained from an *E.coli* expression system. The experimental approach used to optimize the protein crystallization conditions involved minor changes associated with the pH, salt concentration, substrate dyes, and

buffers using a 96 well additive screen or 24 custom-well screen. The screen plates created were observed each day for crystal growth. Sufficiently formed crystals were collected, frozen, and transported to the National Synchrotron Light Source for X-ray diffraction. Computer software used the diffraction data to obtain the final structure of the enzyme. The results will provide important structure and function information for AzoC, which will impact the medical and environmental community.

FRI-566

PROBING THE NATURAL PRODUCT BIOSYNTHETIC POTENTIAL OF THE ACTINOMYCETE *ACTINOSYNNEMA MIRUM*

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Natural products are complex organic molecules made by a variety of organisms including bacteria, fungi, and plants which often possess bioactivities that make them useful as drugs, drug leads, or probes for deciphering biological networks. Using bioinformatics tools developed in the Melancon lab and elsewhere, we have identified and partially annotated 6 natural product gene clusters of interest in *Actinosynnema mirum*, including 2 encoding analogs of ansamycin class anticancer compounds. To determine if these 6 gene clusters are transcriptionally active, we have designed and begun to optimize real-time PCR assays targeting 1 to 2 genes in each cluster by creating four cDNA libraries from mRNA samples collected at time points representing several growth phases of *A. mirum*. From this, we have determined that 2 of the 6 gene clusters of interest, including 1 of the clusters encoding an ansamycin analog, are transcriptionally active. Additionally, we have also cultured *A. mirum* in large scale and have obtained crude natural product extracts from it using standard isolation techniques, including organic extraction and adsorption onto Amberlite XAD-7 and XAD-16 resins. Extracts will be analyzed for the predicted compound using analytical HPLC-ESI mass spectrometry. Once compounds of interest are identified, they will be purified using preparative HPLC. The effect of the ansamycin analog will be assessed in an *in vitro* assay. If active, its structure will be determined by NMR. Other purified compounds will also be assessed for antibacterial and anticancer activities by our group and by collaborators.

SAT-563

CULTIVATION OF HETEROTROPHIC MARINE BACTERIA ALONG THE PACIFIC COAST OF NORTH AMERICA

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Environmental factors vary geographically along coasts (i.e., temperature) and may affect the abundance and diversity of marine heterotrophic bacteria along the Pacific coast. This project involved isolation of cultures from seawater samples collected from sandy beaches from Baja California to northern Oregon in January and August of 2010. Monthly samples were collected at Huntington Beach. It was hypothesized that heterotrophic marine bacteria would display significant differences in diversity and abundance geographically (north and south of Point Conception) as well as seasonally (summer and winter). Bacteria were counted via serial dilution (MPNs) in marine broth to determine abundance. Cultures were isolated via streak plate serial dilution and were characterized by Gram staining and light microscopy. Nucleic acid extractions, PCR amplification, and sequencing of 16S rRNA genes were performed to construct a neighbor joining tree using ARB software. In parallel, salinity tolerance experiments were done on marine broth isolates (N = 77) using treatments of 3.5%, 15%, and 23% salinity. There was no significant difference in bacterial abundance between seasons after comparison of winter and summer MPNs (unpaired t-test, $p = 0.057$). Within the seasons, there were no strong relationships between temperature and bacterial abundance (winter $R^2 = 0.005$, summer $R^2 = 0.127$). The salinity experiment showed growth only in the 3.5% concentration. Sequencing analysis revealed diverse assemblages of *Gamaproteobacteria*, *Flavobacteria*, *Actinobacteria*, *Alphaproteobacteria*, and *Bacillus* spp. along coastal North America. Current phylogenetic analyses indicate biogeographical influence south of Point Conception along with seasonality of *Actinobacteria* and species of *Vibrio* and *Psychrobacter*.

SAT-573

COMPARISON OF MATRIX COMPONENT AND DRUG SUSCEPTIBILITY BETWEEN *CANDIDA ALBICANS* AND NON-*ALBICANS* SPECIES

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Fungal infections are becoming an increasing problem in hospital settings leading to growing mortality rates and skyrocketing health-care costs. The most prominent fungal infection is due to *Candida albicans* and non-*albicans* species *Candida glabrata*, *Candida parapsilosis*, and *Candida tropicalis*. These pathogens, when attached to a surface such as a catheter, produce a biofilm which is highly resistant to antifungal drugs. Most of the drug resistance is due to the extracellular material (matrix) secreted by the biofilm. This study focuses on matrix components of non-*albicans* species in comparison to *C. albicans*. Our hypothesis is that the matrix components of biofilms are key to antifungal resistance. Carbohydrates such, β -1,3/1,6 glucan, mannans, and proteins are present in matrix. In order to understand how these components contribute to drug resistance, matrix was produced by growing the organisms in roller bottles forming a biofilm, and the matrix was harvested after 48 hours. Samples were dialyzed and lyophilized. The matrix components were analyzed with phenol sulfuric assay (for total carbohydrate content), BCA assay (for total protein content), and ELISAs for mannans and β -1,3/1,6 glucan (for specific carbohydrate content). Although all components of the matrix play a role in antifungal resistance, preliminary data show that carbohydrates are the most important components in the drug resistance mechanism. This was shown by XTT assays with a drug combination of tunicamycin and fluconazole where a correlation was found between the amount of matrix carbohydrates and drug susceptibility between strains.

FRI-578

ASPERGILLUS MOLD – BACTERIA COCULTURE: IMPROVED POLYCYCLIC AROMATIC HYDROCARBON DEGRADATION THROUGH SYNERGISTIC METABOLISM

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Tens of thousands of Superfund sites, abandoned or inactive hazardous waste sites recognized by the Environmental Protection Agency (EPA), are found throughout the United States and hold dangerous contaminants such as polycyclic aromatic hydrocarbons (PAHs). PAHs are carcinogenic, mutagenic, and highly toxic and also have high persistence in soil. Some organisms have been found in Superfund sites that can metabolize these contaminants. Bacterial organisms have been found which degrade PAHs with 2 to 3 benzene rings, while fungal organisms have been found which degrade PAHs with 4 or more rings. The hypothesis for this experiment is that by having the 2 types of organisms live and work together, the range and quality of PAH degradation will increase. This idea will be tested using a Transwell-24 system. This system will allow small metabolites to be exchanged between the two organisms but will disallow all physical interaction. The fungus *Aspergillus nidulans* is a common soil fungus known to degrade benzo[a]pyrene, a 5-ring PAH. The bacterium *Burkholderia* sp. Ch1-1, is found in Superfund sites and is known to degrade phenanthrene, a 3-ring PAH. It is suspected that the fungus will mineralize pyrene, a 4-ring PAH, which will then allow the bacterium to metabolize pyrene. If the hypothesis is correct, improved bioremediation strategies will become possible, as well as more accurate PAH biosensors which can be used to measure initial concern or subsequent success.

FRI-582

ANALYSIS OF GROWTH PATTERNS OF *PSEUDOMONAS STUTZERI* AND *STREPTOCOCCUS EPIDERMIDIS*: A MULTISPECIES BIOFILM

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The objective of this project is to analyze the growth and development patterns of bacteria living in communities known as biofilms. A biofilm is a communal of single-species or multiple-species microorganisms that adhere to a moist surface and to one another using extra polymeric substances that are synthesized by them. Bacteria can also have an independent growth pattern known as planktonic or free-swimming. The growth pattern of planktonic cells is well studied and shows a logistic growth pattern. Studies in our lab on single species biofilms of *Streptococcus epidermidis*, a Gram-positive, coccus-shaped bacterium, and *Pseudomonas stutzeri*, a Gram-negative, rod-shaped bacterium, have demonstrated a cyclic pattern of growth. We have developed a mathematical model for the cyclic growth pattern. This model, which is a Bessel function, predicts the cyclic nature of the growth and a dampening

of the cycles with time. In nature, multispecies biofilms are commonly found. As such, in this project, the multiple-species biofilm growth patterns of *S. epidermidis* and *P. stutzeri* are being studied as a mixed species biofilm. Based on our studies of the two bacteria, we predict that as resources deplete, *P. stutzeri* will overshadow and outlast *S. epidermidis*. We plan to develop a predator-prey model between the two organisms that establishes growth peaks for one organism and troughs for the other over a period of time. The model could then be used to explain some of the dynamics of natural biofilms.

SAT-568

IDENTIFICATION OF BACTERIA OF THE RIO GRANDE WATERS BY DGGE ANALYSIS

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Previous studies examining the microbial community of the Rio Grande border have focused on culturable pathogenic bacteria, mainly *E. coli*. This study will focus on the identification of noncultured bacteria obtained from a previous study using denaturing gradient gel electrophoresis (DGGE) of the 16S rRNA gene amplified from the DNA extracts of three water sampling sites within the Laredo, Texas, and Nuevo Laredo, Mexico, border of the Rio Grande. The three sampling sites were Zacate Creek area (Site 1), International Bridge I (Site 2), and the Jefferson Water Treatment Plant (Site 3). Sites were chosen based on effluent discharge points that were greatest at Site 1. Phylotype bands were excised from a DGGE gel after DGGE-PCR using primers 1070F and 1406-GC. Eluted DNA from each band will be reamplified using DGGE-PCR followed by cloning using the TOPO-TA cloning kit. Plasmids will then be purified for sequencing using T3 and T7 primers. Sequences will then be used for bacterial identification using the NCBI-BLAST database. Although all sites were similar (80%, Dice coefficient) based on DGGE profiles, Site 1 contained the most unique types of bacteria and was significantly greater in heterotrophic bacterial counts (9.4×10^3 CFU/ml, $p < 0.01$) than all other sites. We expect that Site 1 will have an even greater number of unique phylotypes identified assuming that the DGGE bands will contain a greater number of mixed templates. This study will allow us to identify potential microbial biomarkers for understanding fluxes of nutrients and contaminants in the Rio Grande waters.

SAT-579

DISCOVERING THE STRUCTURE OF AN IMPORTANT HUMAN HEALTH ENZYME IN *ENTEROCOCCUS FAECIUM*

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Enterococcus faecium is an anaerobic bacterium that flourishes within the human intestine. This organism contains an important enzyme called azoreductase (AzoM), which is involved in cleaving the azo bond within azo dyes, producing a toxic, aromatic amine. Carcinogenic compounds can result from the reduction of dyes, which are commonly used to color food, clothing, drugs, and cosmetics. In terms of structure and function of the enzyme, very few intestinal bacteria containing azoreductase have been studied. This study used sophisticated crystallization methods to obtain the structure of AzoM. The pure AzoM protein was obtained from an *Escherichia coli* expression system, extracted using BugBuster Protein Extraction Kit, and protein purity was verified by SDS-PAGE gel electrophoresis. The protein sample was collected in two different buffer conditions, Tris and HEPES, and concentrated to over 10 mg/ml. Initial protein crystallization was obtained by the sitting drop method using the 96-well Hamilton and Index Crystal screens. Positive samples were then optimized using additive screens as well as 24-well, custom-prepared conditions based on varying concentrations of salts, dyes, buffers, and pHs. Based on microscopic examination, crystals with sufficient size were subjected to X-ray crystallography using the Brookhaven National Lab, National Synchrotron Light Source. Computer software was used to create the 3D structure based on data from X-ray diffraction. Analysis of crystallization will provide an understanding of the structure and function of AzoM, ultimately impacting the environmental, medical, and biotechnology fields.

FRI-571

ISOLATION AND PURIFICATION OF AN ACTIVE COMPOUND PRODUCED BY *STREPTOMYCES BACILLARIS* AGAINST *STAPHYLOCOCCUS AUREUS*

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The emergence of multidrug resistance in *Staphylococcus aureus* has triggered an urgent need for new antibiotics and novel antibiotic combinations against both Gram-positive and Gram-negative bacteria. Actinobacteria, in

particular, the genus *Streptomyces*, produce almost two-thirds of today's clinically useful antibiotics. The objective of this study is to isolate actinobacteria from local soil samples and investigate their potential as producers of antibiotics against *Staphylococcus aureus* by using direct overlay assays with *S. aureus* ATCC 25923. A neomycin producer, *Streptomyces fradiae* ATCC 10745, was used as a positive control. Inhibition zones surrounding actinobacteria colonies were measured after overnight incubation at 35 °C. Active compounds were extracted using ethyl acetate. The extracts were separated by thin-layer chromatography (TLC) using different ratios of methanol-dichloromethane. The TLC plates were overlaid with *S. aureus* to identify compounds with antibiotic activity. A disk diffusion assay was used to confirm the TLC's result. Species identification was done by 16S *rRNA* gene sequencing analysis. The active compound produced by isolate AC1359 was obtained from ethyl acetate extraction. The active compound from AC1359 was purified by using flash chromatography with a methanol-dichloromethane gradient. The 16S *rRNA* gene analysis showed that AC1359 has a 100% identity to *Streptomyces bacillaris*. AC1359 has been found to produce an active compound that acts as an antibiotic against *S. aureus*. Further investigation is necessary to understand the structure of the active compound produced by isolate AC1359.

FRI-579

ANTIMICROBIAL EFFECTS OF *MIMULUS AURANTIACUS*Jackson Womck, Christine Case.*Skyline College, San Bruno, CA.*

The rising prevalence of antibiotic-resistant infections has led to a public health crisis. New antimicrobial compounds are needed to combat resistant pathogens. Plants used by traditional healers may provide these new antibiotics. Historically, the California Miwok used *Mimulus aurantiacus* leaves to treat skin infections. Our aim is to explore the antibacterial properties of *M. aurantiacus*. Ethanolic extracts of plant leaves were prepared by grinding leaves in 70% ethanol (400 mg/mL). This extract was tested against *Micrococcus luteus* (Gram-positive) and *Escherichia coli* (Gram-negative) bacteria in agar-diffusion assays. Our results suggest that *M. aurantiacus* contains effective antibacterial agents. The leaf extract inhibits growth of both bacteria. We are investigating the effects of root and flower extracts on the growth of *Salmonella enterica* and methicillin-resistant *Staphylococcus aureus*. The minimum inhibitory concentration and method of action will be determined. These are valuable findings as they may lead to the development of novel antimicrobials to which bacteria do not show resistance.

SAT-566

ANALYSIS OF THE EFFECTS OF BIOFILM FORMATION OF THE GASTROINTESTINAL PATHOGEN *CRONOBACTER* BY PROBIOTIC SPECIES OF *LACTOBACILLUS*Jessica Mesa, Maia Bland, Ana Vallor.*University of the Incarnate Word, San Antonio, TX.*

Lactobacillus have been isolated and found to be beneficial in the maintenance of intestinal health by the production of antimicrobial substances and adherence to mucosal epithelial cell surfaces. Loss of *Lactobacilli* may result in dysbiosis in some cases and lead to increased infection rates of opportunistic pathogens and allergies in susceptible hosts. *Cronobacter sakazakii* has been identified as an emerging intestinal pathogen in infants causing bacteremia and necrotizing enterocolitis. Fatality rates in neonates with invasive *Cronobacter* infections range between 40 and 80%. *C. sakazakii* has been shown to produce microbial biofilms in order to promote and sustain colonization. Previous work in this laboratory has resulted in isolation and preliminary characterization of lactobacilli outer membrane S-layer proteins which may play a role in inter-species aggregation. Further, lactobacilli were found to form biofilms *in vitro*. This study characterized the effects of incorporation of *Lactobacilli gasseri* and *Lactobacilli jensenii* cells and S-layer proteins on *C. sakazakii* biofilm formation. Coincubation of *Cronobacter* with each *Lactobacilli* species was performed in a dose-dependent manner to assess the effects on *Cronobacter* biofilms as monitored by light microscopy and a metabolic, semiquantitative colorimetric assay. Initial results demonstrated that levels of *Cronobacter-lactobacilli* biofilms were lower as compared to *C. sakazakii*-only biofilm, and the difference in biofilm inhibition was more pronounced at subsequent time points. Studies are ongoing to assess the effects of *Lactobacilli* S-layer proteins on *C. sakazakii* biofilms. Future studies will also entail further characterization of the possible roles of other antimicrobial *Lactobacilli* factors (i.e., lactic acid production, bacteriocins) on *C. sakazakii* biofilm inhibition.

FRI-580

BACTERIAL CONTENT ALONG THE SALINITY GRADIENT IN RIO GRANDE DE MANATÍ, PUERTO RICO

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Studies of microbial communities from aquatic ecosystems provide important insights into relations between various aspects of ecosystem functioning and changes in biodiversity. The differences between marine and freshwater bacterial populations have always been intriguing. Our objective is to assess the aquatic bacterial communities in response to changes in salinity. Water samples from river, estuary, and ocean along Río Grande de Manatí were cultivated on tryptic soy broth (0.5X) made with site water, and alternative salinity conditions. The resulting microbiota were diluted and cultivated on contrasting saline conditions. Bacteria from the river sample grew on riverine- and marine-based media to 10,000,000 cells/mL. A similar amount was found for the estuary sample under native conditions. However, estuarine bacteria increased in number under marine conditions (100,000,000 cells/mL). Still, marine bacteria were found at lower concentrations (approximately 1,000,000 cells/mL). The growth in plated media did not show evident antimicrobial activity. Bacterial populations seem to survive the effects of changes in salinity along the river system examined. However, the bacterial content may have changed as the fittest strains cope with the environmental stress of salt concentration. Modern molecular techniques based on DNA will be applied to overcome the limitations of traditional cultivation methods to assess microbial diversity. Additionally, isolates will be tested for biotechnological applications.

FRI-572

CONTINUED EMERGENCE OF H5N1: THE URGENCY FOR NOVEL INHIBITORS

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H5N1 influenza, more commonly known as the bird flu, is a reemerging virus that continues to surface in avian and human populations around the world. The reemergence of such highly pathogenic influenza viruses poses a serious threat as their resistance to current therapeutics continues to increase. The purpose of our research is to identify novel H5N1 influenza entry inhibitors. Discovering new viral countermeasures would provide a great deal of potential to create new therapeutics that can be circulated to prevent possible viral outbreaks in the future. In our study, 3,000 small drug-like molecules were screened against an H5N1 pseudovirus carrying a luciferase reporter gene using a high-throughput screening platform. A549 human lung epithelial cells were infected with H5N1 pseudovirus and incubated with each compound. Forty-eight hours post-infection, luciferase levels were assayed as an indirect measure of viral entry. Lead compounds were chosen based on their ability to decrease H5N1 pseudovirus entry, indicated by decreased luciferase levels when compared to the controls. We predict that the lead compounds will prevent entry by inhibiting either the influenza glycoprotein hemagglutinin, which mediates entry, or its receptor sialic acid, which is present on the host cell surface.

FRI-564

EXPRESSION OF THE IMMUNE MEDIATOR GALECTIN-9 IN A MURINE MODEL OF NEUROCYSTICERCOSIS

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Neurocysticercosis (NCC) is the most common parasitic disease of the central nervous system (CNS) caused by the metacestode stage of the parasite *Taenia solium*. NCC is characterized as having an initial prolonged asymptomatic stage followed by a range of symptoms associated with the immune response towards the degenerating parasite. The metacestode harbors antigenic material rich in glycan moieties recognized by C-type lectin receptors (CLRs). Galectin-9 (gal9) is a lectin receptor that recognizes β -galactoside residues, carbohydrate moieties that are known to be abundant in helminths. Using a murine model of NCC (infecting with the related parasite *Mesocostoides corti*), our goal was to determine potential infection-induced changes in the expression of gal9 in the CNS. To this end, we compared brain sections at 3 days (3dpi), 1 week (1wkpi), and 2 weeks post-infection mice (2wkpi) as well as mock-infected mice. We used immunofluorescence staining to determine changes in gal9 expression as well as to characterize cell types expressing gal9. We found that there is an elevated expression of gal9 in the 2wkpi mice compared to earlier time points and mock-infected mice. Double immunofluorescence staining with GFAP, an astrocyte-specific marker, showed co-localization with gal9 indicating that astrocytes express gal9 during NCC. Other cell types appear to express gal9 as well. In the future, we plan to characterize the distribution pattern of gal9 during

NCC and delineate the role of gal9 in the immunopathology of NCC using mice genetically deficient in gal9. (Partially supported by MBRS-RISE GM0060655.)

FRI-570

IDENTIFICATION OF TRANSCRIPTIONAL REGULATORS OF RBMA IN *VIBRIO CHOLERAE*

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In *Vibrio cholerae*, biofilm formation enhances environmental survival and host colonization. Biofilms are a sessile community of organisms enclosed in a three-dimensional matrix. The formation of this matrix directly depends on the production of exopolysaccharides (VPS) and structural extracellular proteins (RbmA, RbmC, and Bap1). We focused on identifying transcriptional regulators of *rbmA*. *RbmA* is required for retention of the daughter cell after cellular division; it is necessary for proper stability and architecture of biofilms. Little is known about the transcriptional regulation of *rbmA* in the formation of biofilms. Our objective was to randomly suppress the expression of genes of *V. cholerae* A1552 harboring a pBBR *rbmAp-lux* reporter construct, by disrupting their sequence with a transposition insertion. We evaluated a *mariner*-based transposon for its ability to generate insertion mutations with increase, decrease, or abolished *rbmAp-lux* expression. Using the *mariner* derivative transposon, we screened 25,000 insertion mutants and identified 236 candidates that may represent transcriptional regulators of *rbmA*. Therefore, this experimental approach can be used to comprehensively characterize the transcriptional regulation of genes encoding exoproteins involved in biofilm formation for the study of *Vibrio cholerae* pathogenesis.

FRI-565

SULFIDOGENIC COMMUNITY ALONG LIFE ZONE AT EL YUNQUE RAIN FOREST IN PUERTO RICO

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Sulfate-reducing bacteria (SRB), prevailing in anoxic sites, have been detected on terrestrial habitats with limited perspectives on diversity and distribution. Five life zones in El Yunque tropical rain forest (tabonuco, palm, elfin, dry, and colorado forest) are developed in an elevation gradient subjected to natural disturbances and contrasting physicochemical conditions. Diverse SRB must prevail across life zones. Our goal is to describe the structure and distribution of SRB throughout life zones in the rain forest. Soil samples were collected during June and December 2005 from plots at 2 depths (0 - 5 cm and 5 - 10 cm). Total genomic DNA was extracted for amplification of the dissimilatory sulfite reductase gene (*dsrAB*) and terminal restriction fragment length polymorphisms (TRFLP) analysis. A diverse sulfidogenic community is comprised by 451 TRF (representing 371 phylotypes) among the set of samples analyzed. SRB were more predominant for June and the deeper layer (5 - 10 cm) than December and top soil (0 - 5 cm). The *dsrAB* cloned from the elfin forest were phylogenetically diverse, with closest similarity to *Desulfobacca acetoxidans* and *Desulfomonile tiedjei*, and minimal similarity to those from mangroves (~2%). Most of the clones comprised novel lineages within the *dsr*-based phylogeny. Phylogeographic data for SRB is more related to vegetation type than precipitation, pH, and temperature. The sulfidogenic communities across the elevation gradient are rich, with diverse distributional patterns, and seem to thrive within the saturated soils of the forests with a potential role on decomposing complex substances from decaying trees.

FRI-575

IDENTIFICATION OF POTENTIAL LMP1-BINDING PROTEINS FOR SIGNALING OF EPSTEIN-BARR VIRUS-ASSOCIATED DISEASES USING BIMOLECULAR FLUORESCENCE COMPLEMENTATION

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The Epstein-Barr virus (EBV) is a herpes virus which has been associated with many different types of diseases. EBV has been connected to Burkitt's lymphoma, Hodgkin's lymphoma, gastric carcinoma, and nasopharyngeal carcinoma. EBV has also been connected to various autoimmune diseases including multiple sclerosis, lupus, rheumatoid arthritis, and Sjögren's syndrome. Understanding the association of EBV to multiple diseases is of particular interest to health professionals. It has been determined that a vital component of EBV infection and EBV-associated diseases lies within the signaling of the viral oncogene, latent membrane protein 1 (LMP1). In a previous study, several proteins were identified as potential LMP1 binding proteins. The focus of this study is to determine if bimolecular fluorescence complementation (BiFC) between candidate proteins and LMP1 is affected by LMP1-signaling mutants. It is known that tumor necrosis factor receptor associated factors (TRAFs) are required for LMP1 signaling. BiFC between TRAFs

and LMP1-signaling mutants has been shown to go down. Thus, our hypothesis is that if the identified LMP1 binding proteins are needed for LMP1 signaling, BiFC between LMP1 mutants and the candidate proteins will decrease. Observed decreases in BiFC between LMP1 and prospective proteins suggest a critical role for these proteins in LMP1 signaling of infected cells. Such insights can be used to better understand the LMP1-signaling complex and design novel therapeutic approaches to inhibit EBV-associated diseases.

SAT-564

PRODUCTION AND CHARACTERIZATION OF MONOCLONAL ANTIBODIES TO THE EBOLA VIRUS

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Ebolavirus hemorrhagic fever is a severe, often fatal disease in humans and nonhuman primates, with a case fatality rate of up to 90%. There is no cure, established drug therapy, or vaccine licensed for human use. There are 5 identified species of Ebola virus that include Bundibugyo, Ivory Coast, Reston, Sudan, and Zaire. There is limited cross-protection among the 5 Ebola virus species. One of the key steps in any virus infection occurs when a virus binds to and enters a cell. The Ebola virus glycoprotein mediates viral attachment and entry into host cells. Based on sequence homology between virus strains, we hypothesize that conserved epitopes are present on the Ebola virus glycoprotein that can be targeted by monoclonal antibodies binding to all known Ebola virus species. We tested this hypothesis by generating monoclonal antibodies from splenocytes of Balb/c mice vaccinated with vesicular stomatitis virus expressing Zaire Ebola virus glycoproteins (rVSV Zebov-GP) and boosting with a Sudan Ebola virus GP expressing VSV. ELISA was used to test reactivity of monoclonal antibodies against the different Ebola virus GP. We performed western blots to determine whether these antibodies recognized conformational or linear epitopes. Competitive ELISA assays were also performed to characterize the antibody binding sites. Interestingly, we found 4 antibodies that cross-react with all known species of Ebola virus and recognize Zebov-GP as a linear epitope. Studies involving phage display libraries are underway. Using computational analysis and X-ray crystallography data, epitope mapping of these antibodies will give us important insight into the conserved epitopes of these cross-reactive monoclonal antibodies.

FRI-581

THE ROLE OF THE SOLO *LUXR* GENE IN *DICKEYA* SPECIES

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Dickeya is a genus of enterobacteria that is responsible for many phytopathogenic outbreaks affecting crop and food production. The pathogenicity of *Dickeya* spp. is partly attributed to the production of signal molecules (acyl-homoserine lactones-AHLs) by LuxI synthase and delivered to the bacteria's environment. If AHL reaches the threshold level in the environment, they are sensed by LuxR proteins, a process referred to as quorum sensing. Recent studies have shown that plant-associated *Pseudomonas* spp. possess the LuxR proteins but lack the LuxI homolog necessary for the AHL signal production; this is a solo *luxR* gene. This genetic makeup suggests that such bacteria can only receive signals, indicating that solo *luxR* may play a role in inter-species and inter-kingdom signaling. The aim of this study is to investigate the role of solo *luxR* in *Dickeya* pathogenicity. For this, solo *luxR* from *Dickeya* was amplified using PCR with specific primers and ligated into a vector conferring resistance to ampicillin. Then *E. coli* competent cells were transformed with the obtained construct. The next steps of the study are placing a gene conferring resistance to chloramphenicol within solo *luxR*, thus inactivating solo *luxR* to obtain pMBsolo construct. After introduction of pMBsolo to *Dickeya* sp. cells, homologous crossing over is expected to occur. Obtained *Dickeya* sp. mutant affected in solo *luxR* will be compared with the wild-type *Dickeya* sp. for the siderophore production, motility, and virulence, allowing the determination of the role solo *luxR* plays in the pathogenicity of *Dickeya*.

FRI-573

CHARACTERIZING POSTMORTEM MICROBIAL ECOLOGY OF THE MAGGOT MASS THROUGH MEASURES OF PH, OXIDATION-REDUCTION POTENTIAL, AND TEMPERATURELauren Chun, David Carter.*Chaminade University of Honolulu, Honolulu, HI.*

As a corpse decomposes and the postmortem interval increases, the evidence present at crime scenes diminishes. To compensate for this loss, many investigative techniques use decomposition processes as investigative tools. Recent research has shown that microorganisms, particularly bacteria, have the potential to assist investigators, but a deeper understanding of postmortem microbiology is necessary. We aimed to characterize culturable postmortem microbial communities and present trends that will allow investigators to use microbes as physical evidence. We began with the conspicuous habitat of the maggot mass. We hypothesized that the chemistry and microbiology of the maggot mass will not change as fly larvae develop. To test this, we conducted a field experiment to decompose swine (*Sus scrofa domestica*) carcasses and characterize postmortem microbial communities throughout decomposition. We placed the swine in a tropical savanna ecosystem in Palolo Valley near Honolulu, Hawaii, which we replicated 3 times. We scored gross decomposition and characterized maggot masses through measures of pH, oxidation-reduction potential, and temperature. To characterize the microbial community, we swabbed the maggot masses and streaked samples onto standard nutrient agar, which we incubated at 22 °C. Isolated bacteria were identified using matrix-assisted laser desorption/ionization time of flight mass spectrometry. Through 153 hours postmortem, we observed a discrete habitat characterized by high temperature (35 to 39 °C), moderate and decreasing pH (7.4 to 6.6), and highly reducing conditions (approximately -250 mV to -190 mV). The taxonomy of the bacteria will be presented. This information will be important to entomologists and investigators because it provides a better understanding of corpse breakdown.

FRI-577

DESIGN OF MOLECULAR CHEMISTRIES TO EVALUATE SYNECHOCOCCUS IRON LIMITATION IN MONTEREY BAYAndrea Reyes-Ortiz, Julie Robidart., Jonathan Zehr.*University of California, Santa Cruz, Santa Cruz, CA.*

The cyanobacteria *Synechococcus* are significant contributors to the synthesis of organic compounds from carbon dioxide in the ocean, but the factors limiting their distribution in Monterey Bay are unknown. Iron is often a limiting nutrient for phytoplankton, and an examination of *idiA*, an iron-deficiency induced protein, will indicate whether iron stress occurs in Monterey Bay. Degenerate primers were used on archived samples collected from 4 different seasons within Monterey Bay, and a phylogenetic tree was constructed to examine the local diversity of the *Synechococcus* clades present. Quantitative PCR assays were designed for the *idiA* clades, and each was quantified throughout the year using archived samples. The *idiA* gene expression will be used to evaluate differential iron limitation over time for each clade. These assays will be optimized for deployment on the environmental sample processor (ESP), a robotic eco-genomic sensor for autonomous *in situ* gene quantification. With these data, we are able to determine the factors contributing to the biogeography and ecology of this important organism over space and time.

SAT-628

APOLIPOPROTEIN E 4/4 SERUM INHIBITS GROWTH OF PLASMODIUM FALCIPARUMElizabeth Perry¹, Clyde Phelix¹, George Perry¹, Xiongwei Zhu², Hisashi Fujioka².¹University of Texas at San Antonio, San Antonio, TX, ²Case Western Reserve University, Cleveland, OH.

Our evolutionary history has been characterized by a constant war between pathogenic microorganisms and various defense mechanisms to counter their pathogenicities. For instance, heterozygotic individuals with sickle cell trait are protected against severe falciparum malaria infections, and the high frequency of hemoglobin S in Africa is due to the selective advantage of the balanced polymorphism. The apolipoprotein E4 (ApoE4) allele has been linked to the pathogenesis of Alzheimer's disease, cardiovascular disease, and atherosclerosis, but these occur late in life when the force of natural selection has become attenuated. However, the frequency of ApoE4 is highest in the African subcontinent (especially in sub-Saharan Africa) and in certain other isolated populations such as in Papua New Guinea, all areas which exhibit endemic malaria. One hypothesis is that ApoE4 may give a selective advantage against falciparum malaria. In these studies, we determine the growth of malaria in human serum with different ApoE isoforms. We find malaria growth is greatly inhibited by ApoE4/4 serum, suggesting its maintenance in modern humans is a balance between early-life protection from malaria and increased risk of late-life diseases. (Support

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SAT-583

COMPARISON OF THREE DNA EXTRACTION KITS FOR DETECTION OF *MYCOPLASMA SUIS* DNA FROM BLOOD AS ASSESSED BY QUANTITATIVE PCR

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Mycoplasma suis is a blood-born pathogen of pigs. Both chronic and acute forms of infection have been reported. Chronically infected animals show few clinical signs of disease; acute infection is characterized by fever, listlessness, anorexia, and in severe cases, by a life-threatening anemia. The detection of *M. suis* in blood samples using quantitative PCR (qPCR) depends on the efficiency of the extraction method used. This study evaluated 3 commercially available DNA extraction kits (Zymo Quick-gDNA™ Blood MiniPrep, Qiagen DNeasy Blood & Tissue Kit; and Promega ReliaPrep™ Blood gDNA Miniprep System) to determine the relative recovery of *M. suis* from pig blood. Serial dilutions of whole EDTA blood from an *M. suis* infected pig were subjected to DNA extraction using the various kits as per the manufacturer's instructions. Yield and purity of total genomic DNA extracted from the blood were compared spectrophotometrically while detection of the *16S rRNA* gene of *M. suis* was performed using a Taqman qPCR assay specific for *M. suis*. Expected results are for the 3 DNA extraction kits to have a different yield and qPCR results.

FRI-576

THE ROLE OF CARBONIC ANHYDRASE IN CAMP SIGNALING AND SOCIAL MOTILITY IN *T. BRUCEI*

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Trypanosoma brucei is a protozoan parasite that causes African sleeping sickness, a disease with high mortality rates in sub-Saharan Africa. *T. brucei* has a complex lifecycle that alternates between a tsetse fly vector and a mammalian host. In the insect vector, migration through several tissues is required for maturation into mammalian-infectious forms. However, little is known about how surface contact impacts parasite behavior because African trypanosomes have been traditionally studied in suspension culture. The insect form of *T. brucei* engages in social motility (SoMo) when cultivated on semisolid agarose surfaces. It is found that SoMo is affected by changes in CO₂ levels and regulated by flagellar adenylate cyclases (ACs), which catalyze the synthesis of cAMP. In many organisms, ACs function as CO₂ sensors and rely on the activity of carbonic anhydrases (CA), which are enzymes that interconvert CO₂ and bicarbonate. Here the role of the *T. brucei* CA as a mediator of cAMP signaling and social motility is investigated. To test this hypothesis, a knockdown of CA was first generated using tetracycline-inducible RNA interference. Cumulative growth data was collected on several clonal KD lines during uninduced and induced conditions. This data indicated that CA was not required for viability. Additionally, qPCR data further verified CA depletion of clones upon RNAi induction. SoMo assays are in progress to assess KD level and its impact on social motility. These studies could explain the role of carbonic anhydrases as an early step in cAMP signaling, thereby providing a novel target for therapeutic agents.

SAT-574

SCREENING FOR SMALL MOLECULE INHIBITORS OF THE DENGUE VIRUS PROTEASE AND TESTING FOR DIS3L2 EXORIBONUCLEOLYTIC ACTIVITY IN *S. CEREVISIAE* IN VITRO

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Currently, there are no effective treatments for infections caused by dengue virus. The incidence of dengue infections is about 50 to 100 million people per year, making it a clear public health concern. These infections result in dengue fever and potentially lethal dengue shock syndrome. Our aim is directed toward drug development to cure dengue infection. The virus's compact genome requires viral and host factor collaboration for virus propagation within the cell. This project involves activity analyses of two proteins: the virus NS3 protease and host exoribonuclease Dis3L2. The NS3 protease, with cofactor NS2B, cleaves the viral polyprotein made early during infection, leading to production of mature viral proteins. We hypothesize that a small molecular weight, soluble, drug-like compound will inhibit protease activity. Assay plates were prepared containing NS3-NS2B purified from *E. coli*, artificial substrate Ac-nKRR-pNA, and 50 uM solutions of potential inhibitors. Absorbance readings of *p*-nitroaniline, a product of cleaved substrate,

were used to measure enzyme activity. The exoribonuclease Dis3L2 was shown to be necessary for replication in cells from RNAi experiments. Assay plates prepared with potential inhibitors and *S. cerevisiae* that were transformed with the *Dis3L2* gene displayed a slow growth phenotype. These observations may be the cause of *Dis3L2* disrupting yeast metabolic pathways. Thus, we hypothesize that human *Dis3L2* inhibits *S. cerevisiae* growth due to its exoribonucleolytic activity. PCR site-directed mutagenesis was done in plasmid YESHA to silence *Dis3L2* expression in transformed yeast. Spot tests were used to quantify growth effects of mutant *Dis3L2* yeast and controls.

NEUROSCIENCE

FRI-591

IFNG INDUCED GENE EXPRESSION DURING THE COURSE OF EXPERIMENTAL AUTOIMMUNE ENCEPHALOMYELITIS

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Multiple sclerosis (MS) is a neuroinflammatory disorder, characterized by multifocal inflammation, demyelination and axonal damage within the central nervous system (CNS). MS manifests a broad range of physical and cognitive disabilities and may include balance and coordination impairments, which are linked to poor prognosis. Little is known about the pathogenesis of these deficits. Experimental autoimmune encephalomyelitis (EAE) is a commonly used animal model for MS. Wild-type (WT) mice with EAE develop ascending paralysis associated with lesions in the spinal cord. EAE induction in mice lacking interferon gamma (IFN γ) results in development of balance and coordination defects. Although these atypical deficits were previously associated with inflammatory foci within the cerebellum/brainstem, we showed that the onset is not dependent upon the extent, composition, or areas of inflammatory foci formation in the CNS. Instead, we showed that atypical deficits are linked to the absence of IFN γ R/STAT1 in the CNS cells. We hypothesize that IFN γ signaling in the CNS promotes anti-inflammatory/neuroprotective events in EAE. To examine IFN γ -induced differences in transcriptional regulation within the CNS, cerebella, brainstems, and spinal cords were harvested from IFN γ R-KO and WT mice at onset and chronic phases of EAE. RNA was extracted and analyzed by real-time PCR. Our data show that disruption of IFN γ signaling results in the absence of MHC class II molecule mainly in microglia, while molecules that are associated with phagocytosis and oxidative stress are upregulated. Results from this study will be instrumental in understanding the disease process that contributes to balance and coordination deficits in multiple sclerosis.

FRI-592

THE REGULATION OF PH IN AN *IN VITRO* BRAINSTEM PREPARATION OF THE BULLFROG TADPOLE, *LITHOBATES CATESBEIANUS*, BY CENTRAL RESPIRATORY CHEMORECEPTORS DURING INDUCED ALTERATIONS IN MEMBRANE POTENTIAL

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Sudden infant death syndrome (SIDS) is the spontaneous and unexpected death of an infant who is less than 1 year of age. Even though the incidence of SIDS has declined by more than 50% since 1990, SIDS represents the third leading cause of infant fatalities in the United States. Although risk factors associated with an increased incidence of SIDS have been described, the cause of death and documented health disparity basis of SIDS remain unexplained. Dysfunctions of brainstem regions responsible for central carbon dioxide chemoreception have been proposed as an underlying pathophysiology of SIDS. Our experiments will test the hypothesis that an inverse relationship exists between intracellular pH (pHi) regulation by the central respiratory chemoreceptors and the neuron's membrane potential. Simultaneous recordings of both variables will be done using an *in vitro* brainstem preparation of the bullfrog tadpole, *Lithobates catesbeianus*, because of its synaptic connectivity to respiratory rhythm generators, central respiratory chemoreceptors, and motor neurons. Moreover, the ratiometric fluorescent dyes to be used are di-8-ANEPPS, which responds to membrane potential variances, and BCECF, which responds to changes in pHi. Using electrophysiology and ratiometric fluorescence, preliminary data demonstrate we can employ flash photolysis to induce decreases in pHi within physiological limits and it is possible to record and optically quantify, pH regulation during extracellular pH (pHe) and pHi modifications. The definitive aim is to understand if impairments in brainstem regions responsible for central carbon dioxide chemoreception are possible mechanisms of SIDS.

FRI-589

EFFECTS ON BEHAVIORAL IMPAIRMENT OF BLOCKING ADENOSINE IN THE DORSAL STRIATUM

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Stress-anxiety disorders are the most common mental health disorders among the human population, affecting about 40 million Americans. Adenosine A_{2A} receptors play an important role in the development of behavioral depression in a rat model of post-traumatic stress disorder (PTSD). Adenosine is a neuroprotectant released to inhibit neural activity, preventing further cell damage. Binding adenosine at the striatal A_{2A} receptor has been shown to decrease dopamine binding at D_2 receptors. This antagonistic relationship disrupts dopamine-signaled motivation, preventing adaptive stress coping, thus resulting in behavioral depression. Blockade of A_{2A} receptors in the ventral striatum (nucleus accumbens) following traumatic stress prevents behavioral impairment in rats. However, it is unknown if A_{2A} receptor blockade in the dorsal medial striatum (DMS) will have the same effect. Rats were implanted with bilateral cannulae into the DMS (bregma: AP +1.2, ML +1.5, DV -5.5) during stereotaxic surgery. Following recovery from surgery, rats were exposed to traumatic, inescapable shock or simple restraint. Rats were tested for their ability to learn to escape administered shocks in a shuttle-escape apparatus 24 hours after traumatic stress. Ten minutes prior, rats' cannulae were infused with adenosine A_{2A} receptor antagonist CSC (8-(3-chloro-styryl) caffeine) or vehicle. Brains were extracted to confirm cannula placement using crystal violet stain. Shuttle-escape testing revealed that blockade of A_{2A} receptors in the DMS had no effect on escape deficits, indicating that A_{2A} receptors in the nucleus accumbens are strictly involved in learned helplessness. These findings may be significant in treating stress-anxiety disorders such as PTSD with comorbid depression.

SAT-601

SELECTIVE PRESYNAPTIC GENE MODULATION BY *IN VIVO* ELECTROPORATION IN THE CALYX OF HELD IN NEONATE MICE

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The Calyx of Held is a glutamatergic nerve terminal that innervates a small but vital group of auditory inhibiting neurons and originates from globular bushy cells in the ventral cochlear nucleus in mice. The Calyx is the largest, most reliable synapse in the mouse brain, making it an excellent model system for studying neuron circuit organization, vesicle mediated exocytosis, and synaptic development. Many of the molecular mechanisms underlying these fundamental processes remain unknown. Gene-knockout mice and viral-vector mediated gene expression techniques used to study these mechanisms are costly and time consuming. A faster, efficient, and more adaptable technique is needed to augment understanding of vital synaptic processes by using the Calyx of Held as a powerful model synapse in the brain. In this study, we refine a cutting-edge gene expression technique comprised of targeted microinjection followed by electroporation to reproducibly deliver and express desired genes into the Calyx of Held. By establishing precise timing for hypothermia, injection coordinates, postinjection recovery time, and implementing a novel stereotaxic set up, we can reliably inject plasmids into the 0.2 to 0.9 mm VCN region with relatively high mouse survival rate and achieve *EGFP* gene expression. Developing the targeted microinjection- electroporation technique in the Calyx of Held region opens a new avenue to efficient molecular manipulation in this often-elusive structure *in vivo*. Further studies can implement this fast-acting, virus-free method to study the vesicle-formation and calcium-dependent signaling mechanisms at the Calyx and other central synapses, which are the underlying mechanisms in synaptic development, Alzheimer's disease, and autism.

FRI-595

USING CHANGE BLINDNESS TO STUDY THE EFFECT OF VISUAL ATTENTION ON NEURAL ACTIVITY IN VISUAL AREA V4

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Visual attention is necessary to perceive and react to our world; when we do not attend to something, we are often completely unaware of it. This lack of perception is exemplified in change blindness tasks in which we are unable to detect a difference between 2 scenes of objects separated by a blank screen even though the change may be huge. Past studies have suggested that any behavioral effects of attention, including change blindness, are due to a change in neural activity in visual area V4. The current study seeks to test this hypothesis. Subjects were trained in a simplified change blindness task comprised of 1, 2, 4, or 8 objects on a screen. Subjects had to pay attention

to all objects presented and determine if 1 of the objects rotated. While attention can be focused when only 1 object is presented on the screen, attention must be spread when multiple objects are presented. Given the results of past studies we expected to see the neural activity of V4 correlate with the degree to which attention is spread: high activity correlating with focused attention and lower activity with spread attention. Using extracellular electrodes to measure spiking activity from single neurons, preliminary data demonstrates no correlation of V4 activity with the number of objects. Since the V4 activity is unchanging and different behaviors based on object number are seen, these results suggest that V4 is not responsible for the behaviors associated with attention as has been suggested in the past.

SAT-586

PROTEASOME AND IMMUNOPROTEASOME DISTRIBUTION IN CEREBELLAR CELLS OF EXPERIMENTAL AUTOIMMUNE ENCEPHALOMYELITIS

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Multiple sclerosis (MS) is a severe neuroinflammatory disorder characterized by the loss of myelin around the axons of the central nervous system. Experimental autoimmune encephalomyelitis (EAE) is a commonly used animal model of MS that recapitulates the various stages of the disease. Our laboratory has recently discovered that oxidized proteins accumulate in the cerebellum of mice with chronic EAE, and this seems to be the result of diminished levels of proteasomes, the proteolytic machinery responsible for their degradation. The build-up of oxidized proteins is toxic to cells and thought to play a role in the pathophysiology of MS and EAE. We have recently found that the reduction in the standard proteasome levels, as measured by the catalytic b5 subunit, and immunoproteasomes, as measured by the catalytic ib5 subunit, is not a generalized phenomenon, but occurs in particular cell types. Specifically, ib5 and b5 levels are reduced in neurons and oligodendrocytes in the EAE cerebellum during the chronic phase of the disease. This supports insights into the relationship between proteasomal dysfunction and tissue damage in this disease. (Work supported by IMSD and R01 NS057755 from NIH.)

SAT-592

SCREENING CHEMICALS FOR HCN CHANNEL INHIBITION

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Depression impacts many people and the drugs currently on the market primarily target serotonin, norepinephrine, or other neurotransmitters. Though these drugs are effective antidepressants, large populations of people still suffer from depression. Therefore, alternative drugs that target different neural channels are being considered for treatment. An example of ion channels being considered is HCN1 and its auxiliary subunit Trip8b. The interaction between the two has been studied in previous research. Trip8b is necessary for proper trafficking of HCN channels' selectivity to dendrites. Mouse models where Trip8b was knocked out displayed anti-depressed phenotypes. Therefore, the inhibition of Trip8b binding to HCN is the topic of interest for this study. The process of screening chemicals will be conducted through pull down assays which tell us about protein-protein interaction. Through the screening process, different HCN derivatives will be paired with different chemicals (drugs) to see whether there is an inhibition of Trip8b. Consequently, an inhibition of HCN channels by the chemical will provide an understanding of how HCN channels are blocked. As a result, this inhibition by the chemicals will later be used to develop a drug that combats depression. Thus, this screening process represents the first steps in developing a drug that provides an alternative form of antidepressant medication that works on HCN channels.

FRI-598

NEURODEVELOPMENTAL TRAJECTORY OF SIMPLE ARITHMETIC IN BILINGUAL CHILDREN

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It has been established that adult bilinguals retrieve arithmetic facts from memory more efficiently in the language in which a concept was learned (LA+) than in their second language (LA-). There is a developmental transition for learning simple arithmetic that begins with calculating (i.e., the procedural method) and develops toward the retrieval of arithmetic facts from memory. In bilingual children, the transition in arithmetic strategy may occur at a time when they are taught arithmetic using a language that may not be their first language (L1). To examine the impact of the second language on arithmetic and investigate the neurodevelopmental trajectory of simple arithmetic, electrophysiological activity will be measured in English/Spanish bilingual children in 3rd grade (novice multipliers)

and 5th grade (experienced multipliers) while they complete a simple arithmetic judgment task. English monolinguals at each grade level will act as controls. As in previous studies, an N400 component along with a late positive component is expected when presented with erroneous solutions to multiplication problems. The distribution of the N400 is predicted to change as the transition from procedural to memory extraction occurs, with the N400 being more prominent in the frontal lobe for the 5th grade population as facts are extracted using a verbal memory strategy. In addition, the N400 component is expected to be more negative-going among the monolingual population compared to their bilingual counterparts, as they are predicted to be more attuned to recognizing incongruent solutions in their L1.

SAT-584

TREATMENT OF A MOUSE MODEL OF MULTIPLE SCLEROSIS WITH HIGHLY SPECIFIC ESTROGEN RECEPTOR-B LIGANDS, WAY200070 AND WAY200041

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Multiple sclerosis (MS) is an autoimmune neurodegenerative disease that affects the central nervous system (CNS) and is characterized by motor, sensory, and cognitive deficits. Current therapies for MS come mostly in the form of immunomodulatory drugs which indirectly slow disease progression. Our lab has shown that the estrogen receptor β (ER β) specific ligand diarylpropionitrile (DPN) has a direct, neuroprotective effect in mouse models of MS. DPN is a moderately selective ligand, and there are more selective ER β ligands available for study that could provide greater efficacy and safety. For example, WAY200070 and WAY200041 have a 200-fold selectivity for ER β over ER α , compared to the 70-fold selectivity of DPN. Our aim was to investigate the potential neuroprotective effects of prophylactic and therapeutic treatment with WAY200070 and WAY200041 in a chronic mouse model of MS: experimental autoimmune encephalomyelitis (EAE). Treatment with the WAY compounds both prior to and after disease onset improved EAE clinical scores. Immunohistochemistry of brain and spinal cord sections from WAY-treated mice showed improved myelin density and increased mature oligodendrocyte and axon numbers compared to vehicle-treated mice. WAY200070 and WAY200041 treatment had no effect on the peripheral immune response or CNS inflammation. Together, these findings strongly support a direct, neuroprotective effect of WAY200070 and WAY200041 treatment in a chronic mouse model of MS. Therefore, these compounds should be investigated further as a potential treatment option for MS.

FRI-590

SEIZURE FREQUENCY AND SUSCEPTIBILITY IN SLEEP-DEPRIVED MICE

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Sleep and health have always been linked. Although there are many unknowns concerning the physiological purposes of sleep, it is clear that sleep is essential, and sleep deprivation causes major damage, including death. However, there is evidence that sleep deprivation is closely related to one of the many triggers of seizures in epilepsy. Therefore, this research's main focus is the relationship between sleep deprivation and seizure threshold and frequency. We hypothesized that the increase of seizure frequency in epileptic mice and seizure susceptibility in seizure-naïve mice will be directly proportional to the intensity and duration of the sleep deprivation protocol. The seizure-naïve mice will be exposed to the volatile convulsant Flurothyl to induce seizures, quantifying latency to seizure. The epileptic mice will be used for EEG recording to monitor brain activity (seizure frequency) during and after sleep deprivation. Animals from both groups will be euthanized and brain slices prepared to record electrophysiological activity to determine specific cerebral changes. It is expected that, with sleep disruption, the naïve mouse susceptibility to Flurothyl-induced seizures and epileptic seizure frequency will increase indicating hyperexcitability in sleep-deprived mice. Because the main purpose of this research is to discover how sleep deprivation affects the frequency of and susceptibility to seizures in mice, the findings of this study carry great translational value in neurology, aiding in the diagnosis and treatment of this debilitating disease.

FRI-584

PROTEIN AGGREGATION ANHIBITORS DECREASE NEURAL CELL DEATH IN THE SPINAL CORD OF DIETHYLMALEATE-TREATED MICEItzy Erin Morales Pantoja, Oscar Bizzozero, Anushka Dasgupta, Jianzheng Zheng.*University of New Mexico Health Sciences Center, University of New Mexico, Albuquerque, NM.*

Reduced levels of the antioxidant glutathione and increased protein oxidation are observed in several neuroinflammatory and neurodegenerative disorders. Protein oxidation triggers the formation of large, protease-resistant aggregates that are believed to be cytotoxic. Indeed, we have previously shown that the protein aggregation inhibitors congo red (CR) and 2-hydroxypropyl β -cyclodextrin (HPCD) significantly reduce cell death in glutathione-depleted, neuron-like PC12 cells. In this study, we investigate whether CR and HPCD also prevent neural cell death *in vivo*. Ten, week-old C57BL/6 mice were given an intraperitoneal (ip) injection of diethylmaleate (DEM) (6.0 mmol/kg), a treatment that reduces glutathione levels in the spinal cord by 70 to 80%. Some DEM-treated animals also received an ip injection of either CR (40 nmol/kg) or HPCD (20 nmol/kg). After 12 h, mice were euthanized and spinal cords were rapidly removed and processed for immunohistochemical analysis. Apoptotic cell death in the lumbar spinal cord was determined by TUNEL staining, and neurons, oligodendrocytes, and astrocytes were identified using antibodies against NeuN, CAII, and GFAP, respectively. We found that DEM treatment increases the number of apoptotic cells by 10-fold and that both protein aggregation inhibitors decrease cell death by 50%. TUNEL-positive cells in glutathione-depleted mice were identified as neurons (51%), oligodendrocytes (9%), and astrocytes (20%), and both CR and HPCD reduced apoptosis of all these cell types. Our results not only demonstrate the cytotoxic role of protein aggregation *in vivo* but also validate the therapeutic potential of these agents. (Supported by NIH grants NS057755 and NS084042, and by the IMSD program)

SAT-596

ATTEMPT TO ATTENUATE AGE-RELATED HEARING LOSS CAUSED BY OXIDATIVE-STRESS BYPRODUCTS USING AN ACROLEIN SCAVENGERJulie Luna¹, Charneka Hopkins², Aravindakshan Parthasarathy³, Edward Bartlett³.¹*University of Puerto Rico-Aguadilla, Aguadilla, PR,* ²*Rust College, Chicago, IL,* ³*Purdue University, West Lafayette, IN.*

Age related hearing loss is caused by degeneration of the peripheral auditory system, including the cochlea and the hair cells, or by changes in neurons of the central auditory pathway. Peripheral changes are seen mainly as an increase in the hearing threshold, while changes in processing complex sounds are thought to reflect central pathway damage. Theories speculate that damage to mitochondria caused by reactive oxygen species (ROS) is one of the causes of aging. Byproducts like acrolein affect cell membrane and myelin in axons, resulting in decreased responses of neurons in the central pathway. Our study aims to assess age related hearing loss using an acrolein scavenger called hydralazine to recover neuron damage in a rodent model of aging. Hydralazine was administered to aged Fischer-344 rats using intra peritoneal injections during a period of weeks, and the controls were treated with saline. To test the auditory function, we used auditory-evoked potentials including auditory brainstem responses (ABR), middle latency responses (MLR), and frequency following responses (FFR) using subdermal-needle scalp electrodes. Responses were recorded during the presentation of different auditory stimuli in a pre-session. We expect to see an increase in amplitude and a decrease in latency shifts in the ABR and MLR results. Positive results using this technique could lead to new therapeutic approaches to prevent, treat, or lessen the oxidative stress effects that cause age-related hearing loss.

SAT-597

VASCULAR COGNITIVE IMPAIRMENT IN AGED, SPONTANEOUSLY HYPERTENSIVE STROKE-PRONE RATSPatricia Perez Bonilla¹, Anne Dorrance².¹*University of Puerto Rico, Rio Piedras Campus, Rio Piedras, PR,* ²*Michigan State University, East Lansing, MI.*

Carotid arteries are the major blood supply to the brain; about 600 to 700 ml of blood flows through the carotid arteries every minute. Impaired dilation in these arteries could affect the regulation of cerebral blood flow. The spontaneously hypertensive stroke-prone rat (SHRSP) was analyzed in this study because recent investigations using the SHR strain have demonstrated that hypertension combined with age significantly alters cerebrovascular resistance and impairs cerebrovascular activity. The purpose of this experiment is to study the thromboxane U46619-induced contraction and the acetylcholine (ACh)-induced dilation in the carotid arteries from the SHRSP at different ages. We will also test the role played by cyclooxygenase (COX) metabolites in controlling vascular function by inhibiting COX with

indomethacin. This study will also assess the cognitive impairment in SHRSP using the elevated cross maze and the novel object test. Control normotensive Wistar Kyoto (WKY) rats will be used for comparison. Two hypotheses are proposed: the SHRSP strain will show an increase in cognitive impairment with increasing age, and COX activity will increase with age causing indomethacin to have a greater effect in arteries in aged SHRSP.

FRI-597

BASAL GANGLIA VOLUME RELATES TO THE SEVERITY OF SYMPTOMS OBSERVED IN AUTISM SPECTRUM DISORDER

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Autism spectrum disorder (ASD) is a class of neurodevelopmental disorders characterized by broad social and cognitive impairments and the presence of repetitive behaviors. This research examined the hypothesis that a mechanism for routing signals to the frontal lobes through the basal ganglia (BG) is impaired in ASD. Functional implications of structural abnormalities in the BG have been limited to motor impairments. Our research correlates BG volume with indices of cognitive and social functioning in ASD. Anatomical tracings of the caudate and putamen of the BG were defined on high-resolution MPAGE structural images by two trained tracers (inter-rater cross correlations = .86 - .90), for 31 individuals: 14 with ASD and 17 controls. BG nuclei volume was correlated with full intelligence (Wechsler Adult Intelligence Scale) and scores from the subscales of the autism diagnostic interview (ADI) and the autism diagnostic observation scale (ADOS). No significance was found between groups t-tests in total BG volume between groups. Correlations with BG structure and behavioral measures indicated that size of the BG was positively correlated with IQ in controls $r(17) = .50$, but was negatively correlated with IQ in individuals with ASD $r(14) = -.53$. BG size was correlated with measures of repetitive behaviors on the autism diagnostic interview $r(14) = .59$ and with a measure of social distress $r(14) = .55$. The results showed that larger BG are associated with better functioning in controls and poorer functioning in ASD.

SAT-591

THE BILINGUAL ADVANTAGE

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Bilinguals demonstrate better cognitive control and later onset symptoms of Alzheimer's than monolinguals. The specific aspect of bilingualism responsible for this advantage is still highly debated. Our goal is to determine whether experience in a code-switching environment affects language control, measured as the speed and accuracy of switching between languages. Code-switching is when an individual switches between two or more languages within a conversation. For the study we compared Spanish-English bilingual switchers: people who spend time in a code-switching environment; non-switchers: people who speak only one language per conversation; and monolinguals. Data was previously collected on a picture-naming paradigm in which bilinguals were cued to switch between naming pictures in Spanish and English. In some trials they stayed in the same language as the previous trial (nonswitch trials) and in some trials they were cued to switch languages (switch trials). We categorized errors and calculated both naming accuracy and reaction times for each participant. Switch cost is calculated as the average response time, switch minus nonswitch. We hypothesized that people who code switch frequently will have a smaller switch cost and higher accuracy than those who do not. This would indicate that code-switching experience improves the ability to switch between languages. This study is part of a larger goal of determining why bilinguals show a cognitive advantage over monolinguals in tasks that involve executive control, so we may better understand in what way it can delay cognitive decline.

SAT-600

CAN SCHEDULED EATING IMPROVE SLEEPING HABITS AND MOTOR FUNCTIONS IN BACHD MICE

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Many suffering from neurodegenerative diseases such as Huntington's disease (HD) experience a wide variety of ailments in addition to the loss of motor coordination that characterizes these diseases. Prior to the appearance of motor dysfunction in HD patients is the prevalence of poor sleep, suggesting a problem with the circadian clock. BACHD mice, a mouse model of HD, exhibit poor motor skills and disrupted circadian rhythms in activity and heart rate. These daily rhythms in activity and physiology are regulated by the master pacemaker in the brain, the

suprachiasmatic nucleus (SCN). The SCN can be considered the conductor of an orchestra of clocks throughout the body, including the heart, liver, and digestive system. The SCN integrates multiple environmental and biological cues to time the circadian system, which can be altered by photic and gustatory input. This study targets this feedback to the SCN by allotting BACHD and wild-type mice a six-hour window per day in which they can feed. Preliminary results indicate that scheduled meals during the active period of the mice (night) are able to strengthen activity rhythms as demonstrated by them staying asleep for longer throughout the night and being more active during the day. Even more intriguingly, the BACHD mice's progressive motor-coordination decline slowed, and in some cases motor coordination improved compared to the control group. Further studies will determine whether a protocol of scheduled mealtimes can be used as a treatment for failing circadian clocks in HD and other neurodegenerative diseases.

FRI-587

THE CONTROL OF NEUROGENESIS BY FRAGILE X PROTEINS

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Fragile X syndrome (FXS) is the most common form of inherited intellectual disability. Loss of function of the *fmr1* gene results in lack of fragile X mental retardation protein (FMRP), an RNA binding protein. Two homologs of FMR1, FXR1 and FXR2, are expressed in the brain and may have functional redundancy in RNA binding, but little is known about their role in development. Recent studies suggest that neurogenesis, the generation of neurons from progenitor cells, is aberrant in FXS patients. We investigated whether fragile X proteins affect neurogenesis, using *Xenopus laevis* tadpoles which express homologs of *fmr1* and *fxr1* genes. We knocked down FMR1 and FXR1 with antisense morpholinos and collected *in vivo* confocal time-lapse images of GFP-expressing radial glial progenitor cells and their progeny over three days. Animals treated with control morpholinos increase the number of GFP-labeled cells between the first and third days of imaging, but FMR1 or FXR1P knockdown animals significantly decreased the total number of GFP-labeled cells generated over the imaging period. We identified neurons and glia based on their morphology and found that the average number of neurons and radial glia cells on days 2 and 3 is significantly reduced with FMR1 or FXR1 knockdown compared to controls, suggesting that proliferation and survival of neural progenitor cells is compromised by loss of fragile X proteins. Interestingly, knockdown of FMRP increased the proportion of neural progeny compared to progenitors, suggesting that loss of FMRP induces rapid differentiation of neurons from progenitors, adding insight into mechanisms of FXS.

SAT-588

RECOVERY OF UPPER LIMB MOTOR FUNCTION IN RHESUS MONKEYS AFTER SPINAL INJURY

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Considerable levels of upper limb function can be recovered in a non-human primate following a severe cervical spinal cord injury. However, the neural reorganization strategies underlying this recovery remain unclear. We hypothesize that one mechanism that contributes to this recovery can be attributed to an increased excitability of the spinal circuitry that controls the motor pools that innervate the muscles of the upper limb after injury. In our study, 4 rhesus monkeys (*Macaca mulatta*) underwent C7 hemisection and EMG electrode implantation while video and EMG recordings were taken during a trained hand task, both pre and post-lesion. Following the injury, based on EMG recordings we observed an immediate loss of the ability to activate most muscles of the upper limb as required for reaching, grasping, and retrieving food. However, about 6 to 20 weeks after injury, we found that the level of activation of these muscles in most cases exceeded the normal level of activation when performing these motor tasks. At the same time, there was increased forelimb muscle coactivation as well as motor unit recruitment. These data suggest that, during spinal cord injury recovery, there is a proliferation of aberrant synaptic connections which results in elevated levels of activation and poorly coordinated patterns of activation among agonist and antagonist muscles. In the more advanced stages of recovery, it appears that the levels of activation and the levels of coordination between motor pools return toward normal levels. Both of these mechanisms probably contributed to the progressive improvement in motor function following the injury.

SAT-599

THE NEURAL CIRCUIT ORGANIZATION SUPPORTING FLEXIBLE EYE MOVEMENTS

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A fundamental goal in neuroscience is to understand the neural circuit organization supporting sensory processing. Cephalopods, which include squid, octopus, and cuttlefish, are highly visual creatures and possess the most complex invertebrate nervous system. In particular, the cuttlefish exhibits unique visual behaviors including independent eye movements and variable eye positioning giving it a large range of binocular overlap. It is assumed that cuttlefish eyes converge to generate stereopsis for effective prey capture, but this hypothesis has not been adequately explored, and its full range of binocular overlap has not been rigorously tested. Additionally, only the basic neural organization of the visual system has been established. To determine the range of binocular overlap during prey capture, we recorded behaving cuttlefish from multiple angles and tracked their eye movements with semi-automated software to generate positional 3D coordinates. Tentacle dynamics were also analyzed. To determine the necessity of stereopsis for efficient prey capture, cuttlefish were deprived of sight in 1 eye and filmed during hunting episodes. Multiple parameters of prey capture were measured and compared to control animals. What is the neural organization in the cuttlefish supporting these visual behaviors? To answer this question, we are injecting a fluorescent tracer into an eye or an optic lobe of the animal to trace its neuronal projections. Preliminary results indicate that projection neurons in one optic lobe travel to (among other regions) the contralateral optic lobe where they are topographically mapped. These results will give us a better understanding of the neural circuitry that evolved to support visual behaviors.

FRI-585

KINDLING RAT MODEL OF EPILEPTOGENESIS FOLLOWING TRAUMATIC BRAIN INJURY AND HYPOXIA

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Traumatic brain injury (TBI) is associated with an increased prevalence of seizures and accounts for 30% of epilepsy observed in individuals between the ages of 15 and 34. We hypothesized that TBI or TBI with hypoxia would increase the rate of epileptogenesis as compared to sham controls in a kindling model of epilepsy. The amygdala was stimulated daily in 4 groups of animals (sham + normoxia, sham + hypoxia, TBI + normoxia, and TBI + hypoxia) between days 2 and 16 post-injury. Behavioral and electrographic data indicated that sham normoxia rats took 7.2 ± 1.4 days to develop epilepsy, while the TBI normoxia group took 12.3 ± 1.6 days, and the TBI + hypoxia group took 16.6 ± 0.4 days. Therefore, counter to our hypothesis, neither TBI nor TBI + hypoxia increased the rate of epileptogenesis. Brain tissue was sectioned from a subset of animals after 7 days of kindling, stained with GFAP (astrocytes) and IBA-1 (microglia), and is being quantified using stereology. Preliminary data suggests an increase in astrocytic cell death in TBI + hypoxia rats as compared to other groups. Interestingly, microglial activation is more prevalent in animals receiving TBI in the absence of hypoxia. As demonstrated by these data, the pathophysiology of TBI and how TBI relates to epileptogenesis is complex. Better understanding of the relationship between cell death, microglial activation, and epileptogenesis are critical in our long-term goal to determine a therapeutic intervention to reduce post-traumatic epilepsy.

FRI-593

TEMPORAL AND SPATIAL PATTERNS OF NAV1.1 EXPRESSION DURING DEVELOPMENT

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Dravet syndrome (DS) is a childhood disorder in which symptoms develop as the patient ages. These characteristics include seizures that are anti-epileptic drug resistant, severely cognitive deficit, and abnormal in EEG. It has been observed that many DS patients as well as patients with other neurological disorders have a loss-of-function genetic mutation on the *SCN1a* gene that affects the coding for the voltage-gated sodium channel type I (Nav1.1). To better understand the age-dependent neurological consequences of Nav1.1 loss of function, we characterized its expression in rats at various ages ranging from birth to early adulthood. Fluorescent and DAB histological staining techniques were used. We found that brain Nav1.1 expression increases with age in a spatial gradient where hindbrain structures express the channel first and neo cortical areas last. These results are validated through two different methods of histology protocols. We are working to expand these results using more quantitative methods including real-time PCR. Such developmental patterns could be directly linked to the progression of seizure types and neurological impairments in Dravet syndrome, a hypothesis that we will test in animal models of the disease. Knowing the timing

of disease progression in specific brain structures will help in the design of therapeutic interventions targeting the functions they support.

FRI-588

MEF2 IN NEURONS

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MEF2, along with various transcription factors, is known to govern important aspects of neural development and synaptic plasticity. Many target genes of such transcription factors have also been identified. Nevertheless, the genome-wide mechanisms that are directly regulated by *MEF2* remain unclear. In this study, we attempted to confirm the target genes identified by ChIP-sequencing using RT-qPCR. Also, we have analyzed the genetic program and mechanisms of *MEF2*, a crucial regulator of activity-dependent synapse development. Overall, our analyses suggest that the ubiquitously expressed transcription factor *MEF2* regulates a broad and intricate transcriptional program in neurons that control synapse development.

SAT-585

EFFECTS OF CHRONIC METHYLMERCURY EXPOSURE ON GLUTAMATE AND GABAA RECEPTOR EXPRESSION ON BRAINSTEM OF ADULT MICE

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Methylmercury (MeHg) is an important environmental neurotoxicant that causes significant damage to the developing and mature nervous system. Studies have demonstrated that MeHg causes alterations in synaptic transmission, $[Ca^{2+}]_i$ homeostasis, and GABA_A receptor (GABA_AR) mediated synaptic inhibition. However the mechanisms underlying MeHg toxicity are not yet understood. In this study, we are focused on determining the effects of chronic MeHg exposure on mRNA expression and protein levels of the $\alpha 1$, $\beta 1$, $\beta 3$, $\gamma 2$, and δ subunits of the GABA_AR; and the NR1 and NR2A subunits of the NMDA receptor (NMDAR) in mouse brainstem. The brainstem is an area rich in motor neurons, a recently identified target of MeHg toxicity. Balb/c mice were exposed to 0 ppm (control) or 5 ppm MeHg *ad lib* in drinking water for 12 months, starting when they were 90 days old. RNA and protein were isolated from 10 mg of brainstem tissue, and quantitative real-time PCR was performed in reverse transcript of the isolated RNA. Relative expression was calculated using the $2^{-\Delta\Delta Ct}$ method, which we normalized to the endogenous control GAPDH and the untreated controls. Chronic MeHg exposure caused alterations in the expression of the GABA_AR and NMDAR subunits studied. The $\alpha 1$ and $\beta 1$ of the GABA_AR were downregulated as well as the NR1 of the NMDAR. However the $\beta 3$, $\gamma 2$, and δ of GABA_AR; and NR2A of NMDAR were close to control levels. Downregulation of GABA_AR and NMDAR subunits could be an indication of the mechanism of MeHg-induced alterations on Ca^{2+} homeostasis on motor neurons.

FRI-601

DEVELOPING A VERTEBRATE MODEL FOR PELIZAEUS-MERZBACHER DISEASE USING *DANIO RERIO*

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Pelizaeus-Merzbacher disease (PMD) is an X-linked disease that is caused by duplication of the proteolipid protein-1 (PLP1) gene. PMD mostly affects young children and infants at an incidence of 1 in 200,000 to 500,000 newborn males. PMD is a leukodystrophy, or disease of the myelin (white matter), with failure of normal myelin development. Our goal is to develop a small, inexpensive vertebrate model using *Danio rerio* (zebrafish) in order to screen for drugs or novel compounds that stop and/or reverse disease progression. The project requires creation of 3 plasmid and transgenic lines. First, we generated a line of zebrafish in which green fluorescent protein (GFP) is expressed and targeted in the myelin (*mbp:egfp-caax*). These transgenic fish will allow live visualization of myelin integrity. Second, we will make a line of transgenic zebrafish in which the *PLP1* gene can be conditionally overexpressed (*mbp:loxP[mCherry]-PLP1-egfp*). Third, we will make a line to control the conditional overexpression by induction of a tamoxifen-dependent (ERT) Cre enzyme event (*mbp:Cre-ERT*). Expression of the different plasmids will use the *mbp* (myelin basic protein) enhancer. We will generate 3 stable transgenic lines of zebrafish for each of the plasmids, and then will intercross them to make a triple transgenic fish. Tamoxifen will then be added to induce Cre function and

characterize the time-course and pathology of myelin degeneration to see if the triple transgenic fish phenocopies PMD. We expect that our model will provide a novel approach to discover drugs to treat PMD.

FRI-600

THE INFLUENCE OF DOMOIC ACID ON GLUTAMATERGIC PROTEIN EXPRESSION IN ORGANOTYPIC BRAIN SLICE CULTURES

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Domoic acid (DomA) is a marine neurotoxin and an analogue to the excitatory neurotransmitter glutamate. At high doses, it acts as an agonist of the glutamate system in exposed marine wildlife and humans. Acute, high-dose exposure to DomA is well documented and known to cause severe neurological damage and, in some cases, death. The neurological effects of chronic asymptomatic doses, however, are not well understood, which is alarming since chronic low-dose exposure is likely far more common than symptomatic acute exposure. The objective of this research is to examine whether chronic low-dose DomA exposure results in altered regulation of certain glutamate-related proteins. Immunohistochemical staining will be used to examine AMPA receptors, glial glutamate transporters, and neuronal nuclei in organotypic brain slice cultures from mice. This will allow quantification of protein expression levels and cellular location in DomA-exposed tissues compared to control samples. The expectation is to find a downregulation of AMPA receptors after prolonged low-level exposure to DomA based on reports from a study of DomA-exposed zebrafish. It is also expected that there will be no measurable change in the total number of neurons present in the DomA-treated samples compared to controls; this will confirm that the dosage was appropriately asymptomatic and did not damage the tissue. Overall, these results will help demonstrate in a brain model system that low-dose DomA exposure produces measurable alterations in the glutamatergic system. Subsequent studies will then explore the functional consequence of these DomA effects.

SAT-598

IS GONADOTROPIN-RELEASING HORMONE-II HYPOPHYSIOTROPIC IN BIRDS

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Gonadotropin releasing hormone II (GnRH-II) is a neuropeptide located in the midbrain and involved in the sexual behavior of vertebrates. Neuropeptides synthesized and stored in the hypothalamus influence hormone release from the anterior pituitary gland via the median eminence and hypothalamo-hypophyseal portal system. Since GnRH-II cell bodies are located outside of the hypothalamus, it is unknown whether GnRH-II acts on the pituitary gland to cause gonadotropin release. GnRH-II can cause release of gonadotropins from pituitary cultures, but whether this occurs *in vivo* has not been determined. There is some immunocytochemical evidence for the presence of GnRH-II in the median eminence of quail, but these data are controversial. To determine if GnRH-II neurons are truly hypophysiotropic in a songbird (zebra finch), we made use of the retrograde fluorescent tracer Fluoro-Gold. After peripheral injection, Fluoro-Gold circulates through the blood and enters the brain via axons that project to the hypophyseal portal system in the median eminence. In theory, any hypophysiotropic neuropeptide neurons should be labeled as a result. In order to visualize cell bodies that had taken up Fluoro-Gold, immunocytochemistry was performed using Fluoro-Gold primary antibody. All neurons containing Fluoro-Gold were immunolabeled, and a second primary antibody specific to GnRH-I and II was used to identify GnRH-II cells. Finally, the routes of these neural projections will be traced. Data are still being analyzed. If it is determined that these neurons contact the median eminence, it will provide unequivocal evidence that midbrain GnRH-II could act on the pituitary directly to control avian reproduction.

FRI-586

LOCALIZATION OF SIRT3 IN THE ENTERIC NERVOUS SYSTEM IN HEALTH AND DISEASE

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Oxidative stress is a contributing factor in the development of inflammatory bowel disease (IBD). Increased production of reactive oxygen species and decreased antioxidant defenses contribute to disease pathology in both humans and animal models of IBD. Oxidative stress promotes the death of enteric neurons, leading to permanent gut dysfunction. The mechanisms that render enteric neurons susceptible to oxidative stress are unknown. Sirtuin3 is a mitochondrial protein that plays a role in antioxidant defenses. Given that Sirtuin3 expression is high in nervous tissue and

visceral organs, we hypothesized that Sirtuin3 is expressed by enteric neurons and that altered Sirtuin3 expression is associated with IBD. We tested our hypothesis using immunohistochemistry to localize Sirtuin3 in the enteric nervous system of healthy and diseased (DNBS-colitis) mice. We performed dual-labeling with Sirtuin3 and the pan-enteric neuron marker Hu or enteric neuron subtype markers neuronal nitric oxide synthase (nNOS) and calretinin to determine the extent of Sirtuin3 expression in the enteric nervous system. We find that Sirtuin3 is expressed in 86% of all myenteric neurons: 58% of Sirtuin3 positive neurons colocalize with nNOS and 41% colocalize with calretinin. Overall, the percentage of Sirtuin3-expressing neurons declined by 21% following DNBS-colitis. Losses of both nNOS and calretinin neurons contributed to the loss of SIRT3-expressing neurons as the percentage of Sirtuin3 neurons expressing calretinin declined by 11% and those expressing nNOS declined by 9%. Our results indicate that Sirtuin3 is expressed in a subset of enteric neurons and that it may contribute to neuron susceptibility in inflammatory bowel disease.

SAT-587

THE ROLE OF THE MAUTHNER NEURON DEPENDENT ESCAPE RESPONSE IN LONG DURATION RAMP WAVE AUDITORY PULSES

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The use of zebrafish as a model organism is advantageous due to their rapid reproduction rate, the transparency of its larvae and its simple neural circuitry. Their neural circuitry can be easily studied in experiments focusing on understanding the underlying mechanisms of learning and memory. Zebrafish larvae exhibit a rapid escape (C-start) reflex when presented with an auditory stimulus that triggers Mauthner cell (M-cell) circuitry. The C-start reflex can be easily habituated through repeated auditory stimulation. Previous experiments have used short tone bursts to elicit the C-start response, however, these short duration tones most likely fail to activate the zebrafish feedforward inhibitory circuit. This problem can be remedied by creating longer duration ramp waves. Using laser ablation of M-cells, we will determine if C-start escapes elicited by long duration auditory pulses requires the M-cell. This project will expand on research pertaining to inhibitory plasticity models and potentially open new avenues to molecular and mechanistic understanding of short-term and long-term memory.

FRI-594

ANALYZING THE ADDICTION CIRCUIT IN THE BRAIN USING BACTRAP

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Drug addiction is characterized by 3 main stages: compulsion to seek/take the drug, loss of control limiting intake, and emergence of a negative emotional state. Various studies have shown distinct circuits mediate each stage of addiction. Our goal is to target distinct neuronal subpopulations within these regions to more specifically understand the microcircuit responsible for each stage. By using bacterial artificial chromosome (BAC) transgenic mice that can express GFP-tagged ribosomal protein L10a (GFP-L10a) in a defined cell population, a methodology was developed for affinity purification of polysomal mRNAs (bacTRAP) from genetically defined cell populations. Using adeno-associated viral-mediated delivery, neurons projecting to the ventral tegmental area, an area well studied for its role in addictive behavior, are examined through tracing studies. Follow-up experiments using this information for bacTRAP analysis following exposure to cocaine provides information on the neurons that make up the microcircuit. Expression of c-Fos by neurons is a useful marker of cell activation and staining these proteins is a useful technique for mapping of the addiction circuit in the brain. Expression of GFP-L10a using the c-fos promoter will allow more relevant characterization of the neurons involved in cocaine exposure. To test this, the lab generated transgenic mice by replacing the coding region of the target gene in the BAC with the transgene cre recombinase upstream of the start codon by homologous recombination in bacteria. Introduction of cre-dependent GFP-L10a using adeno-associated virus under the control of the c-fos promoter provides a way of examining the activated neurons in cocaine addiction.

SAT-589

PREFERENTIAL SELECTION OF HIPPOCAMPAL CA1 PYRAMIDAL CELLS BY PARVALBUMIN BASKET CELLS

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The hippocampus is a brain structure known to play key roles in memory, spatial navigation, and neurological disorders. Its major output station is the CA1 region where neurotransmission occurs between interneurons and pyramidal cells (PC). Studies have attempted to classify CA1 PCs despite their reputation for being homogenous. So far, PCs have been grouped as superficial PC (SPC) or deep PC(DPC) based on their somatic positioning from the border of the stratum radiatum and the stratum pyramidale sublayers: SPCs lie within 50 μ m from the border while DPC lie beyond 50 μ m to 150 μ m. Also found in the stratum pyramidale are GABAergic interneurons, like the parvalbumin basket cell (PVBC), which make synaptic contacts on the soma and proximal dendrites of PCs. Differential, layer-based inhibition from PVBCs to both types of CA1 PCs remains unexplored. Preferential selection of PVBCs to CA1 PCs via GABAergic neurotransmission would suggest that heterogeneity is critical for the modulation. We hypothesize that differential GABAergic inhibitory regulation of CA1 PCs could be layer specific. In this study, we focus our attention on the number of synaptic contacts from biocytin-filled PVBCs to CA1 PCs across the stratum pyramidale. We tested this hypothesis by visually counting synaptic contacts between PVBCs' axon and S/DPCs' perisomatic area, which averaged to 4.8 for 5 SPCs and 9.35 for 6 DPCs. This indicates that PVBCs preferentially target DPCs, suggesting differential innervation between DPCs and SPCs. This could play a crucial role in regulation of CA1 PC output, suggesting differential inhibition of PVBCs to SPCs and to DPCs.

FRI-599

DETERMINATION OF A GENETIC ETIOLOGY OF CEREBRAL SINOVENOUS THROMBOSIS THROUGH EXOME GENOTYPE ANALYSIS

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Cerebral sinovenous thrombosis (CSVT) is a rare form of cerebrovascular disease which accounts for approximately 1% of all strokes with mortality around 10% to 13%. The disease remains a major diagnostic and therapeutic challenge given the diversity of symptomatic presentation and variety of etiological factors. Genetic predisposition to clotting is suspected but only proven in a small proportion of cases. To date, there is no well-characterized DNA repository for CSVT cases and unaffected controls. Our study identifies patients through retrospective chart review of patients hospitalized for CSVT and spousal controls or controls from clinic without CSVT. Case patients include any CSVT patient over the age of 3 months. Control patients are 18 years of age or older, with no history of clotting issues. First, identified patients' consent for permission for a blood draw is needed. Then DNA is extracted from the blood and is sent to collaborators in the United Kingdom for an exome genotype analysis to find associations between genotype and case/control status. Initial data results show 188 total CSVT cases, 115 female and 73 male, admitted to the University of Utah Hospital between 2000 and 2012. Of the 188 total patients, 174 survived. Ages ranged from 16 to 81 years of age. Comprehensive investigation into the genetics of CSVT holds the potential to identify at-risk groups, determine prognosis, and support development of novel therapeutic interventions.

SAT-593

SEX DIFFERENCES IN THE CLINICAL EXPRESSION AND RESTING STATE BRAIN CONNECTIVITY IN BIPOLAR DISORDER

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The course and expression of bipolar disorder (BD) clearly differs between women and men. Previous studies have observed sex effects in connectivity of the default mode network (DMN) of healthy individuals, but more research is needed to see whether a similar effects holds among BD patients. This study investigates how sex differences in DMN activity among BD I patients compared to individuals without BD and how sex differences may relate to clinical or cognitive differences in BD. We compared 21 euthymic patients with bipolar I disorder to 29 age and gender comparable healthy participants using functional magnetic resonance image during a period of eyes-open rest. Averaged functional activity between the nodes of the DMN (medial prefrontal cortex, posterior cingulate, and bilateral angular gyrus) revealed that BD females tend to have greater connectivity within the default mode network than male BDs, contrasted with the pattern of greater connectivity among male healthy participants compared to females ($p = .08$). This interaction was significant for the connections between the right angular gyrus and other nodes in the

network ($p = .02$). Negative psychotic symptoms were more pronounced in male than female bipolar participants ($p = .03$). There was a trend for a negative relationship between right angular gyrus connectivity and negative symptoms [$r(19) = -.35$, $p = .11$], and a significant negative correlation of average DMN connectivity with negative symptoms [$r(19) = -.44$, $p = .05$]. These results suggest subtle sex differences in the interrelationship of resting brain activity within the DMN that may relate to clinical differences between men and women with bipolar disorder, including severity of negative psychotic symptoms.

SAT-595

EFFECTS OF DIET ON DRUG REWARD IN FEMALE RATS

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Reports suggest that after bariatric surgery, the rate of drug and alcohol use increases. Because dopamine mediates the effects of both food and drugs, the question of whether or not altering diet would have an effect on drug reward was posed. In these experiments, animals received high fat (HF), control (CF), or high fat followed by control (HF/CF) food. We predicted that rats in HF food would develop less sensitivity to cocaine whereas HF/CF and CF rats would have higher sensitivity. Condition place preference (CPP) was performed starting on day 32. The apparatus had 2 sides. During the pretest (day 1), rats were placed in the box with no divider and allowed to roam freely on both sides for 30 minutes. On days 2 to 4, rats were injected in the morning with saline and placed on the side they preferred during the pretest. In the afternoon, they were injected with cocaine (1 to 10 mg/kg) and placed on the side they least preferred. After 3 days of training, rats were placed in the boxes without dividers to determine preference. Cocaine was more potent as a reward in the HF/CF rats with significant reward observed at 3 mg/kg. In contrast, the lowest dose at which reward was seen in the CF and HF groups was 5 mg/kg cocaine. The hypothesis was supported because each group did react differently to cocaine. High fat food decreased sensitivity to cocaine whereas being placed on a diet after exposure to high fat food increased sensitivity.

FRI-603

HUMAN RETINAL PROGENITOR CELLS AS A THERAPY FOR DEGENERATING PHOTORECEPTOR CELLS

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Retinal photoreceptor degeneration is the common cause of blinding conditions such as retinitis pigmentosa that, up to date, has no true treatment. Our lab is focusing on the effect that human retinal progenitor cells have on existing photoreceptor cells in retinas that are suffering from photoreceptor degeneration. We expect the hRPC (human retinal progenitor cells) will have therapeutic effects on the retina by salvaging photoreceptor cells that would have otherwise degenerated. We will be using the animal model RCS (Royal Collage of Surgeons) rats as subjects, which exhibit the characteristic of a heritable gene mutation responsible for retinal cell degeneration. These rats are going to be injected with hRPC on postnatal day 30. On postnatal day 90, we will examine the effects that the hRPC had on the subject's retina by first embedding the eyes in OCT and then cutting frozen sections of the retina. We will use methods of immunohistochemical labeling (anti-human antibody) to identify the progenitor cells and the nuclear stain hemotoxylin and eosin to tally the remaining photoreceptor nuclei. In an inflicted subject, most of the photoreceptor cells will have degenerated by postnatal day 90 so we could examine if the presence of the hRPC had an effect by counting how many photoreceptor cells have been preserved in the animal retina. We then are able to determine if the hRPC had a therapeutic effect on the inflicted retinas. The progenitor cell's rescue potential can then be determined.

SAT-602

C. ELEGANS MODEL OF AMYOTROPHIC LATERAL SCLEROSIS: UNDERSTANDING THE ROLE OF TDP-43 AGGREGATION AND ITS EFFECTS ON HSN MOTOR NEURONS

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Neurodegenerative diseases such as amyotrophic lateral sclerosis (ALS) also known as Lou Gehrig's disease, are often characterized by a loss of neurons that lead to death. It is hypothesized that the aggregation of the protein TDP-43 is what leads to degeneration of motor neurons. The nematode *C. elegans* provides a neurodegenerative model for ALS that can be used to perform behavioral assays that monitor motor neuron function. This model was made by cloning the human version of the *TDP-43* gene under a pan-neuronal promoter. Taking advantage of the transparency of *C. elegans*, the human TDP-43 was tagged with a YFP (yellow fluorescent protein) to provide visual representation

of its aggregation during development and aging. Behavioral assays were performed to monitor TDP-43 and the effects of its aggregation in hermaphrodite specific neurons (HSN), which are responsible for the reproductive success of *C. elegans*. According to the preliminary data obtained, there are changes in egg laying rates between wild-type animals and animals expressing TDP-43. Observed changes in egg laying rates suggest defects in HSN motor neurons. The data supports the hypothesis that TDP-43 aggregation leads to neurodegeneration. Our studies using this *C. elegans* model will enhance our understanding of TDP-43 and neuronal defects associated with ALS.

FRI-626

PROLONGED HABITUATION: LONG PULSE RAMP WAVE ELICITS FEEDFORWARD INHIBITORY CIRCUIT IN ZEBRAFISH LARVAE

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Zebrafish larvae are beneficial model organisms for investigating the neurobiological basis for elementary learning. Zebrafish are especially useful because of their rapid development and reproduction. Their transparency in the larval stage makes them appropriate for investigating neuronal function using optogenetics. Zebrafish larvae demonstrate a rapid escape reflex (the C-start), which is mediated by a simple neural circuit located in the brainstem and spinal cord consisting of Mauthner (M) cells. This neural circuit readily lends itself to neurophysiological analyses because of its relative simplicity. Previous research established distinct forms of habituation of the C-start reflex in response to auditory stimuli. Habituation is a nonassociative type of learning in which an organism's responsiveness to a stimulus is decreased after repeated exposure to that particular stimulus. The current research uses a long-duration tone that gradually increases in intensity instead of a short tone burst to induce longer lasting habituation. These long duration tone bursts may elicit a feedforward inhibitory neural circuit that is not elicited by short tone bursts. A high-speed camera captures the images of the larvae while they are exposed to this long duration tone to determine if the larvae exhibit a C-start reflex. Preliminary results indicate that the use of a long-duration tone causes an increase in the strength and duration of habituation. This research may yield insights into the role of inhibition in simple forms of learning and memory.

SAT-594

MECHANICAL CHANGES CAUSED BY CORTICAL SPREADING DEPRESSION

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Cortical spreading depression (CSD) is a slowly propagating wave of neuronal and glia depolarization involved in several neurological disorders including migraine, stroke, and brain injury. The physical displacement of the neural tissue associated with the wave is an important component of CSD that has not been previously quantified. Regarding mechanical changes at the cellular level, it was shown that CSD causes neuronal and astrocytic swelling but only for a short time after the passage of the depolarizing wave has been analyzed, even though the effects of CSD on brain tissue last at least an hour. In this work, we characterized physical changes in the brain as a result of CSD using *in vivo*, 2-photon excitation microscopy. Genetically modified animals expressing green fluorescent protein in interneurons (GAD67-GFP Δ neo) allowed tracking of the position of interneurons as the wave progresses. In addition, the use of a dye that is specifically taken up by astrocytes (sulforhodamine 101) allowed simultaneous measurements of cell volumes in interneurons and in astrocytes. Three dimensional images at different time points before and after CSD were reconstructed from Z-stacks of an area with several interneurons and astrocytes. Images were processed in ImageJ by manually thresholding the local area around each cell, and their volumes were calculated 5 s, 30 s, and 1 h after CSD. This study is providing important information regarding the amplitude and duration of the mechanical changes at a cellular level after CSD. Our results could help explain the effects of CSD in migraine, stroke, and brain injury.

FRI-596

DETERMINING THE FUNDAMENTAL UNIT OF SONG IN ZEBRA FINCHES

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Most complex actions, such as speech, are composed of sequences of more basic motor gestures such as syllables or words. Songbirds have emerged as a leading model system for studying how brain circuits produce

such complex sequences. The song of the most widely studied songbird, the zebra finch, consists of repeats of a stereotyped sequence of 100- to 250- millisecond-long vocal gestures known as syllables. Birds startled by flashes of light interrupt their song between syllables, suggesting that syllables are units of song behavior. However, electrophysiological recordings reveal that individual neurons producing 5 to 10 millisecond bursts of action potentials aligned to the song with millisecond precision. Furthermore, there is no evidence that these bursts are organized into syllable-sized units. Our lab has developed software that extracts acoustic features from each 5 to 10 millisecond long slice of song, allowing variations in song behavior to be measured at the time scale of neural bursts. We hypothesize that, if the syllable is the fundamental unit of song, then the song-by-song feature correlations between slices in the same syllable will be stronger than feature correlations between slices in different syllables. We will record a large collection of adult zebra finch songs (>90 days of age, >500 songs per bird), use computer aided software to identify song syllables, and then determine feature correlations. If our hypothesis is correct, it will indicate the presence of currently unknown neural mechanisms that serve to link neural bursts into syllable-based units. (Partially supported by NSF IOS-0951310 and NIH/NIGMS MBRS-RISE GM06065).

NUTRITIONAL SCIENCES

SAT-605

DRIED PLUMS' ABILITY TO PROTECT FROM POST-MENOPAUSAL WEIGHT GAIN DUE TO ALTERATIONS IN GUT MICRO FLORA

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In less than 40 years, the prevalence of obesity in the US has increased by over 50%. In the female population, a deficiency in estrogen due to menopause is similarly responsible for increased adiposity, increasing chances of cardiovascular disease. Studies have shown that body weights of ovariectomized mice fed dried plum were lower than mice fed a controlled diet. Recently, studies suggest that microflora may play a vital role in obesity through their impact on metabolism and energy storage. It has been shown that normal-weight, germ-free mice inoculated with microflora from obese mice had an increase in adipose tissue despite following a low fat diet. The purpose of our experiment is to understand why ovariectomized mice on a controlled diet are experiencing weight gain and increased adiposity, while ovariectomized mice on the dried plum diet are not experiencing these detrimental effects of hormone deficiency. In this study X-week-old mice will either be Sham operated (Sham = 1 Group) or ovariectomized (OVX = 5 groups) and assigned to the following treatments: groups 1 (sham) and 2 (OVX) on a control diet, group 3 with a 25% DP diet, group 4 with DP polyphenol extract diet, group 5 with a DP carbohydrate extract diet, and group 6 a DP polyphenol and carbohydrate extract diet. All 5 diets are isocaloric and contain the same amount of macronutrient. Body composition will be analyzed, food intake will be recorded, and fecal content will be collected and analyzed.

SAT-604

EFFECTS OF DIETARY CHOLESTEROL AND JOJOBA SEED OIL ON HIGH-DENSITY LIPOPROTEIN SUBCLASSES IN NEW ZEALAND WHITE RABBITS

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Atherosclerosis is the leading cause of cardiovascular disease in America. The body's defense against atherosclerosis is the reverse cholesterol transport pathway (RCT), a multistep process that results in the net movement of cholesterol esters by high-density lipoproteins (HDL) from the peripheral tissues to the liver. The characteristic decrease of serum HDL concentrations in hypercholesterolemic New Zealand White (NZW) rabbits is hindered by dietary jojoba oil. We hypothesize that differences among the two main HDL subfractions, HDL2 and HDL3, that maintain HDL level is due to regulation of HDL2 cholesterol esters (HDL2-CE). NZW rabbits were divided into four experimental groups and placed on either a normal chow diet or a normal diet supplemented with either 3% jojoba oil, 1% cholesterol, or 1% cholesterol + 3% jojoba oil. Cholesterol esters were measured one week after the diets were administered. Our results show a significant interaction between the HDL2-CE concentrations and total serum HDL concentration in the cholesterol and the cholesterol + jojoba oil diets, suggesting that the effects of jojoba oil on HDL concentration are due to the regulation of HDL2. (CSU-LSAMP is supported by the National Science Foundation under Grant No. HRD-0802628 and the CSU Office of the Chancellors.)

FRI-604

SCIENCE IDENTITY MEDIATES THE EFFECTS OF TRADITIONAL ELDER SUPPORT IN A STEM COURSE ON STUDENT LEARNING OUTCOMES

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Published literature documents that underrepresented US minorities (URMs) including African-, Latin-, and Native-Americans in STEM fare better if they have a science identity that does not conflict with ethnic identity. Furthermore, it has been shown that URM students may benefit from having cultural mentors. This study will assess the relationship between the presence of traditional Elder educators in a STEM course, student science identity, and course learning outcomes. We hypothesize that science identity will mediate the effects of cultural mentors (Elders) on learning outcomes for all students, and especially for URM students. A short-term, longitudinal study will be conducted on a STEM online course delivered either with or without Elders. Two mainstream research-intensive universities and two tribal colleges/universities will be the sites of the course delivery (May through June 2013). Students who are enrolled in the course may choose to participate in this research approved by appropriate institutional research ethics boards. Participants will take a pre- and post-course survey. We will test for group differences with ANOVA and establish predictor variables with regression modeling using SPSS software. We expect to find that student science identity mediates the effects of cultural support (presence of traditional Elder instructors in an online STEM course) on learning outcomes. We expect to find that science identity and cultural support predict students' learning outcomes in an online STEM course. These findings can impact science education policy, research, and pedagogy to benefit URM students in STEM.

OTHER BIOLOGICAL SCIENCES

SAT-608

IMPROVING ACCURACY OF STEREOTAXIC COORDINATES IN JUVENILE RODENTS

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Currently, the Paxinos Rat Brain Stereotaxic Atlas is used to obtain the optimal coordinates for targeting rat brain structures. However, this atlas is based on an average of mature male Wistar rats and is inadequate for targeting nuclei in young rats at ages postnatal days 14 through 21 (P14-21). The purpose of this study is to obtain accurate coordinates for the subthalamic and pedunculo-pontine tegmental nuclei in female and male rats in this age range. First, we will confirm existing coordinates in mature Sprague-Dawley rats through injection of red dye beads followed by histological analysis of their locations. Then, we will make proportional modifications of the coordinates, using bregma to lambda distance. The coordinates will be adjusted until reliable stereotaxic coordinates are developed for several regions within each nucleus. These findings will allow us to analyze projections to and from subregions of the nuclei in virally-infected neuronal tissue marked with a fluorescent protein. (This experiment is partially supported by NIGMS RISE GM60655, and NIMH.)

FRI-606

THE INFLUENCE OF VISUOSPATIAL ATTENTION ON UNATTENDED AUDITORY CORTICAL RESPONSES

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Recent advances in EEG technology have made it possible to record EEG within natural settings. However, these recordings are difficult to analyze due to movement artifacts and complex environmental stimuli. Using cortical responses to periodic auditory input, these difficulties can be minimized. Such steady-state responses (SSRs) may be measured even when individuals are not attending to the periodic input. We examined whether cortical responses to an unattended auditory flicker are modulated by visuospatial attention. Using the Actiwavetm mobile device, 8-channel EEG data was collected from healthy subjects: N = 6. SSRs to 40 Hz auditory tone bursts (70 dB) were measured while individuals participated in a "difficult" or "easy" visuospatial task: the game Tetris. These SSRs were compared with SSRs when individuals attended to the auditory bursts. SSRs were isolated using Fourier analysis. The 40 Hz SSR was divided by the response within 38 and 42 Hz, generating the signal-to-noise ratio (SNR). The average log

(SNR) was 0.0955 when individuals performed the difficult task, 0.1095 for the easy task, and 0.1304 when individuals attended to the flicker. Thus, the response increased by 14.6% going from the difficult to easy visuospatial task and further increased from the easy task by 19.1% when individuals attended to the flicker. This pattern of results demonstrates the feasibility of using an unattended stimulus to probe an individual's ability to direct attention toward their current task and may be useful in BCI-based interventions to improve behavioral performance in natural and experimental settings.

SAT-471

EXERCISE AND EPILEPSY: ALTERING SEIZURE SUSCEPTIBILITY BY INCREASING THE PRODUCTION OF NEWLY-BORN GRANULE CELLS

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Epilepsy is a lifelong disorder characterized by the production of seizures. There are currently several preventive medications available. In addition, studies have shown that there are more natural methods to prevent epileptic seizures. Exercise after epileptic onset is one such method that reduces epileptic symptoms. However, the mechanism by which this occurs remains unknown. Interestingly, exercise increases the production of newly born dentate gyrus (DG) granule cells (GC). The DG is one of the few regions of the brain highly affected by epilepsy and produces newly born DGGCs. Another interesting fact is that seizures also produce an increase in production of newly born DGGCs, which could be a compensatory mechanism to reduce seizure susceptibility. We examined whether the exercise-induced increase of newly born DGGCs prior to epileptic onset is the cause for the reduction in seizure susceptibility. To test this, mice were separated into control (nonrunning) and running groups, with the latter given running wheels to increase the amount of DGGCs produced. All mice were then injected with kainate to trigger status epilepticus, and seizures were scored using the Racine scale. The increased number of DGGCs within running mice was expected to decrease the severity and frequency of seizures. Our results have shown that exercise prior to epileptic onset reduces the recovery period as compared to control animals. Continuation of our research will allow us to identify whether these newly born DGGCs contribute to exercise-induced reduction in seizure severity.

FRI-607

MORPHOLOGICAL ANALYSIS OF *RANA EVERETTI*

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The purpose of this research project is to identify a cryptic species in *Rana everetti*, a frog species located on Mindanao Island in the Philippine archipelago, through morphology. Previous genetic analysis showed genetic variation within the species and introduced the possibility of 2 distinct species under the same name. Geographical differences also contribute to the hypothesis of 2 distinct species; "real" *R. everetti* is located on Mindanao Island while the cryptic species is located on the island of Negros. Morphological analyses of specimens collected from the archipelago were conducted and determined the validity in the hypothesis. Twenty-five cryptic species and nine "real" *R. everetti* were measured, including both adult males and females. The outcome of this project is the identification of the cryptic species which would lead to its discovery and eventual naming.

SAT-606

CAFFEINE THERAPY'S EFFECTS ON CENTRAL RESPIRATORY CHEMORECEPTION AND ITS ROLE IN SUDDEN INFANT DEATH SYNDROME

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In the United States, the leading cause of death of infants is sudden infant death syndrome (SIDS), the cause of which is still unknown. Caffeine therapy has been effective in reducing the incidence of SIDS in preterm human infants; however, the mechanisms of caffeine's efficacy are unknown. In this lab, an *in vitro* larval *Lithobates catesbeianus* (American bullfrog) whole brainstem preparation is used as a model for the infant respiratory circuit while allowing manipulation for extended amounts of time. Experiments were designed to test the hypothesis that a failure in CO₂ chemoreception in the brain prevents infants from responding to hypercapnic conditions. Gill and lung patterns are monitored in the control and caffeine-treated tadpoles via cranial nerve (CN) VII. The firing rates of neurons in a central respiratory chemoreceptive area are monitored via their extracellular field potentials. The pH-sensitive dye BCECF is used to determine the intracellular pH (pHi) of the target neurons. Experiments are conducted

in normocapnic (bath pH = 7.8) and hypercapnic (7.4) conditions. During hypercapnia, the control motor output increases and is expected to be directly proportional to the firing rate of action potentials and inversely proportional to the pHi of the neuron, self-regulating their pHi. In tadpoles chronically exposed to caffeine, the motor output increases dramatically in hypercapnic conditions, with no regulation of pHi. By performing these experiments, the potential mechanisms underlying SIDS can be studied and alternative treatments to caffeine could be discovered. (Supported by TWD MARC GM07717 and NIH-NCRR 5G12 RR013646-08.)

SAT-607

CONDITIONED TASTE AVERSION DOES NOT REQUIRE CORTICAL MRNA SYNTHESIS

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The neurobiological mechanisms by which memory consolidation occur depend on the type of sensory information and where it is being stored. It has been established that gustatory cortex (GC) is necessary for consolidation of taste memory, yet the physiological mechanisms that underlie this process have not been thoroughly investigated. Findings suggest taste memory acquisition is dependent on cortical protein synthesis, but have left unaddressed the role cortical gene transcription plays in the learning process. Using actinomycin D (Act-D), a broad mRNA transcription inhibitor, we are investigating the molecular underpinnings of taste memory acquisition in GC. During conditioned taste aversion (CTA) training, wherein rats are exposed to a taste paired with malaise, we microinfused Act-D into cannulae bilaterally implanted into GC. Our data suggests that memory consolidation is independent of mRNA synthesis, at least in GC; all animals learned the appropriate aversion to the taste. It is likely that subcortical production of mRNA, presumably in the amygdala, is sufficient to support cortical protein synthesis and establish taste memory.

FRI-605

A PHYLOGEOGRAPHICAL STUDY OF *MABUYA DORSIVITTATA* IN BRAZILIAN FORESTS

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South American montane species are under serious threat from anthropogenic and climatic forces. This analysis examines the patterns and levels of genetic diversity in a broadly ranged skink that belongs to the vastly understudied South American genus *Mabuya*. *M. dorsivittata* (Squamata: Scincidae) is distributed throughout the Brazilian Atlantic Forest mountains, the Cerrado, and the Argentinian Chaco. To describe phylogeographical patterns within this species, I extracted, amplified, and sequenced DNA from 43 specimens distributed across 21 sites. Fragments of 1 mitochondrial and 6 nuclear genes were analyzed, and a Bayesian inference method was implemented to delineate genetic variation and genetic structure. MaxEnt was used to model the species distribution during the Last Glacial Maximum (LGM), a climatically cooler period during which several tropical species' distributions shifted. Distribution models indicate that the range of this species was relatively unfragmented during the LGM. My phylogeographic study indicates high levels of genetic structure and deep genetic divergence between geographically separated populations, reaching up to 10% divergence in the mitochondrial gene. It can be posited that a historical geological divide promoted divergence within *M. dorsivittata*, delimiting two major clades that are geographically separated along the coastal forest (one to the north and one south of the Tietê River). Similar genetic breaks observed in other species occurring in the same region contribute to this hypothesis. Further inclusion of samples from the Cerrado and the Chaco are needed to determine whether similarly deep genetic breaks are found within the remaining species' range.

FRI-608

EWING SARCOMA AND *SMARCB1*

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Ewing sarcoma is a rare pediatric bone cancer. Nearly all Ewing sarcoma tumors have a chromosomal translocation which results in cellular transformation. In addition, Ewing sarcoma tumors with other genetic variations have been identified, including alterations in P53, CDKN2A, MDM4, and *SMARCB1*. Interestingly, *SMARCB1* deletion is characteristic and used in the diagnosis of rhabdoid tumors. *SMARCB1* gene deletion occurs in a small subset of Ewing sarcoma tumors and could lead to a new sub classification of Ewing sarcoma. Currently, the Schiffman Laboratory is investigating *SMARCB1* gene function in Ewing sarcoma. To determine the role of *SMARCB1*, gene knockdown experimentation will be utilized. Previous research from the literature shows that normal cell lines

perish when *SMARCB1* is knocked down. In these studies, loss of cell viability has been attributed to activation of p53 resulting in apoptosis. Preliminary data from the Schiffman Lab suggests that *SMARCB1* knockdown in Ewing sarcoma cell lines also results in cell death. We hypothesize that p53 activation is involved in cell death after *SMARCB1* knockdown. We are testing this hypothesis by comparing knockdown of *SMARCB1* in mutant versus wild-type p53 Ewing sarcoma cell lines. If p53 activation is required for loss of cell viability, then we expect to see cell lines with wild-type p53 perish after *SMARCB1* knockdown and cell lines with mutant p53 survive *SMARCB1* knockdown. These experiments will help us understand the function and pathways downstream of *SMARCB1* in Ewing sarcoma cells.

SAT-609

THE EFFECTS OF METHYLMERCURY ON RNA EXPRESSION OF CALCIUM PERMEABLE ION CHANNELS IN DIFFERENTIATED AND UNDIFFERENTIATED F11 CELLS

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Methylmercury (MeHg) is a globally distributed environmental contaminant that bioaccumulates in the aquatic food chain making it of great concern because eventually it will enter the human diet. Exposure to MeHg causes damage to the peripheral and central nervous systems, producing sensory neuropathies and ataxia, and can contribute to the development of neurodegenerative diseases. Although the mechanisms of MeHg neurotoxicity are not fully understood, MeHg exposure can result in disruption of protein synthesis, synaptic function, and neuronal excitability. MeHg exposure elevates the levels of intracellular Ca^{2+} concentration ($[\text{Ca}^{2+}]_i$) in two phases. Phase 1 consists of Ca^{2+} released from intracellular storage organelles, such as the endoplasmic reticulum and mitochondria. Phase two (P2) results from an influx of Ca^{2+} through ion channels. Investigators have expressed that cell death is preceded by elevated levels of $[\text{Ca}^{2+}]_i$, explaining how MeHg ultimately can cause cell death. However, the application of Ca^{2+} channel antagonists slows the onset of P2 and cell death following MeHg exposure, suggesting expression of Ca^{2+} -permeable membrane proteins makes cells susceptible to MeHg-induced cytotoxicity. In this study, we will investigate how *in vitro* MeHg exposure of F11 cells affects the RNA expression of high-voltage Ca^{2+} channels, low-voltage Ca^{2+} channels, and transient receptor potential ankyrin 1 through RT-PCR assay. The reason to use this cell line is to immortalize the gene products of single neurons that are sensitive to MeHg. Under those circumstances, changes in RNA expression may suggest which Ca^{2+} -permeable ion channels make DRG-like neurons more susceptible to the neurotoxicity of MeHg.

PHARMACOLOGY

SAT-627

RAC1 INHIBITION AMELIORATES OBSERVED COGNITIVE DEFICITS IN FMRP-DEFICIENT FEMALE MICE

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Identifying the causes and pathogenic mechanisms of neurodevelopmental diseases such as fragile X syndrome (FXS) is complex. It has been reported that, in FXS, there is an unusually high density of long, thin, immature dendritic spines accompanied by aberrant long-term plasticity. Our lab has recently demonstrated that, in the brain of FXS mice, there is an over-activation of Rac1, a protein of the Rho GTPase subfamily implicated in neuronal and dendritic spine development. This mouse model also exhibits alteration of synaptic plasticity and deficits in cognition. Since this particular disease is linked to the X chromosome, most of the existing studies, including ours, make use of male knock-out mice. Thus, this study was undertaken to provide analogous studies in FXS female mice. Expression of Rac1 levels was determined in *Fmr1*-KO female mice. Furthermore, *Fmr1*-KO female mice were treated with a Rac1 inhibitor and subjected to behavioral and morphological studies to determine whether 1) similar alterations to the ones observed in males exist, and 2) modification of the levels of Rac1 could rescue these deficiencies. We observed that pharmacological inhibition of Rac1 indeed ameliorates cognitive deficits observed in untreated *Fmr1*-KO females, as measured in a fear-conditioning paradigm. This suggests that Rac1 activity may contribute to FXS etiology in both male and female and that Rac1 could be involved in the mechanism responsible for the deficient neuronal morphology, perturbed synaptic plasticity, and cognition impairment associated with this disorder.

SAT-610

CHARACTERIZING A NEW PATHWAY IN NUCLEAR QUALITY CONTROL

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Proteins have a three dimensional structure that allows for their specific activity and function. While a protein's structure is usually stable, it can be damaged by physical and/or chemical stresses. Such damage results in misfolding and is often accompanied by exposure of hydrophobic residues. Exposed hydrophobicity can lead to the aggregation of misfolded proteins, which is associated with many prominent neurodegenerative diseases. To avoid these deleterious consequences, cells have evolved protein quality control (PQC) systems that degrade misfolded proteins. In eukaryotes, PQC utilizes ubiquitin ligases to mark proteins with ubiquitin for proteasome degradation. By studying the yeast PQC ubiquitin ligase San1, which is found in the nucleus, we discovered that San1 recognizes misfolded proteins with exposed hydrophobicity minimally equal to 5 contiguous hydrophobic residues. Interestingly, we found that there is another PQC degradation system that recognizes exposed hydrophobicity at a lower threshold than San1. In this study we are trying to understand how this new pathway functions. We took multiple constructs with varying degrees of exposed hydrophobicity to define how broad the substrate specificity for the pathway is. Intriguingly, we found 2 separate pathways, 1 that was ubiquitin dependent and 1 that was ubiquitin independent. Importantly, we found that the ubiquitin dependence changed within two similar constructs that differed by a 24 amino acid deletion. We are exploring this sequence to identify which region defines ubiquitin dependence and independence. Through this study, we hope to gain a better understanding of PQC degradation systems and their methods to preventing severe pathologies.

SAT-611

ANALYSIS OF MITOCHONDRIAL HAPLOTYPES, APOE, AND TOMM40 GENOTYPE WITH ALZHEIMER'S DISEASE

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Mitochondrial dysfunction and decline is well known to be a prominent event in the development of Alzheimer's disease (AD). It has also been strongly suggested that both nuclear and mtDNA variations contribute to mitochondrial dysfunction and AD pathology. Inheritance of the nuclear DNA variant of APOE, the APOE e4, has been known to be a leading risk factor in AD. The *TOMM40* gene, also located on chromosome 19, has been recently associated with AD. Cybrid evidence strongly suggests a role for mt genes in the development of AD. However, previous studies that have investigated mtDNA variation and the risk of AD have gotten mixed results. The objective of this study is to examine the TOMM40, APOE, and haplogroup status of AD and non-AD patients in order to gain a better understanding of the genetic factors that influence AD pathology. This seems to be the first study to assess the TOMM40, APOE, and haplogroup status in association with developing AD. Thus far, primer/probe sets were developed to genotype 8 single nucleotide polymorphisms that distinguish nine common European haplotypes. Using real-time PCR, the haplogroup of 218 DNA samples from AD and non-AD patients were determined. The haplotype data will be combined with genotyping data for APOE and TOMM40, and statistical analysis will soon be used to assess the risk of AD, severity of AD, and age of onset of AD with respect to haplogroup status, sex, and APOE and TOMM40 genotype.

FRI-610

A LIVE-CELL REPORTER THAT DIFFERENTIATES BETWEEN QUIESCENT AND CYCLING CELLS

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One approach to stem cell biology's current limitation to generate sufficient yields of therapeutic target cells is to direct the proliferative expansion of desired cell types after they commit to a specific lineage. Our lab focuses on targeting signaling pathways that trigger cardiac myocyte (CM) proliferation during heart development. Fetal CMs proliferate until the perinatal period where they become arrested in G₀/G₁. This study's objective was to generate a fluorescent-based genetically encoded reporter capable of differentiating between arrested and actively cycling CMs. The Ki67 promoter (Ki67p) previously developed by our lab can distinguish proliferating from quiescent cells. However, using Ki67p to drive *GFP* as a reporter gene results in fluorescent daughter cells due to *GFP*'s long half-life. We hypothesized using Ki67p to drive expression of the fluorescent ubiquitination-based cell cycle indicator (FUCCI) system would enable detection of quiescent (G₀) CMs and CMs in G₁/S and S/G₂/M. The promoter driving the existing FUCCI reporters is constitutively active and cannot distinguish quiescent from proliferating cells that have entered G₁.

To overcome both reporters' limitations, we generated two lentiviral vector constructs with Ki67p upstream of mKO2-hCdt1(30-120) and mAG-hGem(1-110). Using these, we generated a stable double transgenic HL-1 CM cell line that expresses mKO2-hCdt1(30-120) and mAG-hGem(1-110) under control of Ki67p. Examination of time-lapse phase and mAG fluorescence imaging of Ki67p-FUCCI HL-1 CMs with the LumaScope™ 500 indicates selective labeling of dividing cells with mAG prior to cell division. These new reporter constructs will likely enable novel live-cell studies in cardiac regeneration and cancer biology.

PHYSIOLOGY/PATHOLOGY

FRI-615

EFFECTS OF MATERNAL TOBACCO SMOKE EXPOSURE ON ESTROGEN SERUM LEVELS AND SIGNALING IN RAT ADIPOSE TISSUE

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Despite anti-smoking campaigns, the prevalence of pregnant smokers remains high, reaching 18% in the United States and 40% among Native Americans. Maternal tobacco smoking (MTS) results in obesity, specifically among adult male offspring. Obesity is associated with several co-morbidities and adipose tissue dysfunction. Adipose tissue functions are regulated by estrogen receptor alpha (ER α) and estrogen receptor beta (ER β). Lipoprotein lipase (LPL) and perilipin are target genes for ERs. We hypothesized that MTS will alter serum estrogen levels, ER α and ER β abundance, and LPL and perilipin mRNA levels in rat offspring adipose tissue in a sex and adipose depot specific manner. To test this hypothesis, pregnant Sprague Dawley rats were exposed to tobacco smoke or room air from embryonic day 11 until birth (MTS and control groups). The MTS pups were cross-fostered to control dams at birth and both offspring were raised until weaning (postnatal day 21), when they were killed to collect serum and visceral and subcutaneous adipose tissue samples. ELISA, western blotting and real time RT-PCR will be used to determine the serum estrogen, ER α and ER β abundance, and LPL and perilipin mRNA levels, respectively. Our data thus far show MTS decreased serum estrogen levels in both male offspring (-30%, $p < 0.05$) and female offspring (-29%, $p < 0.05$). We speculate that the decrease of serum estrogen levels may be associated with obesity development in the MTS model. We further speculate that the ER abundance will be decreased only in adipose tissue of male offspring, which is consistent with fat accumulation.

SAT-614

HISTONE MODIFICATIONS ON WNT-RESPONSIVE AND STEM CELL SELF-RENEWAL GENES

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The *Wnt10b*/ β -catenin/*Hmga2* axis has been shown to be active in several subtypes of triple-negative breast cancers (TNBC), such as mesenchymal stem-like (MSL), basal-like (BL), and is capable of predicting significant survival outcome. HMGA2 can predict metastasis. However, the role of *Wnt10b*/ β -catenin/*Hmga2* and the underlying mechanism(s) for the aggressiveness of TNBC remain unknown. We found that WNT10B/ β -catenin signaling is deregulated in human TNBC and leads to upregulation of HMGA2. The Wnt inhibitor ICG-001 disrupts CBP interaction with β -catenin, leading to loss of HMGA2-mediated proliferation of TNBC cells by disrupting the protein complex in the promoter regions of Wnt responsive elements (WRE). To investigate the mechanistic role of the β -catenin/CBP complex in mediating potential changes to histone modifications on WREs, chromatin immunoprecipitation (ChIP) assays were performed in cells exposed to ICG-001. Using antibodies against histone H3, Histone 3 lysine 4 trimethylation (H3K4me3), Histone 3 lysine 27 trimethylation (H3K27me3), Histone 3 lysine 18 acetylation (H3K18Ac), and Histone 3 lysine 9 acetylation (H3K9Ac) in MDA-MB-231 cells exposed to ICG-001, revealed rules of a chromatin consistent with transcriptionally "closed" conformation. Decreased changes of transcriptionally active chromatin markers near HMGA2, BMI-1, AXIN2, and c-MYC are consistent with observed loss of proliferation. The results suggest that ICG-001 interference of the β -catenin/CBP complex at WREs alters the histone modification, thus making the chromatin compact and transcriptionally inactive. Our findings may alter therapeutics for the highly metastatic TNBC tumors by specific inhibitors to chromatin modifications.

FRI-619

THE THERAPEUTIC USE OF ATROPINE IN DIABETIC NEUROPATHY

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Diabetic neuropathy, a neurological complication of diabetes, is associated with significant rates of morbidity and mortality and affects both the somatic and autonomic divisions of the peripheral nervous system. Manifestations of diabetic neuropathy include sensory loss, pain, and autonomic dysfunction. Limited therapeutic approaches currently exist for diabetic degenerative neuropathy as pain management procedures do not address the roots of this diabetes-generated affliction. Thus, we aim to investigate the efficacy of approaches to treating diabetic neuropathy. Specifically, we will focus on the use of atropine, an alkaloid and commonly-used drug that affects the autonomic nervous system. To investigate the therapeutic potential of atropine in treating diabetic neuropathy, insulin-deficient (type 1) diabetes was induced in mice via injection of streptozotocin (STZ), producing insulin deficiency and hyperglycaemia within days. By applying atropine to the eyes and feet of mice and later assessing cutaneous innervation in skin biopsies, we will be able to detect any differences in epidermal innervation by measuring intra-epidermal and sub-epidermal nerve fibers (IENF and SNF). Corneal nerve fibers will also be measured throughout the study in live animals by corneal confocal microscopy (CCM). These assays will provide accurate, quantifiable information about degenerative neuropathy in the small sensory fibers innervating the skin and cornea. We predict that atropine will prevent onset of degenerative neuropathy in diabetic mice, supporting use of this drug as a possible therapeutic approach to the treatment of diabetic neuropathy.

SAT-616

PLATELET DYSFUNCTION IN A MURINE MODEL OF DIET INDUCED OBESITY

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Patients with type 2 diabetes mellitus (T2DM) and metabolic syndrome (MS) have increased thrombosis. This increase in thrombosis is thought to contribute to microvascular and macrovascular complications in diabetic patients. The mechanisms responsible for increased thrombosis in T2DM and MS are not well understood. Thrombosis requires the involvement of platelets, small anuclear cells in circulation that, when activated, can form blood clots. Additionally, patients with T2DM and MS have an altered metabolic milieu, which can result in altered cell metabolism. Therefore, we hypothesize that increased metabolic flux in platelets will lead to increased platelet activation induced by agonists. In order to better understand the contribution of platelet dysfunction to increased thrombosis in T2DM and MS, we used a murine model of diet-induced obesity (DIO). We fed mice a high fat diet of 45% fat (HFD) and a control normal fat diet of 10% fat (NFD) for 12 weeks. We monitored weight and performed glucose tolerance and insulin tolerance tests to verify the obese model. Platelets from these mice displayed similar counts, circulating half life, and mean platelet volume. However, HFD mice displayed increased sensitivity towards convulxin, a GPVI receptor agonist, when monitored by flow cytometry. Four out of 10 HFD mice displayed no tail rebleeding following tail lesion, whereas all NFD fed mice rebleed. Together these data indicate that in the murine model of DIO, platelet activation is increased. These studies could lead to therapies that could prevent thrombosis complications in T2DM and MS patients.

FRI-617

ENHANCING THE CHEMOSENSITIVITY OF ENDOMETRIAL AND OVARIAN CANCER CELL LINES TO PACLITAXEL USING AN ADENOSINE A1 RECEPTOR AGONIST

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Endometrial cancer and ovarian cancer are the most common and most deadly gynecological malignancies in the United States, respectively. Despite the advancement of single-agent and combined-agent chemotherapy regimens for these cancers, most tumors eventually develop resistance toward these agents. Therefore, strategies to enhance the sensitivity of tumor cells to common chemotherapies are needed. Adenosine is a small molecule known for its tissue-protective role in numerous tissues and organ systems. Recently, our lab has shown that adenosine's activation of the adenosine A1 receptor (ADORA1) is protective of the integrity of epithelial cells in the endometrium. Studies in breast and colon cancer have shown that cancer cells are more sensitive to chemotherapy agents when they exhibit more epithelial-like features. Thus, we hypothesized that the treatment of cancer cells in combination with

ADORA1 agonist, N6-cyclopentyladenosine (CPA), would cause cells to be more sensitive to paclitaxel, a standard chemotherapy agent used to treat gynecological cancers. To test our hypothesis, we assessed ADORA1 expression by quantitative RT-PCR and cell viability to drug treatments using MTT assays in a panel of endometrial and ovarian cancer cell lines. Two endometrial cancer cell lines, HEC-50 and KLE, and an ovarian cell line, HEYA8, showed significant sensitivity to paclitaxel (0.5 nM) in combination with 10 uM CPA as compared to paclitaxel alone. CPA alone did not induce cell death, which suggests CPA sensitizes cells by another biological mechanism. These preliminary results suggest that the use of CPA may be a rational approach to sensitize cancer cells to chemotherapy agents.

SAT-619

AFTER A COMPLETE SPINAL CORD TRANSECTION TRANSPLANTED OLFACTORY ENSHEATING CELLS (OECs) SURVIVE AND INTEGRATE INTO THE INJURY SITE

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Spinal cord injuries cause a loss of axonal connections across the injury site, which result in the loss of sensory and motor functions. Transplantation of OECs facilitates axon regeneration, neuronal preservation, and functional recovery in rats 8 months after a complete spinal cord transection (spinal rat), yet the interaction of OECs within the injury site is unknown. Following enhanced green fluorescent protein (eGFP)-labeled OEC or control eGFP-fibroblast (FB) transplants in spinal rats, we evaluate the cell survival and migration within the host injury site 1 to 4 weeks post-injury. We hypothesize that OECs will migrate into and integrate within the injury site, preserve neurons, and decrease the size of the lesion. Preliminary data shows no difference in lesion size between spinal rats transplanted with OECs versus FBs. One week post-transplantation both OECs and FBs survived and migrated into the lesion core in all spinal rats. Two weeks post-transection, 67% of OEC-transplanted and 33% of FB-transplanted spinal rats had visible cells, but no cells were found in the lesion core. After 4 weeks, 67% of the OEC-transplanted spinal rats had surviving cells and 33% of them had OEC migration into the lesion core. No FB-transplanted rats contained any transplanted cells at 4 weeks. There were no significant differences in neuronal preservation between rats transplanted with OECs or FBs, but in OEC-treated rats, neurons were found in the lesion core. To date, our findings suggest that OECs survive longer and migrate better than FBs within an injury site following a complete spinal cord transection.

FRI-613

EFFECTS OF HYPOCRETIN ANTAGONIST INTERACTION WITH ISOFLURANE ANESTHESIA ON LOCOMOTOR BEHAVIOR IN MICE

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Hypocretin (HCRT), a hypothalamic neuropeptide, is involved in arousal and wakefulness. HCRT acts in the lateral preoptic area of the hypothalamus, an area that opposes wakefulness by regulating sleep-promoting behavior via inhibitory GABAergic connections. Isoflurane anesthesia has been shown to enhance the effects of sleep-promoting systems through GABAergic pathways. Though much research has been done on the effects of HCRT on wakefulness, the interaction effects of HCRT and anesthesia are relatively underrepresented. Early work suggests that an HCRT/anesthesia interaction with mice will alter the ability to regain posture on foot-paws. In this study we examine recovery from an HCRT-receptor 1 antagonist and the interaction effects with isoflurane anesthesia by measuring gross locomotor movement over a 20 minute time period in an open-field apparatus. The HCRT antagonist will prevent the action of HCRT at the receptor, likely inhibiting typical levels of arousal and wakefulness. We hypothesize that mice given an HCRT antagonist while under isoflurane anesthesia will exhibit significantly less locomotor movement on an open-field test than saline injected mice while under anesthesia. The results of this study may expose a confounding variable of drug interaction that has been overlooked in earlier HCRT research.

SAT-615

INTERLEUKIN-10 ADMINISTRATION TO DYSTROPHIC MICE MODULATES MUSCLE INFLAMMATION AND INCREASES MUSCLE DIFFERENTIATION

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Duchenne muscular dystrophy (DMD) is a fatal disease characterized by muscle necrosis, inflammation, and variability in muscle fiber size. Pro-inflammatory M1 macrophages increase muscle damage by releasing cytolytic free radicals. Subsequently, anti-inflammatory M2 macrophages promote muscle regeneration. Recent findings show

that interleukin-10 (IL-10) can shift muscle macrophages to an M2 phenotype, a change that coincides with muscle differentiation. Ablation of IL-10 from *mdx* mice increased muscle damage and weakness suggesting that increased delivery of IL-10 to dystrophic muscle will decrease pathology. We tested that possibility by injecting *mdx* mice with IL-10 and then assaying pathology. Our findings show M1 macrophages decrease, reflected by reduction in inducible nitric oxide synthase, while M2 macrophages increase, indicated by elevated arginase expression. Additionally, elevated levels of muscle regulatory factor-4 (MRF4) in treated muscles indicate an increase in muscle differentiation. Muscle cell expression of MRF4 is elevated when they are co-cultured with IL-10 stimulated macrophages. Collectively, these findings indicate that IL-10 can promote muscle differentiation through a macrophage mediated process. Further investigation will test whether IL-10 also has a direct effect on muscles. Establishing a relationship between muscle differentiation and IL-10 levels may lead to the development of therapeutic strategies for attenuating the pathology of DMD in human patients.

FRI-616

BPA SLOWS DOWN MEDIAL AND LATERAL GIANT FIBER CONDUCTION VELOCITY AND DISRUPTS REGENERATION IN *LUMBRICULUS VARIEGATUS*

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Bisphenol A (BPA) is a carbon-based synthetic compound used to make certain plastics that are common in consumer goods. Recent studies have shown BPA exhibits hormone-like properties, which has raised concern for its possible hazards. The ability of Bisphenol A to disrupt both neurological function and regeneration were examined in the freshwater oligochaete worm, *Lumbriculus variegatus*. Worms can avoid predator attacks via a rapid shortening response mediated by the medial and lateral giant nerve fibers. *Lumbriculus* also possesses an extraordinary ability to regenerate lost body parts such as might occur after a partially successful predator attack. Noninvasive electrophysiological testing showed that immersion in water containing 10 μ M BPA led to time- and concentration-dependent reductions in the conduction velocities of the medial and lateral giant nerve fibers. Exposure to 10 μ M BPA, measured in 24 hour increments, produced significant reductions in giant fiber conduction velocities ($n = 8$). To monitor regeneration, worms were cut into 3 equal parts and then exposed to BPA concentrations of 10 μ M, 25 μ M, and 50 μ M ($n = 8$ worms per concentration). The regenerating ends were photographed and measured for growth using *ImageJ*. BPA exposure is expected to produce concentration-dependent reductions in the amount of regeneration present from cut surfaces. BPA induces conduction velocity reduction that could reduce the ability of the worm to escape predators, while its effects on regeneration would disrupt the ability of the animal to repair predator-induced damage.

SAT-613

UPPER THERMAL LIMITS OF INSECTS ARE NOT THE RESULT OF INSUFFICIENT OXYGEN DELIVERY

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Most natural environments experience fluctuating temperatures that acutely affect an organism's physiology and ultimately a species' biogeographic distribution. Here we examine whether oxygen delivery to tissues becomes limiting as body temperature increases and eventually causes death at upper lethal temperatures. Because of the limited direct experimental evidence supporting this possibility in terrestrial arthropods, we explored the effect of ambient oxygen availability on the thermotolerance of insects representing six species: *Acheta domesticus*, *Hippodamia convergens*, *Gromphadorhina portentosa*, *Pogonomyrmex occidentalis*, *Tenebrio molitor*, and *Zophobus morio*; four taxonomic orders: Blattodea, Coleoptera, Hymenoptera, and Orthoptera; and multiple life stages: adults vs. larvae or nymphs. The survival curves of insects exposed to 45 °C or 50 °C under normoxic conditions (21% O₂) were compared with those measured under altered oxygen levels 0%, 10%, 35%, and 95% O₂. Kaplan-Meier log-rank analyses followed by Holm-Sidak pairwise comparisons revealed that anoxia sharply diminished survival times in all groups studied. Thermotolerance under moderate hyperoxia (35% O₂) or moderate hypoxia (10% O₂) was the same as or lower than that under normoxia. Half of the experimental treatments involving extreme hyperoxia (95% O₂) caused reduced thermotolerance, and thermotolerance differed with developmental stage. Adult *G. portentosa* exhibited much higher thermotolerance than their first-instar nymphs, but responses from larval and adult *Z. morio* were equivocal. We conclude that some factors separate from oxygen delivery are responsible for the death of insects at upper lethal temperatures.

FRI-611

IMPACT OF ENDOCRINE-DISRUPTING COMPOUNDS ON SEX DIFFERENTIATION IN A TELEOST FISHEric Kessler, Kristy Forsgren.*California State University, Fullerton, Fullerton, CA.*

Chemical contaminants enter the coastal marine ecosystem through a variety of sources including wastewater effluent, agricultural runoff, and urban runoff. Endocrine disrupting compounds (EDCs) interfere with the natural hormones of the endocrine system of organisms by altering their synthesis, secretion, transport, binding action, or a combination of these effects. While the potential for aquatic contamination is evident, an unanswered question is what effects EDC exposure has on embryonic development during sexual differentiation in marine organisms. Given the importance of endogenous sex hormones during reproductive development, our overall goal is to determine if two common contaminants found in the marine ecosystem have the potential to impact sex differentiation during embryonic development in teleost fishes. We hypothesize that zebrafish (*Danio rerio*) embryos exposed to environmentally relevant concentrations of an estrogenic insecticide, carbaryl, and an androgenic herbicide, diuron, will alter the phenotypic sex of fish. Zebrafish embryos will be exposed to carbaryl or diuron and will be compared to a positive control of estradiol or testosterone, respectively, and a negative control (no EDC exposure). Genotypic sex will be determined by measuring gene expression of doublesex/mab-3 related transcription factor 1 in males and forkhead transcription factor L2 in females. Observable phenotypic sex will be compared to genotypic sex to determine if EDCs altered gonadal tissue. Given the increased use of anthropogenic products that may contain EDCs such as insecticides, herbicides, pharmaceuticals, personal care products, and manufactured goods, a more comprehensive understanding of their impact on wildlife is imperative for improving risk assessment in coming years.

SAT-618

SEX CHROMOSOME EFFECTS ON OBESITY AND FEEDING RHYTHMSJessy Martinez, Xuqi Chen, Maureen Ruiz-Sundstrom, Arthur Arnold.*University of California, Los Angeles, Los Angeles, CA.*

Obesity has become a rising problem affecting one-third of the US population. It is connected to conditions such as diabetes, high blood pressure, and cancer. Males and females gain weight differently with males gaining more visceral fat and females gaining more subcutaneous fat. Sex differences in body weight and adiposity have been studied from the viewpoint of sex chromosomes and gonadal hormones. Previous work using the four core genotypes (FCG) model shows that the number of X chromosomes in particular affects weight gain when gonadal hormones are absent. The FCG model is composed of XX and XY mice with testes (gonadal male) and XX and XY mice with ovaries (gonadal female). The XX gonadectomized mice show higher levels of weight gain and adiposity than the XY gonadectomized mice and also show more food intake during their inactive phase than the XY mice. Here the hypothesis was that weight gain and adiposity are a result of a higher intake of food during the inactive phase. To test the hypothesis, mice were prevented from eating during the inactive phase. Two groups were compared, one group of XX mice eating *ad libitum* and another group of XX mice eating only during the active phase. If the XX and XY mice show no difference in weight gain and adiposity when there is no inactive-phase eating, it can be concluded that the number of X chromosomes influences feeding rhythms that might contribute to the accumulation of body fat.

FRI-618

DOES OXIDANT STRESS MEDIATE EFFECTS OF INFLAMMATORY LIPIDS ON PARATHYROID HORMONE RESPONSIVENESS IN OSTEOBLASTSJamie Garcia, Xin Li, Jinxiu Lu, Yin Tintut.*University of California, Los Angeles, Los Angeles, CA.*

A high fat diet over an extended period of time can cause hyperlipidemia. Hyperlipidemia, the consistently high concentration of low-density lipoprotein (LDL), or lipids, in the blood, causes an accumulation of lipid oxidation products in the subendothelial spaces of arteries and bone. Prolonged accumulation of these lipids leads to oxidative modifications and elicits an inflammatory reaction. This project is investigating the possibility that oxidant stress is mediating the pathway from oxidized lipid to parathyroid hormone receptor (PTH1R) expression. This pathway is important because if PTH1R expression is reduced, downstream processes such as osteoblastic differentiation will be affected. Evidence suggests that the presence of hyperlipidemia reduces PTH1R expression. The inflammatory lipids inhibit osteoblastic differentiation and decrease response to intermittent parathyroid hormone treatment (iPTH). The hypothesis is that oxidant stress mediates the effects of inflammatory lipids on PTH1R expression in osteoblasts. Calvarial preosteoblasts (MC3T3-E1) were plated to determine PTH1R gene expression at 2, 4, 6, 8, 10, and 12 days

by real-time RT-qPCR. This PTH1R time-course experiment showed that expression of the *PTH1R* gene peaked after 4 days. MC3T3-E1 cells were also plated and treated with the enzyme xanthine oxidase (5 mu/mL, 10 mu/mL, and 25 mu/mL), and the substrate xanthine (25 uM). Xanthine and xanthine oxidase (XXO) are known to produce oxidant stress. Results showed that PTH1R expression was inhibited in a dose-dependent manner by XXO. Pretreatment of MC3T3-E1 cells with XXO reduces PTH-induced expression of *Nurr1* and *PTH1R*. Our preliminary experiments showed that oxidant stress might be mediating osteoblastic differentiation and PTH1R levels.

FRI-612

A RADIOGRAPHIC GRADING SYSTEM FOR KNEE OSTEOARTHRITIS IN BABOONS

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Osteoarthritis (OA) is a degenerative disorder of synovial joints with several known risk factors in humans. Disease etiology is not well understood, and the disease cannot be reliably diagnosed until late stages. Baboons have skeletons that resemble those of humans in many ways, including development of musculoskeletal disorders such as naturally occurring OA. Our purpose was to develop a radiographic grading system so that OA can be noninvasively imaged in live baboons to track the progression of the disease. Knee radiographs of 47 baboons were analyzed, and a grading system for OA severity was developed based on the grading systems of other model animals and humans. Our grading scale ranges from 0 (unaffected) to 3 (advanced) OA based on the presence or absence of osteophytes, intrajoint calcifications, subchondral bone erosion, and femoral-tibial contact. A blind interobserver analysis yielded a substantial agreement of 74% (n = 94 knees) between two radiograph scorers with a coefficient mean of 0.61. We found slight agreement between our radiographic OA grades and visually assessed severity scores of articular cartilage of the knees of the same animals with a coefficient mean of 0.18. Radiography is currently the standard for diagnosing OA in humans and, because of this, we are applying the imaging technique to baboons as part of the broader research program to establish baboons as model animals for human OA.

SAT-617

INFLUENCE OF VASCULAR ARCHITECTURE ON GENERATING VARIATION IN TRANSLOCATION OF "CANDIDATUS LIBERIBACTER SOLANACEARUM" IN SOLANACEOUS CROPS

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Zebra chip is a new disease affecting potatoes in Central America, North America, and New Zealand. Zebra-chip disease is responsible for millions of dollars in losses to the potato industry. The disease is caused by the phloem-limited bacterium *Liberibacter*, "*Candidatus Liberibacter solanacearum*" and is vectored by the potato/tomato psyllid *Bactericera cockerelli*. To date, little is known about how *Liberibacter* moves through plant tissues from acquisition sites. Studies have shown transport of minerals, hormones, photosynthates, organic compounds, and other signal molecules in phloem tissues is controlled by vascular architecture. We assessed whether vascular architecture influences translocation of *Liberibacter* from the initial site of infection to distant, noninfected plant tissues. Potato and tomato plants were grown under normal greenhouse conditions until plants had 5 fully-expanded leaves. Plant vascular architecture was mapped by excising the terminal leaflet of the second fully expanded leaf and inserting the petiole into a microfuge tube containing 0.25% rhodamine-B tracer dye, and observing the translocation of the dye from the cut petiole. For examination of *Liberibacter* translocation, 5 *Liberibacter*-infected potato psyllids were confined to the terminal leaflet of the second fully expanded leaf for 24 hours. After 2 weeks, all leaves were tested for *Liberibacter* infection using PCR. Results obtained will facilitate the development of effective risk assessments, prevention, and diagnostic strategies for zebra chip disease.

FRI-620

ATRIAL NATRIURETIC PEPTIDE IMPROVES HEARING IN MICE

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Atrial natriuretic peptide (ANP) is a critical regulator of fluid balance that has an important role in hearing. ANP acts via the guanylyl cyclase NPR-A to raise intracellular cyclic guanosine monophosphate (cGMP) concentrations. Decreased cochlear cGMP have been correlated with hearing loss. In the current study, the hypothesis was tested that raising

plasma ANP concentrations increases cochlear cGMP and improves hearing. Adult CBA/J mice with normal hearing were given 10 minutes of intra-arterial saline infusion as a control, followed by an ANP infusion (0.25 ng/g/hr) for a maximum of 30 minutes or an infusion of cyclic ANP (cANP; 60 ng/g/hr) for a maximum of 70 minutes to prevent ANP degradation. Hearing was assessed at 2 to 3 minute intervals using auditory brainstem response (ABR) techniques. Plasma ANP and cochlear cGMP were determined following the infusion. Infusions which increased plasma concentrations > 0.1 ng/mL resulted in hearing improvements of 5 to 20 dB. Hearing improvements reached their peak at approximately 10 minutes after the ANP infusion started and returned to control values after 20 to 30 minutes. In mice infused with cANP, peak improvements were observed approximately 30 minutes after the infusion began and returned to baseline about 60 minutes later. Determination of the effect of increased plasma ANP on cochlear cGMP is the goal of this summer project. The data obtained thus far support the hypothesis that circulating ANP modulates cochlear function via a mechanism mediated by cGMP. [Supported by a grant from the American Otological Society and funding from the Pathways to Advanced Degrees in Life Sciences (NIH/NIGMS R25GM086669)].

FRI-614

ASIC1 CONTRIBUTES TO PULMONARY ARTERIAL REMODELING FOLLOWING CHRONIC HYPOXIA

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Pulmonary arterial remodeling associated with chronic hypoxia (CH)-induced pulmonary hypertension is attributed to the medial hypertrophy and hyperplasia of pulmonary arterial smooth muscle cells (PASMC) which leads to increased wall thickness and neomuscularization of small pulmonary arteries. This response is largely dependent on elevated intracellular free Ca^{2+} ($[\text{Ca}^{2+}]_i$) in PASMC. Recently, our laboratory has demonstrated an important role for the voltage-insensitive, Ca^{2+} -permeable ion channel, acid-sensing ion channel 1 (ASIC1), in mediating enhanced Ca^{2+} influx in PASMC from CH animals. In addition, ASICs have been shown to contribute to migration, proliferation, and apoptosis in many different cell types. Therefore, we hypothesize that ASIC1 contributes to the pulmonary arterial remodeling associated with CH-induced pulmonary hypertension. To test this hypothesis, we assessed indices of CH (4 wk, $P_b = 380$ mmHg)-induced pulmonary arterial remodeling in wild-type (ASIC1^{+/+}) and ASIC1 knockout (ASIC1^{-/-}) mice. Immunofluorescence was performed for antismooth-muscle alpha actin in paraffin-embedded lung tissue sections to determine the number of fully muscularized arteries and the degree of muscularization. CH increased the number of fully muscularized arteries in ASIC1^{+/+} but not ASIC1^{-/-} mice. Furthermore, the degree of muscularization was greater in small pulmonary arteries from CH versus control ASIC1^{+/+} mice. However, such medial hypertrophy was absent in arteries from ASIC1^{-/-} mice. These data suggest that ASIC1 contributes to pulmonary arterial remodeling in CH-induced pulmonary hypertension. To further our investigation, we plan to examine the specific role of ASIC1 in proliferation, migration, and apoptosis associated with this response.

SAT-620

ETHINYL ESTRADIOL EFFECTS ON MALE REPRODUCTIVE BEHAVIOR IN *XENOPUS LAEVIS*

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Previous studies showed that the herbicide atrazine inhibited male reproductive behavior in exposed African clawed frogs (*Xenopus laevis*). Atrazine both reduces androgens and induces estradiol (E2) production. The current studies were designed to determine whether the decrease in androgen or the increase in estrogen is directly responsible for the loss of male mating behavior. Initial studies treated male *X. laevis* with E2 by immersion. E2 had no effect on behavior, but it was revealed that frogs rapidly metabolized E2. We therefore examined 17 α -ethinyl estradiol (EE2) as an alternative to E2. EE2 is a synthetic compound used extensively in oral contraceptives and can affect endocrine pathways that affect reproductive functions. EE2 is degraded and metabolized less easily than E2 because of the ethinyl group in C17; therefore it serves as a better alternative to test the effects of estrogen on the male *X. laevis*. We hypothesize that EE2 will decrease reproductive behavior and male fertility. Clasp behavior, fertility, and testosterone will be measured to assess reproductive success.

PLANT SCIENCES

SAT-621

CHARACTERIZING THE EFFECTS OF SEAGRASS CANOPY ON WATER FLOW ALONG THE TEXAS COASTAL BEND

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Seagrasses are submerged marine plants found along most coastlines worldwide. They form vast underwater meadows whose leaf canopies extend into the water column and provide essential food and habitat for commercially and ecologically important species. The influence of seagrass leaf canopy on water flow is complex and depends on several factors, including seagrass leaf length, shoot density, water velocity, and water depth. We investigated the effects of seagrass canopy and water depth on flow velocity at three locations along the Texas Coastal Bend that experience different flow regimes. Water speed and direction were characterized within and adjacent to natural turtle grass (*Thalassia testudinum*) and shoal grass (*Halodule wrightii*) beds using SeaHorse HOBOWare current tilt meters. Results indicate that presence of the seagrass canopy, species morphology, and water depth influenced water flow at each of the three sites. These results have implications for flow-mediated processes in seagrass meadows such as seed and larval dispersal, nutrient cycling, and sedimentation.

ZOOLOGY/ENTOMOLOGY

FRI-623

ENHANCED REAL-TIME PCR AND GEL ELECTROPHORESIS METHODS TO IDENTIFY FIVE INTERNAL FEEDING TORTRICIDAE OF POME AND STONE FRUITS IN NORTH AMERICA

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Apple, pear and cherry fruits are subject to quarantine regulations and inspection by trading partners to prevent establishment of exotic pests from the United States and other countries. Morphological traits are used to identify fruit-feeding moth larvae, but to identify smaller larvae, DNA analysis is required. Without clear identification of pests in infested fruit, exported products can be rejected or delayed at foreign ports. Using a real-time polymerase chain reaction (PCR) protocol, we are able to identify the 5 most common internal feeding pests: *Cydia pomonella*, *C. latiferrana*, *Grapholita molesta*, *G. prunivora* and *G. packardii*; Lepidoptera: Tortricidae, of apples, pears, and cherries in North America. PCR primers were designed to be specific for each pest species and provide diagnosis in 3 ways: positive amplification of target; specific melt temperature of amplified product; and distinct band sizes in gel electrophoresis. The first 2 categories provide extremely rapid results and the electrophoretic information can act as either confirmation or direct use in laboratories without real-time PCR capacity.

FRI-624

ASSESSING MULTIPLE-PATERNITY IN BROODS OF THE TRAPDOOR SPIDER *BOTHRIOCYRTUM CALIFORNICUM*

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A recent genetic study found no evidence for inbreeding in *B. californicum* populations, despite the potential for adult males to mate with siblings and other relatives in their natal area. Since multiple mating by females is one way to avoid the costs of inbreeding, we are looking for evidence of multiple paternity in *B. californicum* broods. In 2012 and 2013, we gathered 5 *B. californicum* broods and their mothers from the Kenneth Hahn State Recreation Area (SRA), Los Angeles, California. This summer, we have been genotyping each set of mothers and broods for variation at the phosphoglucosyltransferase (PGM) locus. Thus far, 3 of the 4 broods examined have shown a significant deviation from a Mendelian genotype ratio, given the adult female involved and her presumed male partner under a hypothesis of single mating. This is evidence that field-collected *B. californicum* females frequently mate with multiple male partners. During the balance of 2013, we will continue to search for additional sets of mothers and broods from Kenneth Hahn SRA in order to expand our sample size for genetic analysis.

SAT-625

LEG LOSS AND FITNESS IN FEMALE GREEN LYNX SPIDERS *PEUCETIA VIRIDANS*

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Autotomy is the loss of a grabbed or blocked appendage by reflex, which can be followed in some species by regeneration of the lost limb by subadult individuals. Autotomy allows an individual to escape from a predator, to flee from a conspecific during a fight, or to release itself from the exuviae during a faulty molt. The loss of a leg is also a handicap, since it can result in a decrease in mobility, as well as reduced functionality in specific behaviors where this appendage is used (e.g., web construction). While leg loss and its consequences have been studied in many spider species, these studies have often focused on males. Thus, the purpose of this study is to assess the impact of leg loss on reproductive output in female green lynx spiders *Peucetia viridans*. This study is being based on the analysis of leg loss data for 109 adult female *P. viridans* collected from 2004 to 2007 from multiple sites in southern California. Thus far, we have found that females that had lost 2 legs significantly underperformed those who had lost 1 or 3 legs in terms of egg sac weight (ANOVA, $p = 0.018$) and egg number (ANOVA, $p = 0.023$). These findings suggest that leg loss in spiders also has negative consequences for females, in this case, in terms of reduced reproductive performance.

SAT-624

AN EXPERIMENTAL STUDY OF TWO TROPICAL DAMSELFISH IN RELATION TO TIME OF DAY AND STRESS

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Certain species of tropical fishes change their colors in response to time of day and social interaction with other fishes. Patterns of color change in two species of damselfish, the Panamanian sergeant major, *Abudefduf troschelii*, and the Panamanian night sergeant, *Abudefduf concolor*, were studied experimentally at the San Miguel Biological Station, Cabo Blanco Absolute Reserve on the Pacific Coast of Costa Rica. Colors of fish of both species varied over time, from dull, typical nighttime colors, to bright, typical daytime colors. This study shows that color change occurs flexibly in response to changing light levels and is not a simple circadian rhythm. In addition, changes may be brought on by other stimuli. Sergeant majors took longer to change color than night sergeants at dawn, but both had similar changing rates at dusk. When daylight was extended with artificial lights, sergeant majors changed more quickly than under natural light conditions. Behavior, operculum movements, and color change in response to mirrors were assessed in the 2 species. Responses differed in and between species. Individual fish tended to show idiosyncratic responses to the manipulations.

FRI-621

PLATYNECTES REGIMBART: DISCOVERING EVOLUTIONARY HISTORY AND NEW SPECIES

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The study of evolution has led to a myriad of discoveries in many different fields. To continue this pattern of discovery, it is essential that society works toward accomplishing Darwin's dream: to categorize, describe, and find the evolutionary history of every species. Two new species of *Platynectes* have been discovered in Venezuela. The phylogenetics of the genus *Platynectes* has thus far not been determined. It is the goal of this research to describe the 2 new species of *Platynectes* and to map out the phylogenetic tree of genus *Platynectes* Regimbart. To describe the new species, a number of specimens will be carefully observed for distinguishing morphological characteristics, including an in-depth analysis of adeagus structure. For determination of the phylogenetic tree, DNA extractions will be taken from a representative of each species within the genus, as well as from 2 outgroup species. PCR analysis will be used to amplify the DNA, which will then be sequenced. Finally, using the Bayesian statistical model for data analysis, a maximally parsimonious tree will be constructed.

SAT-623

HOST SPECIFICITY OF FRESHWATER SNAILS TO HORSEHAIR WORMS

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In nature, freshwater snails are commonly infected with cysts of horsehair worms or gordiids (Nematomorpha). However, it is unclear if all species of freshwater snails are equally susceptible to hairworm infections. In this study we tested the host specificity of North American freshwater snail species from different freshwater streams in Oklahoma for infections from North American horsehair-worm species. A sample of 20 to 30 snails were collected from each stream and tested to look for horsehair worm larvae or cysts. Our results are not complete as of this time and this project is still in process at the time of abstract submission.

FRI-622

GENETIC VARIABILITY AND FITNESS IN THE GREEN LYNX SPIDER *PEUCETIA VIRIDANS* (ARANEAE, OXYOPIDAE)

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The relationship between fitness and the genetic variability was investigated in the green lynx spider *Peucetia viridans*. In 2010 and 2011, we collected female *P. viridans* and their egg sacs from the Kenneth Hahn State Recreation Area, Los Angeles, California (2010, $n = 60$; 2011, $n = 150$). In the lab, 3 measures of female body condition and 11 measures of reproductive performance were determined for each spider. With samples from both years, we determined the phosphoglucose isomerase (PGI) genotypes for each female using allozyme electrophoresis. Among the 2010 spiders, PGI^{BC} females made more egg sac silk relative to egg sac mass and offspring number than PGI^{CC} females, while PGI^{CC} females invested more in clutch and egg sac mass relative to their own mass than PGI^{BC} females. Among the 2011 spiders, PGI^{BC} and PGI^{CC} females did not significantly differ for any reproductive indices. The fact that significant differences among PGI genotypes were detected in 2010 but not in 2011 could be due to many factors. One factor which differed greatly between years was rainfall; in 2010/2011, Los Angeles had nearly 4 inches more rain than in 2009/2010. Thus, prey items for *P. viridans* may have been easier to find in 2011 than in 2010, resulting in generally heavier females and consequently more minimal differences in reproductive performance among genotypes in 2011.

SAT-626

RELATIONSHIPS BETWEEN FORAGING STRATEGY AND ECTOPARASITE LOAD OF NEOTROPICAL BATS

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Ectoparasites are an important factor in bat health due to emergent diseases. These external parasites usually consist of mites, ticks, and bat flies. Past studies have shown how roosting preference among bats affects ectoparasite load. My hypothesis was that foraging strategy will affect parasite load. Bats were caught at Las Cruces Biological Station in Costa Rica. Ectoparasites were collected using forceps at the time of capture. Preliminary data shows that nectarivorous bats carried more bat flies; however, frugivorous bats appear to carry a larger diversity of ectoparasites. Changes in food availability may change probability of encountering conspecifics and, therefore, transferring parasites to other bats.

SAT-622

NATURAL SELECTION IN THE SOW BUG KILLER SPIDER *DYSDERA CROCATA*

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¹*Loyola Marymount University, Los Angeles, CA*, ²*Mississippi Valley State University, Itta Bena, MS.*

In 2009 to 2010, we determined the phosphoglucose mutase (PGM) genotypes for a large sample ($n = 333$) of *D. crocata* from Kenneth Hahn State Recreation Area, Los Angeles, California. We found that there was a significant reduction or absence of heterozygotes at this locus at 9 of 12 sites in the park. This may be due to selection against heterozygotes. To determine if this was the case, we then documented the representation of heterozygotes and homozygotes among life stages in a new sample of *D. crocata* ($n = 339$) collected in summer 2010. This analysis has shown that while PGM genotype frequencies did not violate Hardy-Weinberg expectations for either adult females or the oldest juveniles, there were significant violations in the form of a reduction or absence of heterozygotes for adult males and younger juveniles. Thus, for juveniles, there is an excess of homozygotes that diminish as they age,

resulting in genotype ratios that match Hardy Weinberg expectations. As for adult spiders, while females are also in conformance with such expectations, adult males are exclusively homozygotes. Although this outcome suggests that natural selection is operating at the PGM locus in *D. crocata*, it is unclear what mechanisms would simultaneously act to disfavor or favor heterozygotes depending on the life stage and/or gender.

COMPUTER/INFORMATION SCIENCES

FRI-354

THE ROLE OF PROVENANCE IN ONTOLOGY MAPPINGGuillermo Flores Jr., Natalia Villanueva-Rosales.*University of Texas at El Paso, El Paso, TX.*

The Semantic Web leverages cyber-infrastructure to integrate and exchange machine-processable information, thus providing a way for scientists and researchers to expose their collected data and allow machines to reason about it. Ontologies provide the means to describe knowledge for a domain of interest with a formally defined language that machines can understand. The advent of different ontologies within the same or different domains has produced a problem of creating different terminology to represent the same real-life concept. Different ontology representations for collected scientific data give rise to heterogeneity, ushering in the problem of how to find correspondences between ontology concepts. Consequently, ontology mapping research focuses on the discovery and representation of the correspondences found between terminologies of different ontologies. Augmenting ontologies with provenance can provide a history of the creation and usage of the data sources and transformations encoded by such ontologies. This research project investigates the elements of the W3C newly developed provenance language PROV, in particular the PROV ontology PROV-O that can be used for ontology mapping. With the use of the domain independent PROV-O, we aim to improve ontology mapping alignments with respect to precision, recall and f-measure. In the initial stage of this project, we have created a hybrid ontology matcher that considers an input PROV-O terminology. Our future work includes the creation of case studies that involve domain-specific and domain-dependent ontologies that include PROV-O metadata, the implementation, and evaluation of our hybrid ontology matcher.

FRI-353

IMPLEMENTATION OF A SLIP REDUCTION ALGORITHM FOR ELECTRIC-POWERED WHEELCHAIRSJorge Candiotti¹, Jorge Candiotti¹, Hongwu Wang¹, Oscar Chuy².¹*University of Pittsburgh, Pittsburgh, PA*, ²*Florida State University, Tallahassee, FL*.

Commercial electric-powered wheelchairs lack stability when driving on slippery and non-slippery surfaces, and they lack features to maintain control in adverse conditions. The goal of this project was to implement a low level control algorithm that prevents electric-powered wheelchairs from slipping. The key idea for the algorithm was to indirectly reduce torque applied to the wheels by reducing desired acceleration when slip occurs. It was believed that less slip would occur when the wheelchair used the slip reduction algorithm than when it used a normal electric-powered wheelchair control algorithm. The control algorithm was initially developed in simulation for different slippery coefficients and user's mass; this was followed by its implementation into the wheelchair's controller. Then, the algorithm was validated by running the wheelchair on a flat surface, with one wheel on a rough surface, and the other wheel on a slippery surface. In this test, the wheelchair attempted to go forward using normal control on one trial, and slip reduction control on another trial. Future experimentation involves implementation of the control algorithm for change in the center of mass and disturbance in free caster wheels. The over-riding goal of this project is to prevent slippage and provide electric-powered wheelchair users increased mobility while maintaining safety.

SAT-350

SIGNAL PROCESSING TECHNIQUES FOR A DIGITAL HEARING AID SYSTEMSylmarie Davila-Montero, Domingo Rodriguez.*University of Puerto Rico at Mayagüez, Mayagüez, PR.*

This ongoing research deals with the problem of designing a hearing aid system using digital signal processing techniques in order to address important issues such as providing algorithmic solutions with ease of programmability and reduced computational complexity. In particular, my research participation in this area centers on the design of signal processing algorithms to treat acoustic signals in order to reduce unwanted noise interference, enhance spectral characteristics, and improve precision of modeled electro-acoustic parameters. This work presents preliminary results in the area of digital filter implementations using the Open Media Application Platform (OMAP) developed by Texas Instruments. For algorithm implementation, we are using the OMAP-L138 C6-Integra DSP+ARM processing unit. The types of filters being implemented are causal finite impulse response (FIR) filters. These filters were selected due to the fact that they are always stable and can be implemented indirectly using fast Fourier transform (FFT) algorithms. Special attention is being given to the analysis, design, and implementation of FFT algorithms used in hearing aid signal filtering techniques. The language of Kronecker Signal Algebra (KSA) is being

used as a mathematical language to formulate the FFT algorithms and to assist in the overall signal processing algorithm development effort.

SAT-343

MATCHING FUNDING OPPORTUNITIES WITH POTENTIAL APPLICANTS

Joshua Hicks, Natalia Villanueva-Rosales.

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According to the United States Federal Government web site USASpending.gov, in fiscal year 2013 there are \$216.8 billion dollars budgeted across its various agencies for research grants, representing not only a great resource for locating research funding, but also a challenge: how to match up grants with qualified potential applicants. In this project, we use modern Semantic Web technologies to help search for appropriate grants. The federal government's current center of aggregation for grant data is the website grants.gov's RDF Site Summary (RSS) feeds. Within these RSS feeds, information is encoded and then exchanged across platforms using the Semantic Web languages Resource Description Framework (RDF) and the eXtensible Markup Language (XML). A custom-made parser built with Java parses the feed and creates an instance of our in-house developed ontology "Grants_by_Category" (GGC), available at http://cybershare.utep.edu/ontology/Grants_by_category.owl. An ontology is a formal description of concepts and their relationships in a domain that allows the use of a "reasoner" to infer implicit knowledge. Using GGC along with 2 other ontologies named "Expertise", containing all areas of expertise, and "Person", containing all potential applicants, a reasoner can then be used to match grants with potential applicants in UTEP based upon their areas of expertise. This data mashup aims to automate the process of keyword searching through grant information released by funding agencies, which is currently done manually. This application is being integrated with UTEP's Expertise System which aims to provide individuals and organizations easy access to innovation, knowledge, technologies, and know-how.

FRI-345

DEVELOPING AN OUCHTERLONY SIMULATOR USING JAVA

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The antigen-antiserum relationship detection is one of the most important aspects in immunology. The Ouchterlony double immunodiffusion technique is extensively used in the field to study this relationship. The problem with this method is that a few days are required to see and analyze the results until precipitates are formed between wells that have been filled with proteins serving as antigens and antisera. The purpose of our project is to develop a simulator to aid in obtaining results from the Ouchterlony technique without having to wait days until the precipitates form. There is one simulator that also tackles this problem; however, it not always available for use. In this simulator, a select number of proteins working as an antigen or an antiserum may be selected. When running, the simulator creates the precipitates if the proteins are fully detected in the form of a straight line (both proteins have the same components) or partially detected (the proteins have at least 1 similar component). The simulator allows the user to put one or two proteins in the same well. The simulator runs as a Java applet on a local server. The list of antiserum and antigens will be called from a database. For future work we are extending the list of proteins in the database and adding more functionality to the simulator such as adding factors to the environment of the simulator (temperature, humidity, etc.).

SAT-344

A COMPUTATIONAL FRAMEWORK FOR THE TIME-FREQUENCY MODELING OF SPEECH SYSTEMS

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This work presents the formulation of a time-frequency acoustic signal analysis framework for the modeling of speech production systems in order to contribute to the study of the clinical assessment of vocal pathologies. The work concentrates on the mathematical modeling of the diverse-coupled physiological subsystems that contribute to the generation of human speech, from lungs, larynx, and pharynx, to nose and mouth. Special attention is given in this work to the time-frequency modeling of the vocal tract which includes a linear, randomly time varying subsystem in its overall transfer function. Our work deals with the use of time-frequency signal analysis tools for the modeling of speech production systems. Time-frequency tools are gaining much attention in the study of speech production systems due to enhanced computational techniques, such as parallel computing, developed to implement of these types of tools. Our particular work centers on the use of novel cyclic time-frequency representations as time-frequency

signal analysis tools and the efficient parallel implementation of these tools for processing very large-scale voice data sets. The MATLAB software package is being utilized as a starting algorithm development environment for this proposed time-frequency computational framework. Parallel implementation techniques are being studied using the pMatlab parallel programming environment.

FRI-348

MODEL EXTRACTION OF MOSFET USING ANNULAR GEOMETRIES FOR RADIATION-ACTIVE ENVIRONMENTS

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Radiation adversely affects MOSFETS by ionizing its isolating material and increasing the conducting carrier concentration underneath the gate. In n-channel devices, this significantly reduces their threshold voltage, shorting out the transistor channel. Annular MOSFETs have been shown to be tolerant to the effects of total ionizing dose, which is the accumulated dosage of radiation across time. However, these devices have the disadvantage that the width of the channel cannot be easily determined and varies with the length drawn. This research focuses on obtaining an automatized industry rated model by measuring and comparing experimental data of monolithic annular and standard geometry MOSFETs and extracting the parameters required for said model. The final product is an automated parameter extractor that has the potential to create a BSIM3 model from a dataset of predetermined test benches. Currently, our work has focused on extracting the threshold voltage, body effect coefficient, and channel length modulation parameter. Experimental data for these parameters are extracted from characteristic curves of drain current vs. gate voltage and drain current vs. drain voltage. Test benches for these measurements have been designed using LabView along with Keithley sources and meters. Both annular and standard geometry transistors were fabricated through MOSIS® using 0.5 micrometer technology. They had a fixed length of twice the minimum size, and the width was varied. Their threshold voltage, body effect coefficient, and channel length modulation parameter were successfully extracted with results within the acceptable limits for the current technology node.

FRI-346

AN EXPERT AND ARTIFICIAL INTELLIGENCE SYSTEMS APPROACH TO FRACTAL RECOGNITION AND RECONSTRUCTION IN C/CLIPS

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Iterated function systems (IFSs) are within a diverse family of fractal and chaotic systems, among the most commonly observed in nature. Readily recognizable examples of such systems include plant limb and crystal growth, animal patterning, river/liquid flow paths, and neuronal and capillary tissues. The basis for IFSs is that of scalable recursive affine transformations, in which spatial patterns are repeated while changes in length, area, rotation, and/or skewing remain proportional or scalably factorable throughout iterations. As a group, fractals are difficult to reduce by any single specific method; theoretically an infinite number of fractal forms and variants exist. Thus we have reduced our scope to the aforementioned IFSs in attempt to circumvent this issue. This project involves the use of C programming language enmeshed with CLIPS, a language developed by NASA for use in the development of expert and AI systems. Our ongoing approach utilizes image recognition/manipulation, artificial neural networks (ANNs), and graphical analysis to extract IFSs from images and translate them into mathematical/algorithmic representations of fractal structure. From such formulae, fractals can then be replotted as images and compared to their originals, using ANNs to correct the fractal translation algorithm until they are within relatively low margins of error.

SAT-345

DEVELOPING A SMART CALENDAR SCHEDULER THROUGH CLOUD COMPUTING TECHNOLOGIES

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The focus of this project is to develop a software-as-a-service (SaaS) time scheduling system based on cloud technologies that help students manage their time efficiently. This system takes into account time management studies to intuitively generate schedules that are easy to follow, and offers the capabilities to make changes to the current arrangement. In the scheduling process, our scheduling algorithm takes into consideration user preferences such as productivity, eating, and sleeping preferred times. The structure of the application consists of a web-based user interface where users log in, add events, and customize their preferences and submit them to have their

managed scheduler generated for them. These schedules are stored on a database and can be exported as an iCalendar file (.ics), a protocol compatible to almost all calendar desktop and web applications or directly to previously existing calendar applications such as Google Calendar. Events are divided into 2 main categories: static and dynamic events. Static events consist of elements such as classes and meetings that are already scheduled. Dynamic events are those events that need to be generated on the scheduling process such as study or project work time. The scheduling process occurs on the server-side Java implementation where events go through an algorithm based on a combination of the Pareto and the Eisenhower Method time management techniques. In addition, the user can choose to have the Pomodoro Technique applied to his or her schedule.

FRI-349

A NEW GRAPHIC USER INTERFACE AND ADMINISTRATIVE INTERFACE FOR TOA MONITORING SYSTEM

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Previously we presented TOA, a network data visualization framework using open source interactive visualization libraries based in NetFlows. In this framework we apply visualization analytics techniques to aid system administrators to monitor complex network infrastructures with big amounts of data, and the possibility to identify anomalies in the network. In this work, we present the new graphic user interface (GUI) and the administrator's interface for the network data visualization framework. The interface manages the system data for the generation of the dictionary that allows the dynamic data mining of the network data, the generation of the graphs, and the GUI menus. Some of the features of this administrative interface are encryption of passwords, assignment of unique session identification, a session timeout that logs the user out of the system if there is inactivity, multiple session notifications that allow the user to close sessions in other machines, and administration levels to create an administrative hierarchy and change the password. We look forward to keep improving and adding features to the interfaces, not only to make them pleasing to the eye but to maintain them securely.

SAT-352

COMPARING AND EXTENDING APPROACHES THAT ACCESS SCIENTIFIC DATABASES THROUGH SEMANTIC WEB ONTOLOGIES

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The increasing amount of scientific data produced and managed using heterogeneous formats and schemas has created the need to automate the access, search, and retrieval of this data. Semantic web technologies provide a promising solution for this challenge through the creation of ontologies that further describe scientific data. The goal of this research is to evaluate current approaches that integrate legacy scientific databases with ontologies. One of the challenges when creating ontologies from legacy databases is that the data is typically migrated into a triple store or an ontology management system, which creates an additional data source to maintain and update. We are investigating approaches that allow us to access these databases with ontologies without migrating them into other systems. We are currently comparing the scalability and expressivity of D2RQ (<http://d2rq.org/>) and Virtuoso (<http://virtuoso.openlinksw.com>) which implement the RDB to RDF Mapping Language (R2RML). To compare these approaches, we are using 2 test scenarios: 1) sensor-generated data for ecological research generated by the Systems Ecology Lab, and 2) data from the Virtual Geocaching project developed at the Cyber-ShARE Center, both located at the University of Texas at El Paso. These projects require the storage and integration of large amounts of heterogeneous data that will be integrated via ontologies as part of our future work. We anticipate that efforts that bridge legacy databases and ontologies will facilitate the adoption of semantic web technologies for the handling and processing of large amounts of scientific data.

FRI-347

THE FEASIBILITY OF USING JAVA REAL-TIME AS THE EXECUTION CODE FOR AN AUTONOMOUS UNDERWATER VEHICLE

Samori Price, Antonia Boadi.

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Autonomous underwater vehicles (AUVs) are very useful devices often used in detection and exploration. AUVs must be able to search, survey, document, and possibly clear dangerous areas that may be too hazardous for humans to explore. They must complete these missions without any human interaction unless the administrator chooses to take

control. During the course of our research, we created a model for an AUV and simulated it in an obstacle course. The model was created using the AUV Workbench simulation software from the Naval Post-Graduate School. With the data gathered from the model and simulation, we were able to use a joystick to simulate controlling the AUV. The joystick holds significance in setting the proper dynamic coefficients for the model's behavior in the simulation. These coefficients are directly related to the real model's features (i.e., center of buoyancy, inertia matrix, etc.) and instrument calibration. I now plan to explore the feasibility of using Java Real-Time to implement a real time system for the project's life-size model. Java Real-Time is important for the AUV to react to situations in a timely manner.

FRI-355

AN INTERACTIVE ASSISTIVE APPLICATION FOR PEOPLE WITH COGNITIVE IMPAIRMENTS

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People with cognitive impairments (e.g., traumatic brain injury, Alzheimer's disease, etc.) usually suffer from various cognitive deficits with memory, attention, planning, and executive functions. These cognitive deficits can limit individuals from completing activities of daily living (ADLs) independently. Among ADLs, cooking tasks have been identified as essential skills for living independently, which can play an important part in an individual's overall health implications, accomplishment in social roles, self-esteem, and sense of control. The objective of this study is to develop interactive surfaces in the kitchen that can give intuitive prompts for people with cognitive impairments when doing multi-step cooking tasks. Our touch-based interactive application is developed based on the WorldKit technology which pairs Kinect's depth camera with a projector to create interactive surfaces. In this application, an interactive kitchen island that shows image lists of required ingredients have been created and different types of prompts (text, audio, and visual) have been enabled according to detected user response activities. Also, we integrate a MySQL database of the kitchen inventory into this assistive application, making it easy to adjust different recipes and kitchen storage. The main parts of the application development have been completed, and further user assessment will be needed. This study presents an innovative method to assist people with cognitive impairments. Through further user assessment of this interactive application, we may be able to improve the functions of this application, identify the efficiency of interactive prompts for people with cognitive impairments, and increase individuals' independence levels.

FRI-350

A WEB SERVICE TO VISUALIZE AND MONITOR NETFLOW DATA USING THE WEB IMPLEMENTATION OF THE SPINNING CUBE OF POTENTIAL DOOM

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The monitoring and analysis of computer networks to detect abnormal network behavior is a complex task for network administrators, which is assisted by the use of visualization analytics. In this work, we present a web-based implementation of the three dimensional cube known as the Spinning Cube of Potential Doom using WebGL and the Three.js library to provide an easy-to-use and access network visualization interface. In the first version of the cube, we worked with NetFlow data stored in an application server. Our current implementation works as a web service to allow the visualization of Netflow data uploaded by users on the internet without the need to install and configure any additional software in their servers. This application allows system administrators to visualize distinct network events such as network and port scanning. Also, a control panel is provided to filter data by network classes. The computing needed for the filtering and parsing of the file is done on the server side; the web browser is only used as the graphic user interface. For future work, we will implement the feature where the user can upload and hold multiple files on the server and select which one to display.

FRI-344

A CONSTRAINT-BASED MODEL TO GENERATE T-WISE TEST SUITES

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University of Texas at El Paso, El Paso, TX.

Having reliable software is a difficult task to achieve. Today, many people rely on software to accomplish everyday life activities. Moreover, software failures can cause significant costs to companies. Software testing is used to find errors before releasing software. Ideally, testing all possible scenarios will result in high confidence that the software is reliable. However, testing all possible scenarios is unrealistic for large systems. Therefore, it is important to determine

a cost-effective and reliable testing approach. In order to accomplish this, common causes of software failures have to be identified. Empirical studies show that most software errors are caused by the interaction between 2 to 6 input parameters. This strategy, called combinatorial testing, leads to generate test suites that include such interactions. This strategy is cost-effective since it significantly reduces the number of test cases generated, when compared to generating all possible test cases, and ensures high levels of reliability. Some of the algorithms developed to generate such test suites include greedy algorithms and genetic algorithms. However, there is no algorithm that can ensure the generation of the smallest set of test cases. The main goal of this project is to generate a t-wise test suite, where t is the number of interactions to be included in the test suite, with the least amount of test cases. To address this problem, we present a constraint-based model that can generate t-wise test suites in an optimal manner. Preliminary results of this model are presented.

SAT-355

THOUGHT-FEELING-EXPRESSION INTERFACES FOR COMMUNICATION AND CONTROL

Khoa Nguyen, Hong Lin, Lucino Flores, Steve Leon.
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Interaction between machines and humans is limited to conscious interaction only. Non-conscious communication such as intuition and perception are reserved for humans. However, Emotiv has changed this by developing a tool by which humans and machines may communicate through non-conscious means. Emotiv has developed the Epoc headset which is a high resolution, multi-channel, wireless neuroheadset. Furthermore, the Epoc uses 14 sensors and 2 references to tune into electric signals produced by the brain to detect a user's thoughts, feelings, and expressions in real time. The objective of this research is to create an application program which is controlled completely by thoughts, feelings, and expressions to perform pre-designed tasks. By doing so, the application will give people the experience of controlling and influencing their virtual environments with their minds. The results of this project will have a wide range of applications in controlling devices with thoughts, feelings, and expressions in real time.

FRI-351

RIZZY THE ROBOT

Antonio Gomez, John Fernandez.
Texas A&M University-Corpus Christi, Corpus Christi, TX.

Over the fall semester of 2012, our team built a 4-wheeled robot named Rizzy from the ground up. The design was entirely our own, as well as all the welding, wiring, and other construction that was necessary. We programmed an Arduino microcontroller to control the motors and to respond to input commands to allow us to steer and accelerate the machine using an Xbox controller. A Microsoft Kinect was mounted to the front of Rizzy to act as machine eyes. RGB along with depth information is transmitted from the Kinect to provide a video display either onto a directly connected laptop or across a wireless network to a remote terminal. In this way, we can drive Rizzy directly with a wired controller or from a remote location. We also programmed a heads-up display to output relevant information to the video display, such as the camera angle. This semester we have many plans to expand its capabilities. Ideally, Rizzy the robot will become a tool for computer science students at Texas A&M University-Corpus Christi to experience writing software and watching it come to life through a robot.

SAT-349

NAVIGATION SYSTEM FOR 3D MODELS

Melissa Greenlee, Ongard Sirisaengtaksin.
University of Houston-Downtown, Houston, TX.

The purpose of this project is to create a program using Microsoft XNA that will allow users to upload any 3D model and navigate through the model. Model navigation will include collision detection to make movement experience more realistic. This program can be used for familiarization with facilities prior to visitation or as a training implement for personnel in case of emergency situations. In addition, this program would be useful in previewing a facility model and determining functionality and aesthetics before construction. The main problem is to develop a collision detection algorithm to detect model objects. A camera object was created for navigation and collision detection. Another problem is placing the camera so it is not placed in the model where it will detect a collision on loading of the model. In order for the developed collision detection algorithm to function properly, the 3D models uploaded must be drawn in a specific way. Another issue encountered was how to ensure that models would load without the camera object initially detecting a collision. Due to this issue, another algorithm was created that uses model vertex information

to determine initial load position of the camera. With the algorithms for collision detection and camera loading, the program created was successful for user navigation and collision detection. Several different models were tested and it appears that any bugs in the program have been resolved. Further testing with more models will bring to light any other program bugs that may need to be addressed.

SAT-351

STRATEGIES FOR PERSUASION IN COMPUTER-MEDIATED DIALOGUES

Brandon DeBord, Mohamed Munir Mohamed Riyaj, Yehuda Gutstein, Rachel Adler.
Northeastern Illinois University, Chicago, IL.

Our research sets out to explore ideal methods to persuade a person through computer-generated dialogue. In order for a dialogue system to construct a successful persuasion strategy, we must first determine which sequence of persuasion strategies work. Based on previous literature on the effectiveness of persuasion in computer-mediated communication, we developed a pattern of persuasive strategies that include emotional positive, emotional negative, rational positive, and rational negative strategies. To determine which sequence of strategies is most effective, we are currently conducting a laboratory experiment to determine how interactive dialogue systems can be most persuasive. We present a Wizard of Oz study where participants interact with a human wizard instead of the dialogue system via a custom-developed web-based chat interface. The wizard will attempt to persuade participants to make a healthy choice and take a free, virtual tai chi class. We will measure the success of our system using different criteria: we will compare their answers to pre- and post-test questions gauging their interest in learning tai chi, we will check whether they print a flyer to receive more information on learning tai chi, and whether they later attend a tai chi class. We will also compare our results to persuasion in a face-to-face setting. The results of our experiment can help dialogue system designers implement ideal strategies for persuasive systems.

SAT-356

AUV MODEL AND SIMULATION USING JAVA REAL-TIME TO DETECT MINES AND OBSTACLES

Chaz Johnson, Samori Price.
California State University Dominguez Hills, Inglewood, CA.

Automated guided vehicles (AGV) are very intelligent robotic-enhanced vehicles, tethered to either land or sea, where pilots control their movement and actions. AGVs are equipped with manipulator arms for grabbing, moving, or placing items in their perspective place. High-definition video and still cameras on the vehicles record images of the land/sea life, precious metals, war mines, geology, and experiments. AGVs can go where humans cannot or should not tread for both investigative and offensive means. The robot is portable and is controlled using either RF (radio frequency) or a tethered line that can send visual or position data feedback to the user. The robot's versatility is remarkable, allowing attachments for additional video monitoring equipment, chemical sensors, distracting devices, and weapons/destructive devices. The vehicles carry a variety of sampling equipment and sensors for collecting information about the land, ocean, and seafloor. AGVs are very effective on land and in the sea; they provide great information during special military operations, search and rescue missions, and recreational use. They must be able to navigate on sand, water, or mud without any human interaction. We will be modeling and simulating a land/sea detection vehicle using a remote controller. By using a remote controller, we will implement a simulation model of a solar powered/remote controlled AGV. The AGV must be able to react to the situation immediately, so a human operated remote controller will help enhance that requirement.

SAT-342

RESDEC: A MOBILE RESISTOR DECODER

Matias Akman, Charles Norona.
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Resistor decoder (ResDec) is an application created on the mobile Android operating system. Its main function is to decode the value of a resistor in an automatic and user-friendly manner. Resistors are one of the most commonly used electronic components and their values are measured in ohms (Ω). These are typically represented by color-coded bands in sets of 4 bands. ResDec's objective is to decode a resistor's value via an image captured using a mobile device. The intended users for this application are people with visual disabilities, such as color blindness, although it could be used for anyone's benefit. This application will help these users to solve a recurrent problem that hasn't had a solution so far. ResDec's current implementation allows the user to take a picture of the desired component and, as a result, the image will be reduced only to the resistor, cutting out most of the unnecessary

background. To achieve this, image processing algorithms and tools like the Haar-Training and a cascade classifier are used. This obtained region of interest (ROI) will be used to quantize the colors of the image. The objective of the quantization is to reduce the amount of colors present to just 13 possibilities, that are used on common resistors. When completed, the image will be composed of only those colors, facilitating the localization of the bands. After this process is successfully implemented the next milestones to address are the localization of the bands and the translation to a numeric value.

SAT-347

SOFTWARE FOR MULTITOUCH TABLE TO ASSIST IN ARCHITECTURE DESIGN REVIEWS

Orlando Nieves, Rafael Arce.

University of Puerto Rico, Rio Piedras Campus, San Juan, PR.

Multitouch technology is a new way to interact with computers. Since its invention, it has been used in touchpads, computer monitors, and cell phones. One of the many applications for multitouch tables is in education, where students can work together to solve problems, and professors can correct students' assignments in an interactive manner. Our project consists of a software application for a multitouch table where architecture professors can electronically correct design projects while the students make recordings of the professors' corrections. The software will emulate the effect of the translucent tracing paper used by architecture professors during design reviews by using layers similar to those used in graphics editing programs. In addition, it will provide various styles and colors of pens, lines, and geometric shapes to assist the professor in his/her corrections. The application works on top of a software stack that includes Community Core Vision to convert images captured by the table's infrared camera into multi-touch gestures; TUIO, an open framework that defines a common protocol and API for tangible multi-touch surfaces; and PyMT, a Python library for developing multi-touch enabled media rich applications. Currently, we have implemented the functionalities of loading and manipulating multiple images simulating the architecture students' designs and drawing on top of them, simulating the professor's corrections. Future work includes implementing the functionality of multiple layers to simulate what is physically done using trace paper over the students' blueprints, saving the professor's marks, and being able to load back the work from a file.

FRI-356

TEMPT: A BLUEPRINT FOR A MORE INTELLIGENT DIALOG SYSTEM

Charla Earls, Abdul Mohammed.

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Artificial intelligence systems are able to imitate human behavior and are being used more and more as advances in capabilities of systems are discovered. This article will focus on the methodology and effectiveness of linguistic accommodation using artificial intelligence systems to persuade a person to take certain actions. Previous studies of face-to-face interaction have shown a person is more apt to take a suggestion from someone who speaks like them. We are testing the effectiveness of this accommodation in computer-human interactions. Our research uses an artificial intelligence dialog system to monitor utterances a user makes. These utterances are then filtered by a program and categorized into stylistic groups. Based on these groups, our system tailors its language to that of the user. The system tailors its language by filtering words from the communications on the subject's Facebook and Twitter profiles. We receive these profiles voluntarily from subjects participating in our research. The language profiles allow us to categorize based on the aforementioned groups and tries to persuade the subject to adopt a healthier lifestyle. We hypothesize that a dialog system is more likely to persuade a human if linguistic accommodation is used. We also hope to prove it is an effective tool of persuasion.

SAT-348

MOBILIZING A VIRTUAL WORLD THROUGH AN ANDROID DEVICE

Raymond Garcia Jr., Scott King.

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Virtual reality has been a fantasy for decades now. Although we have some forms of virtual reality, we have yet to move past the basic keyboard and mouse paradigm. There are systems available, like the CAVE System, which do allow the user to be mobile in a very simple virtual world but only in a small designated area. Our research is aimed at making a virtual world fully immersible with the help of a mobile device and virtual reality (VR) glasses. Gyroscopes on the VR glasses are used to control the orientation of the camera and mobile device sensors will be used to track physical position. Our initial application is a virtual representation of a building local to our campus on an android

device allowing the user to explore the building by walking around using only what is shown on our VR glasses. This research can be used for training professionals in a hands-on manner to offer a valuable real experience. It could also be used in education. Students can be immersed into a virtual representation of what subject they are learning which can greatly aid in their retention.

SAT-354

MACHINES EMULATING HUMANS: A PERSUASIVE DIALOGUE MANAGEMENT SYSTEM

Abdul Rahman Mohammed, Timothy Nguyen, Lathaniel Mejias, Francisco Lacobelli.

Northeastern Illinois University, Chicago, IL.

Persuasion is omnipresent in human dialogue. For example, a friend trying to persuade another that he has found the best pub in town; or a doctor trying to persuade a patient to take her medicine. However, persuasion is hard for automatic dialogue systems. Our research aims to build a dialogue system that can emulate persuasion strategies present in human interaction. By examining the way in which humans use emotional and rational persuasion strategies in conjunction with positive and negative framing, we build a probabilistic model that mimics human interaction. In order to switch strategies, the system will be constantly monitoring features of the dialogue such as sentiment. In addition, there is evidence to suggest that mirroring the interlocutor's linguistic styles results in a more pleasant conversation. Therefore, our dialogue system can produce utterances in a variety of linguistic styles to accommodate the users. We hypothesize that the dialogue system will be more successful at persuasion when it uses both the model of persuasion strategies as well as linguistic accommodation. We analyze the interactions using standard satisfaction metrics derived from log files and surveys. In this research, we quickly describe the study that leads to our model of persuasion strategies and we detail the components of the dialogue system. Finally, we present the results of a study in which the system tries to persuade users to make a healthy choice in their lives that they probably have not considered previously.

SAT-353

A VIRTUAL GEOCACHING BACKEND: DATA INTEGRATION WITH A CONTENT MANAGEMENT FRAMEWORK

Karina Valtierra, Natalia Villanueva-Rosales.

University of Texas at El Paso, El Paso, TX.

The Virtual Geocaching project aims to promote the use of remote sensing satellite data, Visible Infrared Imaging Radiometer Suite (VIIRS), to create a science, technology, engineering, and mathematics (STEM) learning experience for students through a gaming environment. Virtual Geocaching mirrors the real-world treasure hunt by using satellite data to provide clues leading to a hidden virtual location. The focus of this project was on using a semantic-based approach with a content management system to facilitate data integration and management. As part of this project, we followed database-design best practices to redesign the database backend prototype of the game's website to be embedded into Drupal, a widely used content management framework (CMF). During this project, we focused on combining our own database with the default Drupal database. By following database-design best practices, we developed a normalized database that integrates the legacy information from the first prototype, the information required to manage the new Virtual Geocaching version, and external data sources required for the geocaches. Even though there are still large amounts of data to be processed for the Virtual Geocaching project, the use of a content management framework, such as Drupal, has given an insight into how they can be beneficial for data integration and management practices. Future steps include the integration of external sources with heterogeneous formats through semantic web technologies.

SAT-357

DEVELOPING TOOLS AND TECHNIQUES FOR UNDERSTANDING THE BRAIN AND BODY AT WORK

Jenny Sanchez¹, Kyung Su², Kay Robbins².

¹*University of the Incarnate Word, San Antonio, TX,* ²*University of Texas at San Antonio, San Antonio, TX.*

This research develops multilevel/ hierarchical models to account for subject differences in electroencephalograph (EEG) data. We evaluate the effectiveness of these models in several different task classification problems using R and MATLAB. Our models are based on previous recordings from Schalk, G, et al., and Goldberger, Al, *EEG Motor Movement/ Imagery Dataset*. Previous research has shown highly variable performance of classifiers across 109 subjects and 14 tasks. Multiple tasks include both body and eye movements. We expect our models to allow the capability of predicting which brain signals, from a certain category of individuals, are responsible for a particular task.

By modeling subject differences, we hope to improve the effectiveness of brain-computer interfaces (BCI) in practical settings supporting individuals with motor disabilities and overall physical limitations.

FRI-343

A SCALABLE DATA MANAGEMENT SYSTEM FOR ECOLOGICAL RESEARCH

Alla Dove, Christine Laney, Natalia Villanueva-Rosales, Craig Tweedie.

University of Texas at El Paso, El Paso, TX.

Ecologists are addressing complex research questions that require data collected over large spatial and fine temporal scales. To acquire such datasets, researchers are deploying diverse automated sensors to augment and, in some cases, replace manual data collection. Sensors can collect continuous data streams for sustained periods at relatively low cost. However, increased sensor deployment has presented new challenges to ecologists including the management of complex datasets, data integration, and data discovery, access, and sharing. Of benefit to ecologists is a relatively simple data-management system that is free, modular, and scalable. Such a system would ideally provide an interface for data entry or import, a backend database for data storage and documentation, and a web interface for data visualization. In an attempt to manage the data collected by UTEP's Systems Ecology Lab (SEL) at the USDA Jornada Experimental Range (JER), we have devised a relational database schema that handles a range of data types collected at a typical terrestrial ecological research site. This database is scalable to easily incorporate new datasets over time without the need to create new entities or relationships, handles data imported from external sources, and can be accessed through a web interface. This poster presentation provides an overview of this schema and discusses the relative challenges and features of our research to date. Our ultimate goal is to develop the database to accommodate the needs of the SEL research activities on the JER, and share these data with different research laboratories.

FRI-342

SKIN CANCER IDENTIFICATION SYSTEM

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School of Engineering + Technology, Miami Dade College, Miami, FL.

Cancer is a prominent cause of death worldwide and the second leading cause of death in the United States. Skin cancer is the most common form of cancer. A skin lesion has certain characteristics that can be analyzed in order to determine if it has the possibility of being cancerous or not. These characteristics are categorized into four different criteria called the ABCDs of skin cancer: asymmetry, border, color, and diameter. The goal of this research is to develop an Android-based application able to compute and score images of lesions with the criteria used in the dermatological ABCD standard. The scores obtained by the application could potentially be used to aid physicians in the assessment of suspected lesions. This application is still in development and is currently in its final stages for determining the asymmetry ratio of a skin mole by analyzing sample images of lesions through their shape characteristics. Asymmetry is defined as a shape that is disproportional and in violation of symmetry. In order to check this trait, the application analyzes the lesion by fitting an ellipse around it, then dividing the lesion through its major axis in order to compare one area to the other. Any significant deviation of areas would be considered asymmetrical on the axis that separates the two sets. Although still in development, the initial testing results are encouraging and demonstrate that an application of this nature is feasible and can be a helpful tool in identifying early signs of cancer.

EDUCATION

EDUCATION RESEARCH/ADMIN. (EXCEPT EDUC./SCHOOL PSYCHOLOGY)

FRI-143

LONGITUDINAL INVESTIGATION OF FACTORS IMPACTING FACULTY PEDAGOGICAL DECISIONSLaDoris Lee¹, Warren Christensen².¹*Northeastern Illinois University, Chicago, IL* ²*North Dakota State University, Fargo, ND.*

Research-based curricular materials, particularly at the university physics level, have been available for decades, but it is unclear why some faculties choose to use them and others don't seem convinced of their effectiveness. Researchers Melissa Dancy and Charles Henderson have begun to cast light on this question through their numerous studies. Their findings suggest that teachers and change agents (those supporting and advocating the pedagogical change) are not always working together to effectively implement the alternative curricular materials. This barrier often originates from the faculty members not wanting to feel like their teaching methods are no longer applicable. Another identified barrier comes from the students being reluctant to engage in the practices that accompany research-based instructional strategies, such as working in small groups in class. The driving question of this work is, "How does feedback from students influence instructors' pedagogical decisions in the classroom, and to what extent are students' concerns reflective of the learning that occurs in the classroom?" This study was conducted by studying 15 faculty members from different universities over the course of 6 semesters. Numerous data streams were collected, including web surveys and one-on-one interviews. The web-based surveys captured logistical information, and the interviews were conducted at the end of the semester to probe the instructors' perceptions of their own and their students' performance. Students' learning was measured via a course-appropriate conceptual test such as the Force Concept Inventory, and student evaluations of instruction were also collected. We will present notable trends in our data corpus.

SAT-143

EDUCATIONAL GOALS AND ATTAINABILITY FROM THE PERSPECTIVE OF THE AFRICAN AMERICAN COMMUNITYLynnette Allen, Christopher Span.*College of Education, University of Illinois at Urbana-Champaign, Champaign, IL.*

The achievement gap between White and African American students in the United States has been studied in depth, but these studies often fail to apply a historical lens to evaluate the achievements of a historically disadvantaged race. This research argues that, instead of using the achievement gap to evaluate two groups with very different histories, an intergenerational comparison is needed to evaluate how the expectations for African American educational achievement have changed since the passing of the Elementary and Secondary Education Act in 1965. In addition to historicizing African American achievement, this research draws on survey data that evaluates present day expectations that African Americans have of schools. This methodology is applied to assess whether enhanced accessibility increases educational expectations and if increased educational expectations equates to increased achievement. This research seeks to shift the discourse on African American students from deficit thinking to educational success.

FRI-142

HIGH-STAKES TESTING AND ITS AFFECT ON MINORITIESChealci Eddins¹, Julian Heillig².¹*College of Natural Sciences, University of Texas at Austin, Austin, TX,* ²*University of Texas at Austin, Austin, TX.*

This study examines student motivation and achievement at the high school level in relation to the Texas Assessment of Knowledge and Skills exit-level tests. This test is given to assess students' knowledge and determine the performance level of the school. The students' scores determine if they move on to the next grade level. The exit-level exam, given to students in the 11th grade, determines if a student will graduate. There are questions if these high-stakes exams measure a student's success accurately. Students are being held back in their current grade levels, including not being able to graduate, if they do not receive passing scores on these high-stakes exams. The above observations have led the authors to explore the impact of exit testing on African American students. How do African

American students perceive exit testing to impact their motivation? Ten simultaneous interviews will be conducted with students. In these interviews, the author will be engaging in a conversation with each student about their journey on taking the Texas Assessment of Knowledge and Skills test. Using these qualitative interviews, the authors are trying to find a correlation between students' exam results and their motivation in regards to their education.

SAT-142

SERVICE LEARNING AS PROFESSIONAL DEVELOPMENT FOR FIRST-YEAR ENGINEERING STUDENTS

Shawn Ríos, Ricardo Machón.

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In the changing atmosphere of engineering, professionals are encouraged to actively participate in service projects. Similarly, those studying to become engineers take part in volunteer work. However, for first-year engineering students, it is difficult to understand how to use their skill set to help a community in need. To comprehend the unique intersection of engineering and service, the current exploratory survey was conducted to understand the importance students place on their involvement in service. The hypothesis of this study is that first-year students are uninterested in service opportunities, and possible ways of making service appealing to the participants will be made clear. First-year engineering students from Loyola Marymount University, a service-oriented Catholic university, were asked about their interest and participation in service. Through the survey, results detailing the most effective methods of communication will pave the way for increased activity in service, as well as preparing students for a professional career in the engineering industry. After all surveys are administered and analyzed, the results will be the basis for building a curriculum that will engage and encourage first-year students to become service-minded engineers.

SAT-144

HOW IMPORTANT IS CULTURAL RELEVANCE TO OUT-OF-SCHOOL SCIENCE PROGRAMS? FINDINGS FROM SURVEYS AND INTERVIEWS WITH PROGRAM LEADERS

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Out-of-school-time (OST) youth science programs are designed to engage students and support them in pursuing future career paths in science. The OST programs can be a foundation for a successful future for students before they continue to college. Our research study, Mapping Out-of-School-Time Science (MOST-Science), examines a national sample of OST programs focused on science, engineering, and/or technology. Here we describe first findings about the characteristics of programs including aspects of program design and youth audience. Using an electronic survey, we collected data from 417 programs. We also conducted 53 interviews with program directors to help us see other dimensions on which the surveys might not have touched. Program directors mentioned it is important for OST programs to be culturally relevant to students to be able to have a successful program. The interviewees explained how some programs expose students to science to continue learning and pursuing science as a career path, but other programs encourage students to find their own passions which might be outside the sciences. Program directors also said it is very important to know what troubles students outside of school to understand their personal and family needs and to help them feel they belong in the program. We will share examples on how organization leaders use culturally relevant programming to retain their students and lead them in taking college-bound paths and community leadership roles.

OTHER EDUCATION

FRI-144

RESEARCH WITHIN THE ADVANCING OUT-OF-SCHOOL LEARNING IN MATHEMATICS AND ENGINEERING (AOLME) PROJECT: ADDRESSING LATINO/A STUDENTS' IDENTITY DEVELOPMENT IN THE FIELD OF ENGINEERING

Ivonne Orozco, Sylvia Celedón-Pattichis.

University of New Mexico, Albuquerque, NM.

Percentages on eighth-grade mathematics national performance show that fewer than 8% of students achieve the excellence level. Additionally, culturally and linguistically diverse students are still underrepresented in STEM fields. AOLME's central aim is to design and implement an integrated curriculum in mathematics and engineering for middle

school students from underrepresented groups. Students' perceived engineering identity and its development is documented through observations of students' participation and identity surveys. This qualitative study includes students from fifth through eighth grades. The program was implemented for 3 weeks during the summer of 2012 and 10 weeks during the spring of 2013. Video recordings of each session and the students' notebooks used to record their learning experiences were used as tools to track the development of attitudes and identity throughout the program. Preliminary findings indicate that students who do not see themselves as being doers of engineering or mathematics at the beginning of the program develop a more positive technical identity after they experience the program. The involvement in an interactive and supporting program allows students' efficacy in mathematical and engineering skills to develop positively. Through the promotion of programs such as AOLME, students are able to explore their critical thinking and problem-solving abilities. These skills and self identity can be used in a positive way to create the STEM leaders of the future.

SAT-145

COLLEGE PREPARATION PROGRAMS: MINORITY STUDENTS' EDUCATIONAL ASPIRATIONS AND MATHEMATICAL ACHIEVEMENT IN URBAN SETTINGS

Abigail Lopez, Eduardo Mosqueda.

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Recent research has shown the high failure rates of Latina/os and African American students in low funded urban schools. In 2010, Latina/os and African Americans in California had drop-out rates of 21.9% and 29.2%. College preparation programs have been placed in low-funded communities in order to lower this high failure rate. In this study, we examine the complex relationship of students' participation in college preparation programs along with their own educational aspirations to observe how this impacts minority students' mathematical achievement in schools. Using quantitative analysis and data provided by the National Center for Education Statistics, we created a regression model that allowed us to calculate the significance of participation in college preparation programs and students' educational aspirations in relationship to their mathematical success. Understanding the impact of these programs in urban areas is important because it may be one of the few ways minority students are provided with the knowledge and skills needed for higher education. Our interest in mathematical achievement is due to the fact that research shows the highest mathematics course completed in high school to be a strong indicator of whether a student will graduate from college or not. Although 9th grade students who participate in these programs tend to perform more poorly, our results found that a combination of high educational aspirations and participation in these programs can help bring students back up to average mathematics test scores. This suggests that college preparation programs influence students' educational aspirations, which, in turn, can affect their mathematical achievement.

ENGINEERING

AEROSPACE, AERONAUTICAL, ASTRONAUTICAL ENGINEERING

FRI-252

INVESTIGATION OF ARTIFICIAL GRAVITY HABITAT DYNAMICS

Geoffrey Kibble, Jamey Jacob, Zach Barbeau, Steven Asplin, Alyssa Avery, Calvin Brown, Chase Colvin, Brian Delano, Reyhan Eusufzai, Shea Fehrenbach, Jaymie Jordan, Shane Spear, Carolina Vega, Thomas Verschelden, Kale Woosley.

Oklahoma State University, Stillwater, OK

Future envisioned missions to deep space elicit problems and challenges not fully investigated by the world's spaceflight organizations. One of the most prominent issues is prolonged exposure to weightlessness. The human body functions day to day with the resistance and force of gravity; in the absence of this phenomenon, bones and muscles swiftly atrophy. Another alarming effect that has been acknowledged in recent years is loss of vision due to prolonged spaceflight. Researchers hypothesize that lack of gravity increases pressure on the optic nerve, thus causing vision loss. An effective way to generate a force similar to gravity is to rotate a body to produce centrifugal force. For a small-scale investigation of this concept, the Oklahoma State University Space Cowboys team has designed an inflatable beam-rotating experiment. The effects of various internal pressures on the beam's stiffness and rotational stability will be examined. Inflatable structures are lightweight, have a high ratio of deployed-to-packed volume, and could provide sufficient support for a rotating spacecraft that produces an artificial gravity force. The experiment is designed to allow deployment pressure to be altered between test runs (parabolas). As spaceflight becomes more ambitious and missions of longer durations become both desirable and possible, spacecraft designs must provide crewmembers with an Earth-like gravity environment. Therefore, in order to continue expanding our knowledge of the universe, gravitational obstacles such as these must be overcome.

SAT-252

3D MOTION CAPTURE IN REDUCED GRAVITY

Carolina Vega Recalde, Alyssa Avery, Zach Barbeau, Calvin Brown, Thomas Verschelden, Nicole Weidman, Jaymie Jordan, James Evans, Jamey Jacob.

Oklahoma State University, Stillwater, OK.

In order to identify the range of motion of a person in a reduced-gravity environment, motion capture is needed. Motion capture will quantify the movements of the subject and allow the analysis that would follow. The systems considered to meet this criteria would need to be flexible enough to accommodate non-standard data, and reliable enough to collect good data in the dynamic conditions of flight. The Oklahoma State team chose to evaluate 4 off-the-shelf systems: Microsoft Kinects, Opti-track Camera System, GoPro 3D Heros, and traditional digital cameras paired with video-grammetry. Each of these systems uses a distinct method of data input and analysis. Additionally, each of the systems chosen showed merit in reliability and accuracy. The team also chose a series of joint movements for the subject to perform to gather examples of joint mobility data.

SAT-253

HIGH ALTITUDE BALLOON LAUNCH

Lauren Polo¹, James Newman.

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The purpose of this project is to support the ongoing establishment of the Naval Postgraduate School's aerospace program. Interns are expected to work with other students to accomplish designated altitude in a balloon flight using communication systems and cameras to transmit and receive data. Furthermore, the interns will learn to recover data from the experiments and its applications using calculations based on documented altitude and pressure. The methods used to collect the data were to separately test the equipment that we would be using (such as pressure and temperature sensors), and then collectively test them as they would be functioning during the actual launch of the high altitude balloon. The results of the data are still to come as we have not launched this year's high altitude balloon. Based on data from previous launches, we should be able to recover footage from the launch along with the reading from the different sensors and a new satellite that will give us insight into how the payload as a whole works.

FRI-253

DIRECT FORCE MEASUREMENT ON AN OSCILLATING AIRFOIL

Carlos Orozco, Frank Lu.

University of Texas at Arlington, Arlington, TX.

The quantification of aerodynamic forces on wing sections allows for the determination of optimum operating conditions (angle of attack, airfoil shape, etc.) for the specific use at hand. However, for oscillating wing sections, aerodynamic forces become complicated by the addition of inertial forces brought about by the pitching motion of the wing section. Thus, a method of directly measuring the lift and drag forces on a cyclically pitching NACA 0012 airfoil while also separating the inertial forces will be developed. A high power stepper motor will be used to cyclically pitch a machined aluminum NACA 0012 airfoil. Strain gages placed on a shaft running through the span of the airfoil will directly measure the lift and drag as the airfoil is pitched through various angles of attack. After the lift and drag data is collected, it will be corrected by subtracting the inertial forces found during the calibration of the strain gages. Additionally, error due to hysteresis will likely be present in the lift and drag data, and this will need to be accounted for. In this way, the true lift and drag of the oscillating wing section will be determined. For applications that require oscillating wing sections such as wind turbines and biomimetic flight, this method of measuring true aerodynamic forces by accounting for the inertial forces is especially useful.

BIOENGINEERING/BIOMEDICAL ENGINEERING

FRI-256

SELF AGGREGATING CHITOSAN PARTICLES FOR HEMOSTATIC APPLICATION

Ehab Abdelaziz, Shaunak Pandya, C. Mauli Agrawal.

University of Texas at San Antonio, San Antonio, TX.

Uncontrolled hemorrhage remains to be the leading cause of potentially preventable deaths on the battlefield. Trauma resulting in massive blood loss has been shown to induce coagulopathy and demands use of external agents to achieve hemostasis. Currently used hemostatic agents include topical water absorbing agents such as chitosan. Here, we report a modified chitosan in particle form that can self-aggregate when in solution. Chitosan (~200 kDa molecular weight and ~80% degree of deacetylation) micro/macro particles were synthesized using different spray drying techniques. Biotin avidin chemistry has been used for modification of chitosan particles. Chitosan particles were surface modified using EZ-link® biotinylation reagents at different mol% of amine groups, i.e., 1-20. Some of these particles were further modified by addition of NeutrAvidin™ to form avidinylated chitosan particles. We hypothesized that biotinylated and avidinylated chitosan particles would stay inert in dry form but would form quick aggregates in saline or blood. Aggregation behavior of particles was studied using microscopy, and the effect of aggregation of particles was studied on human red blood cells. Microscopy showed significant aggregation of particles compared to non-modified chitosan, and rheology data demonstrated increase in viscosity of whole blood when mixed with self-aggregating particles. We have demonstrated successful use of biotin avidin chemistry for fabrication of self-aggregating chitosan particles. This system has a great potential to be used as an efficient hemostatic agent. (Partially funded by NIGMS MBRS-RISE GM060655.)

SAT-264

TATTOO-BASED POTENTIOMETRIC ION-SELECTIVE SENSORS FOR EPIDERMAL PH MONITORING

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We will discuss the fabrication and characterization of novel tattoo-based solid-contact ion-selective electrodes (ISEs) for non-invasive potentiometric monitoring of epidermal pH levels. The new fabrication approach combines commercially available temporary transfer tattoo paper with conventional screen printing and solid-contact polymer ISE methodologies. The resulting tattoo-based potentiometric sensors exhibit rapid, sensitive response to a wide range of pH changes with no carryover effects. Furthermore, the tattoo ISE sensors endure repetitive mechanical deformation, which is a key requirement of wearable and epidermal sensors. The flexible and conformal nature of tattoo sensors enable them to be mounted on nearly any exposed skin surface for real-time pH monitoring of human perspiration, as illustrated by the response during a strenuous physical activity. The resulting tattoo-based ISE sensors offer considerable promise as wearable potentiometric sensors suitable for diverse applications. The

tattoo ISE sensors were able to tolerate the complex mechanical deformations experienced by the human skin during exercise. The tattoo ISE sensors thus exhibit substantial potential as practical, body-worn devices for continuous physiological monitoring. The new potentiometric sensing concept can be readily expanded to epidermal monitoring of other clinically relevant sweat electrolytes such as sodium, potassium, calcium, or magnesium.

SAT-261

QUANTIFYING CELLULAR PROLIFERATION IN CO-CULTURE MODELS

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Monolayer culture is common for studying cancer on a cellular level. Growing tumor cells alone does not account for the more complex cell-to-cell interactions that occur in a tumor. We have designed a monolayer method for co-culturing cancerous and non-cancerous cells as a first step toward investigating cell-to-cell interactions in tumors. We cultured MCF-7 breast adenocarcinoma and 184A1 breast normal epithelial cells as mono- and co-cultures using standard monolayer growth curve protocols. In order to differentiate the two cell types in a co-culture, MCF-7 cells were stained with a red membrane dye (CellVue Claret), and 184A1 cells were stained with a green membrane dye (PKH27). In addition to allowing independent assay of the growth of each cell type in a mixture, the intensity of the membrane stains can also be used to measure the proliferation index based on dilution of the dye during cell division. The fraction of cells in each cell cycle phase was also determined using standard DNA content analysis by flow cytometry. Growth curves for monocultures gave doubling times of 24 hours for MCF-7 and 44 hours for 184A1. We are currently conducting co-culture growth curves with initial cell ratios of 10:90 (tumor:normal), 50:50, and 90:10. Cell counts and flow cytometry of cells harvested from co-cultures will allow us to determine the doubling time, proliferative fraction, and cell cycle position for each cell line at each time during monolayer growth. After characterizing monolayer co-cultures, we will repeat these experiments using co-cultures grown as 3D multicellular spheroids.

FRI-258

CALCIUM CARBONATE NANOPARTICLES: SYNTHESIS, CHARACTERIZATION, AND POTENTIAL DRUG DELIVERY APPLICATION

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Drug delivery vehicle efficacy is directly influenced by cellular internalization. Therefore, determination and optimization of calcium carbonate nanoparticle (CaCO_3) fabrication and administration was investigated. Influencing factors of size distribution, morphology, and surface stabilization were found to be dependent on synthesis temperature regulation, amount of water used in washes post-synthesis, surface functionalization for aggregation control with sulfonfyl dodecyl sulfate (SDS), and the duration of time particles in aqueous suspension. It was hypothesized that particles of 60 to 100 nm or less in size are optimal carriers capable of facilitating the use of innate cellular internalization mechanisms. Furthermore, it is hypothesized that nanoparticle uptake and biocompatibility may be cell-cycle dependent. Chemically synthesized CaCO_3 nanoparticles were determined to have a positive surface charge and size of 188 nm for calcium chloride dihydrate and 596 nm for calcium chloride hexahydrate derivatives using photon correlation spectroscopy with a dual 30 mW laser. Transmission electron microscopy (TEM) was used to confirm size distribution, and chemical composition was analyzed with x-ray diffraction (XRD). Human fetal osteoblasts (hFOB) were used in stepped serum deprivation studies to evaluate nanoparticle uptake and to assess potential cytotoxicity at each stage of the cell cycles. Fixed cell staining with 4',6-diamidino-2-phenylindole (DAPI) tested whether cytotoxicity was observed as a result of concentration. Nanoparticle dispersion concentrations prepared ranged from 0.001 to 5 mg/mL. ANOVA single-factor analysis indicated no significant toxicity regardless of nanoparticle concentration. We conclude that CaCO_3 nanoparticles provide a biocompatible, highly modifiable system for drug delivery applications that greatly reduce the threat of toxicity to nonpathogenic cells.

FRI-257

OPTIMIZATION OF THE THERMODYNAMICS AND KINETICS OF BIOPOLYMER-BASED SMART MATERIALS

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The availability of materials that change their properties, such as shape or permeability, in response to specific physical and/or chemical cues would revolutionize technologies ranging from targeted drug delivery to medical diagnostics. An emerging strategy for developing such "smart" materials parallels the gated ion channels used to

control transport into or out of cells. Specifically, biopolymer networks can be engineered to form and dissociate in response to small molecule or protein cues, allowing for specific gating within nanoscale pores. Significant tradeoffs, however, likely exist for such materials between their thermodynamic stability and their kinetic responsiveness (i.e., stable materials respond only very slowly to their cues), which could limit their utility. Here we explore this tradeoff in a simple, tunable biopolymer network consisting of alternating aptamer (i.e., a molecular cue-binding DNA sequence) and structural support strands that hybridize to form a functional, concatenated chain (a concatamer), which breaks-down in the presence of its molecular target. Specifically, we will explore the extent to which changes in the overlapping base-pairing regions of the concatamer, such as the overlap length and the inclusion of mismatches, affects concatamer stability and opening kinetics. Our experiments take advantage of fluorescence resonance energy transfer, stop-flow, and equilibrium fluorimetry to monitor these effects. Our goal is to discern the design parameters that will lead to optimal material stability and responsiveness.

SAT-258

CELLULAR RESPONSES TO NANOPATTERNED BULK METALLIC GLASSES

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Bulk metallic glasses (BMGs) are metallic alloys with an amorphous atomic structure. In addition to metallic properties like high strength and exceptional mechanical durability, they have good wear and high corrosion and resistance, which make them attractive for use as biomaterials for short- and long-term implants. Processing BMGs to fabricate microscale and nanoscale features has also been an active area of research. We have recently reported a novel molding technology to fabricate BMGs with precise surface nanostructures. Although there have been no studies exploring cellular responses to BMGs nanopatterns, nanopatterns on other substrates like polystyrene, polydimethylsiloxane, and other polymers have been shown to influence cell behavior. In this study, we fabricated platinum BMGs disks with nanorods of multiple dimensions. Our overall goal was to use nanopatterns to influence cell response and ultimately inhibit biomaterial rejection. Specifically, we investigated the impact of various nanorod aspect ratios on fibroblast cell shape and function. Cells were exposed to nanopatterns for 24 hr and then fixed and stained with rhodamine phalloidin and DAPI to visualize the actin cytoskeleton and nuclei, respectively. Images were collected with a fluorescence microscope. Preliminary image analysis of fibroblasts indicated differences in area, perimeter, circularity, and elongation factor when exposed to different aspect ratios. Statistical analysis was performed by ANOVA (analysis of variance). In ongoing studies, we are investigating the effects of nanorod aspect ratios on inflammatory cells such as neutrophils and macrophages, which will allow us to address the foreign body response.

FRI-260

INVESTIGATING THE USE OF GOLD NANOPARTICLES AS CONTRAST AGENTS FOR CELLULAR TRACKING

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Heart disease is the leading cause of death in the United States. Current therapies for heart disease, including angioplasty and bypass grafting, are not effective and cannot repair irreversible damage following an ischemic attack. The use of bone marrow derived mesenchymal stem cells (MSCs) has been widely investigated for cell-based therapies to promote vascular regeneration following an ischemic event. Prior research has shown that MSCs can undergo tubulogenesis and exhibit phenotypic characteristics of endothelial cells when implanted in a PEGylated-fibrin gel. Thus, MSCs delivered via a PEGylated-fibrin gel have the ability to reestablish blood flow to ischemic areas through the process of neovascularization. However, the current understanding of MSC participation in neovascularization is limited by the inability to monitor and track the cells following implantation. Using a nanoparticle (NP)-based system and noninvasive, photoacoustic imaging we will be able to simultaneously track MSCs and detect the transfer of contrast agents to nonstem cells *in vivo* following delivery. Nevertheless, introducing a foreign component into a healthy MSC could compromise its function. Thus, this project is focused on investigating the use of nanoparticles as contrast agents. MSC viability and retention of function (including proliferation, differentiation capability, and tubular network formation) following NP-labeling will be examined using various assays and qualitative analysis. Should the data analysis of the various assays and observations prove statistically insignificant between the control and experimental groups, we could conclude that our nanoparticle system is sufficient to determine the mechanism of MSC neovascularization.

FRI-255

MODIFYING MECHANICAL AND BIOACTIVE PROPERTIES OF HYDROXYAPATITE SCAFFOLDS VIA COLLAGEN COATINGS

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Currently, many biomaterials are being explored as components for tissue engineering scaffolds. In the case of bone tissue engineering, these materials must provide a matrix that allows for osteoconduction, biocompatibility, biodegradability, mechanical stability, and load-bearing once implanted *in vivo*. Much success has been had with scaffolds made of hydroxyapatite (HA), which is a calcium phosphate mineral similar to the biological apatite that is found naturally in bone. Although HA has had success at producing reasonable osteoconductivity and high biocompatibility, these scaffolds are unable to carry high loads. In this study, porous HA scaffolds were created by replicating a polymer template. Briefly, an HA slurry was applied to a polyetheran template, which was then sintered to a maximum temperature of 1,250 °C. Afterward, the scaffolds will be treated with a 25 µg/ml collagen solution for time periods of 15 min, 30 min, and 1 h after which a brief air current will be applied. Collagen, a structural protein naturally found in bone, will be applied in order to improve the scaffold's structural integrity and enhance biological activity. Helium pycnometry measurements have been taken before collagen coating and will be taken after coating to confirm the porosity of the collagen-coated scaffolds. Further characterization could be obtained by scanning electron microscopy and Fourier-transformed infrared spectroscopy. Mechanical testing will also be carried out to further determine the mechanical integrity of these scaffolds. Currently, we have successfully produced scaffolds using sponges with 40 pores per inch (ppi) and 60 ppi with final volumes of $42.3 \text{ mm}^3 \pm 0.00081 \text{ mm}^3$ and $61.2 \text{ mm}^3 \pm 0.00067 \text{ mm}^3$ respectively.

SAT-257

SPATIAL COCULTURES OF ENDOTHELIAL AND OSTEOPROGENITORS ON HYDROXYAPATITE-COLLAGEN COMPOSITE SCAFFOLDS

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Large bone injuries such as those caused by trauma resulting from military or automobile accidents often do not heal of their own accord and require a bone/tissue graft to stimulate regeneration. Vessel in-growth is a crucial factor in determining the success of bone regeneration because it provides the nutrient supply and waste removal pathways from the injured area. The focus of this study will be to understand the importance of the spatial distribution of progenitor cells on the simultaneous development of bone and vessels in a coculture model. The scaffold system consists of a hydroxyapatite (HA) substrate topped with a collagen hydrogel, the 2, natural extracellular matrix components of native bone. Human umbilical vein endothelial cells (HUVEC) and bone marrow stem cells (BMSC) will be used in a coculture. The BMSCs will be seeded on the surface of the HA disk or within the collagen hydrogel and the HVECs will be seeded within the hydrogel or above the hydrogel respectively. Different ratios of BMSC to HUVEC (1:0, 5:1, 1:1, 1:5, and 1:1) will be used to identify the most favorable ratio for the simultaneous promotion of osteogenesis and angiogenesis. Matrix protein analysis and cell staining for bone tissue and blood vessel formation will be performed on days 3, 7, 10, 12, and 14. We hypothesize that osteogenesis and angiogenesis will be more prevalent in the cocultures with more BMSCs and with the BMSCs on the HA substrate with the HUVECs within the collagen gel. (Partially supported by NIGMS MARC-U*STAR GM007717.)

FRI-259

PRIME-BOOST WITH CELL SURFACE EXPRESSED CLINICAL ISOLATES OF HIV ENV

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The goal of HIV research is to produce a vaccine that offers complete protection from the virus. To date, no vaccine has shown this. The RV144 clinical trial was the first successful clinical trial in HIV vaccine research; however the vaccine showed only partial efficacy. The recent identification of broadly neutralizing antibodies in HIV infected individuals has given hope that a vaccine may be possible. Broadly neutralizing antibodies are antibodies capable of blocking infection from a wide variety of clinical isolates. Swarm analysis is a method developed in our lab that identifies pairs of mutation(s) that confer resistance or sensitivity to broadly neutralizing antibodies. It examines the quasispecies (swarm) from an HIV infected individual and examines the changes that the envelope protein undergoes. The changes can sometimes alter sensitivity or resistance to broadly neutralizing antibodies. Our lab has

identified several pairs of mutation(s) from clinical isolates that confer a change in sensitivity. Our lab will use the clinical isolates identified by swarm analysis as part of a prime-boost immunization protocol. Our project involved increasing the cell surface expression of the envelope protein from the clinical isolates. This involved shortening the cytoplasmic tail of *Env* by placing a stop codon shortly after the transmembrane domain. This modification has been shown to dramatically alter the level of cell surface expression. The hope is that the higher cell surface expression of *Env* will lead to a better immune response in the DNA prime-boost protocol.

FRI-261

FUNCTIONALIZATION OF GOLD-NANOROD-BASED IMMUNOSENSORS FOR LABEL FREE BIO-DETECTION

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Gold nanoparticles have shown great potential applications in biomedical diagnosis and therapeutic treatments due to their shape and size-dependent optical properties. However, densely packed CTAB double layer, a surfactant used to prevent nanoparticle aggregation, on the nanorod surfaces presents challenges for effective biofunctionalization in setting up a nanoparticle-based platform with high detection sensitivity. In this study, we systematically studied the functionalization of gold nanorods with various bioconjugate linkers in pursuit of developing nanorod-based immunosensors with maximal sensitivity and specificity. First, gold nanorod chips were fabricated by chemically binding nanorods onto a silanized glass substrate; the gold nanorods were then functionalized with carboxylic acid or an amine group via thiol linkers for antibody conjugation. The effects of thiol linkers with different lengths such as 11-mercaptoundecanoic acid (MUDA), 4-aminothiophenol (4-ATP), 2-mercaptopropionic acid (MPA), and 6-mercaptohexanoic acid (MHA) were investigated. The optimized functionalization of the gold nanorod chip was applied to develop a nano-biosensor to detect human serum IgG as a model system. Since the localized surface plasmon resonance is highly sensitive to the biological binding on the nanorod surface, this mechanism provides a label-free biodetection, eliminating signaling labels such as fluorophore and radioactive agents. The miniaturized nano-biochip is attractive for rapid medical diagnostics in clinics due to the user-friendly and cost-effective features.

FRI-254

EFFECT OF UREA ON THE SURFACE ACTIVITY OF AMYLOID BETA PEPTIDE

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The aggregation of amyloid beta (A β 40) peptide into insoluble fibrils rich in beta-sheets is a major pathological hallmark of Alzheimer's disease. Previously, we showed that A β 40 is highly surface active and that its binding to model lipid membranes seeds fibril formation. In an effort to better understand the aggregation of A β 40 *in vivo*, we studied the surface activity of A β 40 in the presence of the naturally-occurring osmolyte, urea. Urea is known to preferentially bind to and increase the solubility of proteins in solution. We hypothesized that urea will similarly increase the solubility of A β 40 in solution and thereby decrease the tendency of A β 40 to adsorb to the air-water interface. To test our hypothesis, we assessed the surface activity of A β 40 by measuring its adsorption isotherms (surface pressure versus time) in a Langmuir trough with increasing urea concentration in the subphase. Our results showed that urea lowered the equilibrium adsorption pressure of A β 40, indicating lower surface activity. However, the rate of adsorption increased sharply, and the lag time of adsorption was eliminated in the presence of urea. To better understand our results, we are investigating the roles of some secondary effects, such as pH and ionic strength, on A β 40 surface activity. Understanding how A β 40 behaves in cell-mimicking environments will provide insight as to why and how A β 40 aggregates into insoluble fibrils in the brain, thereby creating a foundation to begin treating and preventing Alzheimer's disease.

FRI-262

ENGINEERING HYALURONIC ACID BASED HYDROGELS FOR 3D STEM CELL CULTURE

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Heart failure arising from myocardial infarction (MI), initially caused by the blockage of coronary arteries, is one of the leading causes of death around the world. Currently, the only available treatment to restore cardiac function after MI is heart transplantation, which is risky and limited by the availability of donor organs. One potential alternative treatment is the use of induced pluripotent stem (iPS) cells to regenerate cardiac tissue that has been damaged by MI. Preliminary experiments with magnetic activated cell sorting (MACS) of mesoderm-differentiated human iPS cells

have demonstrated a cell subpopulation that is positive for CD105, a cell surface marker for proangiogenic endothelial cells. These cells have the potential to form vascularized networks within an appropriate 3D matrix, which we plan to engineer using hyaluronic acid (HyA) hydrogels. HyA is a natural substance found in the extracellular matrix of human tissue, and it can be used in the synthesis of scaffolds for wound healing applications. In addition, hyaluronic acid is biocompatible, biodegradable, and has readily accessible functional groups for chemical modification. The sorted cells can be encapsulated into HyA-based hydrogels to improve their viability in cardiac tissue post-MI. During this project we will determine whether HyA hydrogels will promote the sustained incorporation of the CD105+ cells with native cardiac tissue.

SAT-255

FABRICATION OF ACOUSTIC FOCUSING FLOW CELLS FOR HIGH THROUGHPUT FLOW CYTOMETRY ANALYSIS OF PLANKTON

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Microbes account for most of the primary productivity and biomass in the ocean, and the structure of the microbial community determines in large part that of higher trophic levels. A fundamental understanding of the factors that regulate community structure requires detailed and sustained observations of the plankton. A fully submersible hydrodynamic flow focusing based flow cytometer has been developed to analyze large phytoplankton and microzooplankton in the ocean. Ocean phytoplankton are continuously monitored for about 6 months via fluorescence, scattering, and high resolution images of phytoplankton acquired from the flow cytometer. However, the main drawback of the current setup is its limited throughput. Signal and image quality are diminished with increases in flow rates of sheath fluid and sample fluid in order to enhance throughput. In addition, the maximum flow rate for hydrodynamic focusing is limited to 125 mL/min. Thus, it is important to investigate alternative flow focusing techniques with enhanced throughput capabilities. The purpose of current research is to develop a flow focusing cell that uses standing acoustic waves and investigate its capability to focus and concentrate plankton at very high flow rates prior to analysis. Here, we report design and fabrication of acoustic flow cells and our initial finding on focusing of phytoplankton.

SAT-263

PEEL STRESS ASSESSMENT OF COMMERCIAL WOUND-TREATMENT POLYMER FILMS

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There are different types of polymer films used as temporary substitutes on damaged skin to aid in wound treatment. It is important to understand the tackiness of these films to investigate whether encounters with environmental materials such as stainless steel surfaces, will cause them to be torn from a wound. The objective of this study is to conduct a peel test to determine the tackiness of four commercially available isotropic and nonlinearly elastic wound care films: New Skin, Smith & Nephew, Skin Shield, and Silesse. We designed an apparatus using a 20 mm stainless steel dolly that compressed (≈ 4 N) porcine skin for 3 hours at 37 °C. The dolly was attached to an Electroforce 3200 tensile testing instrument, which peeled it off the skin surface at a rate of 100 cm/s and collected force measurements at 20 Hz. A MATLAB code was used to calculate the peel stress, i.e., the maximum force per surface area of the dolly at the time of detachment from the skin for each polymer. We found that Silesse [0.5 ± 0.5 kPa] did not adhere, while Smith & Nephew [13.8 ± 4.8 kPa], New Skin [12.1 ± 5.4 kPa], and Skin Shield [10.1 ± 4.3 kPa] demonstrated much greater adherence. These results showed that the polymer Silesse is less likely to adhere to household items and may offer reduced chance of damage or reinjury due to contact with environmental surfaces. (This work was partially supported by UTSA MARC-U*STAR GM007717.)

FRI-264

DETERMINING FORCE PRODUCED BY GROUPED VS. SINGLE MOTOR PROTEINS THROUGH DNA ORIGAMI SCAFFOLDS

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Neurodegenerative diseases (NDD) pose a great problem in elderly populations and, less commonly, in adolescents. One of the widely known causes of NDD is the inability for motor proteins to function within the brain's neuronal

axons. These proteins are essential in delivering information, such as neurotransmitters, across the brain in compact vesicles. In order to better understand the capabilities of these motor proteins along the axons on microtubule tracks, a rigid, programmable DNA origami scaffold is created as a synthetic vesicle to mimic *in vivo* movement. We predict that a grouped kinesin 1 motor protein ensemble will perform with an increased pico-newton force when compared to a single kinesin 1 motor protein. Kymograph imaging will be used to measure the force produced from 1, 2, 3, 4, and 7 kinesin 1 motor proteins by attaching them to programmed DNA origami synthetic cargo. The images provide detail on motor-protein velocity, distance. Run time and force produced is measured with the known mass of the scaffold. The labeled DNA origami scaffold has been designed with oligo specific nucleotides for protein his-tag cross linkage.

FRI-263

FABRICATION OF CYTOKINE-LOADED CANCER TRAPS

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Metastatic cancer, which unfortunately often leads to more death than primary cancer, must be better understood in order to treat and control this almost ubiquitous illness. Recent studies have shown that inflammation caused by biomaterial implantation can attract metastatic cancer. It is believed that inflammatory cytokines might be responsible for this. We hypothesize that implanting biomaterials loaded with specific inflammatory cytokines might attract metastatic cancer cells. The role of specific cytokines in cancer metastasis will be examined. Current research in the cytokine and cancer area is inconsistent, possibly due to the high variability of *in vitro* experiments. Hence, cell culture conditions like trypsinization time (that can affect cell phenotype) will be optimized to generate reproducible outcomes. Thereafter, a Boyden Chamber seeded with 50,000 B16F10 melanoma cells on the top and different cytokines at the bottom were used to determine the most effective cytokines. Subsequently, these cytokines will be loaded into a cancer trap comprising of a 3D multilayered PLGA, poly(lactic-co-glycolic acid), scaffold fabricated using a novel protein microbubble-based technique. Using B16F10 cells as a model, our optimization experiments show that trypsinization for 2 minutes proved to be the optimum time for future experiments. Thus far, erythropoietin appears to be a melanoma-cell attracting cytokine. The scaffold's pore size ranges from 75 to 150 μm , with approximately 90% porosity. Currently, drug release from the traps is being studied. Our studies show good potential for the development of cytokine-loaded cancer traps that could localize metastatic cancer cells, which could then be eradicated by localized treatments.

SAT-256

BIOCOMPATIBLE SCAFFOLDS IN ENGINEERING CARTILAGE IN THE TREATMENT FOR MICROTIA

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Microtia is a congenital malformation of the external ear, affecting 1 in 6,000 children. Current treatment options for microtia include complex reconstructive surgery using rib cartilage, an external prosthesis, or artificial implant. A novel approach using biocompatible extracellular matrix (ECM) as a scaffold to develop cartilage has been developed in our lab. We hypothesize that this technique can become a new treatment option for microtia. Preliminary investigations to understand the time for differentiation of mesenchymal stem cells (MSCs) to chondrocytes are currently being done. We used rat GFP-labeled mesenchymal stem cells grown in DMEM over a period of 10 days of incubation until confluence. MSCs were subjected to three conditions: DMEM, serum minus (S-), and chondrocyte differentiation media (CDM). In MSCs subjected to CDM, we observed differentiation of the MSCs into cells morphologically resembling chondrocytes with lacunae formation after 9 days. Significant confluence of the differentiated cells was noted at day 21. Results from this study indicate the ability to successfully differentiate MSCs into chondrocytes. Our next step is to seed and differentiate the MSCs in an extracellular matrix scaffold. We will then implant the engineered cartilage in an animal model with the ultimate goal of using this technique to treat children with microtia.

SAT-254

NOVEL METHODOLOGIES TO INDUCE OSTEODIFFERENTIATION OF HUMAN MESENCHYMAL STEM CELLS FOR TISSUE ENGINEERING APPLICATIONSMarissa Wechsler, Senthilnath Laksmanachetty, Vanessa Wechsler, Rena Bizios.*University of Texas at San Antonio, San Antonio, TX.*

Differentiation of pluripotent stem cells into a specific phenotype is a sought-after outcome for advancing bone-related tissue engineering and tissue regeneration applications of these most promising cells. To date, biochemical compounds (e.g., bone morphogenetic proteins) have been used to promote differentiation of mesenchymal stem cells, which have the potential to differentiate into osteoblasts, chondrocytes, and adipocytes, into osteoblasts. In contrast, the effects of biophysical stimuli on such outcomes remain unknown. The present *in vitro* study examined the effects of electric current in the absence of supplemented exogenous growth factors on the differentiation of mesenchymal stem cells. For this purpose, adult, human mesenchymal cells were cultured on flat, indium-tin-oxide-coated glass precoated with fibronectin in the absence of supplemented exogenous growth factors. A custom-made laboratory set-up was used to expose these cells (passage 3 - 5) to alternating electric current (5 - 10 μ A, 5 - 10 Hz, sinusoidal waveform), for either 3 or 6 hours daily for up to 21 consecutive days. Compared to results obtained from the respective controls (cells cultured in parallel under similar conditions but not exposed to alternating electric current), cell exposure to the chosen biophysical stimulus in the absence of exogenous growth factors expressed genes indicative of exclusive osteodifferentiation since genes for the chondrocyte and adipocyte lineages were not expressed. Osteodifferentiation of mesenchymal stem cells under the conditions examined in the present study can provide critically needed differentiated cell supplies for tissue engineering and tissue regenerating applications.

SAT-260

ANALYSIS OF FOCAL ADHESION PROPERTIES AS A FUNCTION OF DIFFERENTIATION STATEPiyumi Wijesekara Kankanange, Adam Engler, Andrew Holle.*University of California, San Diego, La Jolla, CA.*

Focal adhesions are large macromolecular assemblies of the plasma membrane that allow cells to communicate with their outside environment. Various different focal adhesions exist between the cells and the extra cellular matrix. Preliminary results indicate that focal adhesions play an important role in mechanically induced differentiation. While focal adhesions have been studied to an extensive degree, little is known as to whether focal adhesion dynamics are predictive of differentiation state across a wide range of cell types. In order to address this question, three different cell types from undifferentiated to terminally-differentiated will be characterized with respect to their focal adhesion-related characteristics. Western blots and immunofluorescence of eight focal adhesion proteins vinculin, FAK (focal adhesion kinase), p130Cas, SORBS1, SORBS3, filamin, palladin and paxillin will be performed on all cell types plated onto substrates with stiffnesses of 1, 11, and 34 kPa, as well as glass. Focal adhesion size and distribution will also be quantified from immunofluorescence images. If a certain type of focal adhesion protein is more important for differentiation, one might conclude that this specific focal adhesion protein would be more common in less differentiated cells. This characterization of focal adhesion dynamics across a range of different human cell lines representing the continuum of potency is an important step towards the final goal of understanding whether focal adhesion characteristics are predictive of differentiation state.

CHEMICAL ENGINEERING

SAT-265

THE OPTIMIZATION OF MAGNETIC COBALT CARBIDE NANOPARTICLES SYNTHESIZED VIA A POLYOL METHODRaziel Acosta, Hyojung Yoon.*University of California, San Diego, La Jolla, CA.*

Permanent magnets are an important feature in our current technologies such as in hybrid electrical vehicles and wind generators. Developing alternatives to rare earth permanent magnets has become a critical investment due to the high costs of rare earth metals, which are primarily mined outside of the US. It was recently discovered that cobalt carbide nanoparticles produce substantial magnetic properties even though previous theoretical studies indicated they shouldn't. Our goal is to consistently produce cobalt carbide nanoparticle assemblies that have high magnetic

properties. In the polyol method, a wet chemical synthesis, the reactants are used in a batch reactor to produce cobalt carbide nanoparticle assemblies. By experimenting with certain reaction parameters such as the reaction time, temperature, and concentrations of reagents, different assemblies of Co_3C and Co_2C can be achieved. Even though Co_3C has better magnetic properties than Co_2C , when a mixture of the two is synthesized, even greater magnetic properties can be achieved because the Co_2C phase hinders demagnetizing magnetostatic interactions that occur between neighboring Co_3C phases. By using different characterization techniques such as vibrating sample magnetometry, X-ray diffraction, and transmission electron microscopy, the magnetization and coercivity, phase confirmation, and morphology of the product can be obtained, respectively. Using these methods, we will be able to determine the magnetic properties as well as the physical characteristics of our synthesized material. If cobalt carbide composites with significant magnetic properties can be consistently produced, they can rival current rare-earth-dependent permanent magnets.

FRI-265

MUTATING THE TYPE 3 SECRETION SYSTEM IN *SALMONELLA* TO EXPORT HETEROLOGOUS PROTEINS

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We developed a protein pump in *Salmonella* to continually secrete proteins that can be easily recovered from the media. Heterologous proteins are made by bacteria with recombinant DNA methods for therapeutic and industrial processes, but the purification from the cell is difficult. The proteins aggregate to form insoluble inclusion bodies in the cytoplasm when they are over expressed. During the purification process, large amounts of protein are damaged by the harsh chemicals used and are difficult to separate from other cellular contents; therefore, the recovery of the final product is not the most efficient way for industrial-level production. However, many pathogenic bacteria have a type-3 secretion system (T3SS) that is used to pump proteins out of the cell. In this work, we made point mutations to this protein pump in *Salmonella enterica Typhimurium* to enhance the secretion of heterologous proteins into the media. This prevents the accumulation of inclusion bodies inside the cytoplasm. In addition, the secreted proteins fold into the native state and retain normal function. To determine which mutation results in the highest protein secretion, we compared the secreted protein titer by western blotting. We screened for mutants with a strong signal in the supernatant. This indicates a high secretion of proteins.

CIVIL ENGINEERING

FRI-267

SEISMIC PERFORMANCE AND DESIGN OF EMBEDDED STEEL COLUMN BASE CONNECTIONS

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Steel column base connections are very important structural interfaces because this is where load is transferred from the entire structure to the foundation. It is common for exposed-base connections to be used in low-to-mid-rise buildings with moderate lateral load. However, the use of exposed-steel base connections becomes impractical for mid-to-high-rise buildings in highly seismic regions because of their difficulty in resisting large moments through tension in anchor rods and fulfilling steel anchorage requirements outlined by current building codes. For this reason, embedded steel columns are the preferred alternative to restrain column bases due to their ability to better resist moment and shear. Despite the widespread use of embedded columns, there is very little experimental data and there are no true design guidelines on this type of connection. What this investigation will do is develop a fundamental understanding of the force transfer mechanisms and demonstrate strength, stiffness, ductility, and damage states that occur in embedded steel columns. To do this, five realistically sized embedded steel columns will be taken to a strong reaction floor to be subjected to various combinations of axial compression or tension with cyclic lateral loading. Data from these tests will be recorded as lateral force-displacement hysteretic curves, stress distributions over the embedded part of the columns, and observed failure modes. From this project, it is anticipated that the data acquired will develop new equations for strength, develop guidelines for embedded steel columns and, more importantly, lead to updates to building codes, standards, and specifications.

SAT-266

USING THE STEEL PLATE SHEAR WALL FOR SEISMIC HAZARD MITIGATION

David Alvarez¹, Cheng Chen², James Enright², Cham Htun¹, Jasmine Flores¹.

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In a 10-week summer research internship program, sophomore civil engineering community college students have the opportunity to design a 3-story building structure using a steel plate shear wall lateral force resisting system in the earthquake-prone San Francisco Bay area. Buildings have to be designed with a strong infrastructure such that they will withstand severe earthquakes. The objective of this research is to understand how to implement today's seismic technologies in designing a cost-efficient and environmentally friendly building. The use of structural engineering design specifications and seismic provisions such as ASCE 7-10 (American Society of Civil Engineering) and AISC 341-10 (American Institute of Steel Construction) promotes early exposure to building codes currently being used in the field. Computer programs such as Excel and MathCAD are used to design the innovative lateral force resisting components to optimize the structures' performance. SAP2000 (Structural Analysis Program) is used to simulate and evaluate the response of the designed structure to selected ground motions from past earthquakes in California. This ground-motion data was acquired from the USGS Pacific Earthquake Engineering Research Center. This research internship program allows for the development of project management, time management, and teamwork skills, all of which help strengthen students' knowledge of seismic design in civil engineering and enhance preparation for academic and professional careers. The project intends to provide community college students research opportunities and make recommendations on improving the engineering curriculum at San Francisco State University and Cañada College.

SAT-267

AN INVESTIGATION OF THE DESIGN AND MODELING OF SEISMIC PERFORMANCE FOR THE OLIVENHAIN DAM AND RESERVOIR

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Eighty percent of the water used in San Diego, California, is imported through pipelines that cross several major seismic fault lines. California has many seismic issues, and public water agencies have to be creative in their engineering methods for enhancing water supply availability for emergencies and accommodating population growth. Unanticipated events such as prolonged droughts or a catastrophic earthquake can endanger the water supply for the San Diego region. This is an ongoing issue for San Diego County. The County Water Authority determined there was a need to build the Olivenhain Dam and Reservoir. In this effort, it was critical that the dam, a roller compacted concrete gravity dam, be designed for seismic performance so that it remains operational during a maximum credible earthquake. Using the Olivenhain Dam as a case study, the dam's design will be dissected to investigate the material properties, boundary conditions, applied loads, and the linear and dynamic analyses of the dam and reservoir. Examining the dam model through these components will illustrate the engineering assumptions made in the design process, thus verifying that the dam is designed to remain operational during a 7.25-magnitude earthquake to support emergency water supply operations. The San Diego region is growing, and it is essential that concrete dams in seismic regions be designed to perform satisfactorily during maximum credible earthquake events.

FRI-266

SEISMIC EVALUATION & DESIGN: SPECIAL MOMENT-RESISTING FRAME STRUCTURE

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This project focuses on designing a five-story, steel, moment-resisting frame in the earthquake-prone San Francisco Bay area in California near the Hayward fault. The structural engineer's main priority is safety; buildings have to be designed with a strong infrastructure such that they will withstand severe earthquakes. The objective of this research is to understand how to implement today's seismic technologies in designing a cost-efficient and environmentally friendly building. Computer-aided programs SAP2000 (Structural Analysis Program) and MS Excel are used to design, simulate, and analyze the structure. This research internship program allows for the development of project management, time management, and teamwork skills, all of which help strengthen students' knowledge of seismic design in civil engineering and enhance preparation for academic and professional careers. The project intends to provide community college students research opportunities and make recommendations on improving the engineering curriculum at San Francisco State University and Cañada College.

COMPUTER/SYSTEMS ENGINEERING

FRI-270

MODELING AND IMPLEMENTATION OF BRAIN-INSPIRED NEURAL NETWORK FOR EDGE DETECTION AND OBJECT RECOGNITIONNorman Ettedgui¹, Rita Melgar¹, Hamid Mahmoodi².¹*Cañada College, Redwood City, CA*, ²*San Francisco State University, San Francisco, CA*.

As technology advances, brain networking models become more viable. These models are more desirable because of their parallel nature. However, with the current chip capabilities, the possibilities are limited to the available resources, which run out quickly. Using software instead, combined with the possibility of multiple threading (modern multicore CPUs), we implemented a neural network model to process orientation detection using C++. Biologically, light enters the eye and travels through several layers of cells before reaching the brain. Our software setup collects data from a webcam (eye/photoreceptors) and then passes this data to a 2-dimensional array. Each pixel represents a location in the array (bipolar cells). This array is scanned and transformed into a smaller array (ganglion cells). The new array is scanned for several angles (simple cell) and finally passed into a linear array. This linear array holds all the lines in a specific orientation. These are then summed and expressed as a final amount for each supported angle (complex cell). There are several advantages of working in software such as editability and cost. With the possibility of multiple threading, it is even possible to simulate the parallel tasking performed by the brain, which was the only advantage to the hardware approach.

FRI-268

MULTIAGENT SYSTEM FOR MODELING THE EVACUATION OF AN AMUSEMENT PARK FOLLOWING A TERRORIST ATTACKBrian Herrera, Antonia Boadi.*California State University, Dominguez Hills, Carson, CA*.

This paper proposes a multiagent system for modeling the evacuation of an amusement park after a terrorist attack has occurred. The multiagent system will use the belief-desire-intent model. This system will model how rescue personnel will handle the evacuation of the large number of people who occupy an amusement park. It will model how rescue personnel search for and then triage victims of an attack. It will also model how the personnel communicate with each other so the proper aid will be sent to areas that need it the most. This system can give rescue personnel a visual perspective on how this event could happen and can help plan more efficient rescue operations.

SAT-268

VIRTUAL GEOCACHING: PROMOTING STEM EDUCATION THROUGH A GAMING EXPERIENCEJulian Lopez Sr., Natalia Villanueva-Rosales.*University of Texas at El Paso, El Paso, TX*.

The Virtual Geocaching project was initiated to investigate ways to process remote sensing satellite data, VIIRS (Visible Infrared Imaging Radiometer Suite), by creating a prototype science, technology, engineering, and mathematics (STEM) educational application that uses gaming functionality to engage students in learning scientific topics. Virtual Geocaching carries on the tradition of creating an exciting hunt in cyber and data space for clues that lead to a virtual location. The current Virtual Geocaching contains 3 prototype geocaches: Hurricane Sandy – “A Tale of Two Tracks,” Jornada Experimental Site – “High and Dry Near a Grand River,” and Wildfire – “Hot, Dry, and Dead.” We focused on the database backend design and the processing and integration of satellite data as well as any additional data needed for the Geocaching clues, e.g., ground sensor data obtained from the Jornada Long Term Ecological Research site. We developed tools for manipulating VIIRS data given the lack of free and easy-to-use tools for processing this type of remote sensing data. While our focus was limited on the data needed for the 3 geocache prototypes, our future work includes an automated processing interface for VIIRS data and the use of semantic-based approaches for the integration of data. We expect to engage the future generation of scientists by allowing students to explore the earth from a space perspective and navigate large amounts of online data, including satellite data, to understand current scientific challenges.

SAT-271

WHAT TO LIKE? RECOMMENDING PAGES TO SOCIAL NETWORKING USERS

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In social interactions, people are more likely to befriend others with similar characteristics, personalities, and interests such as movies, celebrities, or hobbies. Successful social networking sites, for example Facebook and Twitter, have made it possible for users to express their interests through “liking” or following a certain interest. However, users have to navigate through various website links in order to find recommendations. We introduce a more efficient, aggregated way for users to find recommended interests. This study proposes a web application for social networking sites that recommends people, places, and things that the users should follow, “like” or visit based on their current subscriptions and checkins. We will be implementing algorithms such as a reputation system and collaborative filtering that analyze a user and his or her friends’ interests and create suggestions. The application will encourage users to become more social by sharing their interests and places they visited with friends.

FRI-269

ANALYSIS OF PERFORMANCE DEGRADATION OF INTEGRATED CIRCUITS DUE TO TRANSISTOR AGING EFFECTS IN NANO-SCALE

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Integrated circuits, or ICs, work behind the scenes to make people’s lives better. ICs can be found in common appliances, such as refrigerators and dishwashers, and in the most sophisticated computers. IC performance has dramatically improved since their first creation. However, with the scaling of ICs to nano scale, an ideal integrated circuit, delivering reliable performance over its lifetime is almost impossible. All ICs experience degradation over time due to the aging of underlying transistors. In this research, analysis of transistor breakdown is performed through computer simulations using the Custom Designer SE tool to understand effects on circuit power and performance. To simulate the effect of transistor breakdown, a ring oscillator circuit is used. This breakdown is modeled by resistors placed between the transistor terminals. The values of the resistors represent the severity of breakdown; large resistors represent fresh transistors, whereas low resistors represent a fully broken transistor. In addition to computer simulations, real ICs are studied by taking power measurements. This research aims to offer better insight into the impact of transistor breakdown on IC performance and to improve IC design in the nano scale.

FRI-271

DISCOVERING AND PATCHING HARDWARE SECURITY VULNERABILITIES IN A ZIGBEE WIRELESS SENSOR NETWORK USED BY BUILDINGDEPOT

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University of California, San Diego, La Jolla, CA.

In recent years, the Smart Building, an ideal and automated energy-efficient building that uses a variety of automated devices has become more of a possibility. One system in research that incorporates the idea of many Smart Buildings is the BuildingDepot (BD): an office-building management system that receives data from wired and wireless sensor networks deployed across the building, processes and stores the data, and provides it to developers via RESTful API. To obtain information from wireless sensors using ZigBee protocol, BD uses a gateway that converts the ZigBee to standard Ethernet/WiFi protocol. BD implements a “star” network, a network that contains no routers and only end-nodes (sensors). For the current experimental building with four floors and ten coordinators per floor, there are many sensors which communicate with the coordinator through an open wireless medium. The wireless sensor network (WSN) implements the Texas Instruments Z-Stack (TI Z-Stack) protocol which uses AES symmetric 128-bit keys to make sure communication is secure between the coordinator and sensors. In addition, on joining the network with the correct certificate information, sensors will initiate key establishment with the coordinator. However, with a large scale “real” deployment of this WSN, security breaches may be more possible than ever. For this reason, the objective in this project is to identify and patch security vulnerabilities in a “real” deployment of ZigBee sensors used in building monitoring and actuation.

FRI-270

CONSTRAINT MODEL FOR PAIRWISE TESTING

Carlos Nieto, Martine Ceberio.

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Software testing is an essential part of the software development process that ensures quality, reliability, and robustness. Sometimes, testing is left for the end of a project, and exhaustively testing a system can be a very expensive and time-consuming process. Pairwise testing is the simplest form of combinatorial testing that requires every pairwise interaction of valid input values to be included in at least 1 test case of a test suite. Pairwise testing is based on the observation that most errors in a system are triggered by the interaction of at least 2 input values. Existing pairwise approaches lack practical features such as defining user constraints and ensuring the minimal number of test cases are considered. In this work, we propose a finite domain constraint model describing the problem of generating a minimal pairwise covering test suite that satisfies user-defined constraints. In such a model, a finite set of input variables are associated with discrete domains of possible values, and the relations between the input variables are captured as constraints. A discrete constraint solver is used to infer the pruned domains for each variable and implement a backtracking process to instantiate the variables while satisfying the constraints. When combined with an optimization function, it is possible to ensure the minimal number of test cases are considered.

SAT-269

ANDROID-BASED BIOACOUSTICS SIGNAL FILTERING

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The purpose of this work is to develop algorithms to conduct signal processing operations on bioacoustic signals. The work centers on the implementation of signal filtering that could be implemented readily by users of personal digital assistants (PDAs), such as e-Tablets and smartphones, under an Android-based platform. Android, as a Linux-based operating system mainly used for electronic visual-display applications, will bring value added capabilities to researchers in the field studying bioacoustics signals. Bioacoustics is defined as the study of natural sounds produced by animals, including humans. Our specific work deals with the implementation of different types of signal filters, such as low-pass, high-pass, band-pass, and band-reject filters, in order to assist in the preprocessing of bioacoustics signals in the field using an Android-based device. The OMAP (Open Media Applications Platform) is being used as a target testbed implementation environment. The OMAP is a multicore device possessing an ARM architecture processor core where the Android is being ported. The OMAP also has a floating-point digital signal processor where the filtering algorithms will be initially tested before being ported to the ARM processor. It is expected that a class of efficient signal filtering algorithms may be developed that could run exclusively on the ARM processors, making them suitable for Android-based PDAs.

ELECTRICAL/ELECTRONICS/COMMUNICATIONS ENGINEERING

SAT-275

POWER-LINE MONITORING USING LOW-COST SIGNAL PROCESSING TECHNIQUES

Gabriela Torres, Domingo Rodriguez.

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With the increasing divestiture of power generation it is becoming very important to develop efficient, low-cost techniques for power-line signal monitoring in order to guarantee the safety and specifications of the power being delivered to customers. This work deals with the development of low-cost power line signal-monitoring techniques for power quality applications. The work centers on the use of signal processing algorithms to provide signal metrics that evaluate the set of power disturbances commonly experienced in a power line environment. Our specific work deals with the design of a voltage step-down circuit that will allow power line signals to be fed to digital signal processing devices. At the present time, TMS320C6713 floating-point digital signal processing is being used to implement these signal processing algorithms. The voltage step-down circuit is being implemented using a step down transformer. A signals and systems characterization of this device is also being conducted in order to evaluate its noise characteristics and determine what noise is being produced by the step-down circuit itself and what noise or disturbance is inherent in the power line signal under analysis.

FRI-278

CORRELATING POWER SYSTEM RESPONSES WITH NOTIONS OF ELECTRICAL DISTANCE: A STATISTICAL APPROACHCarlos Flores¹, Aranya Chakraborty².¹University of California, Davis, Davis, CA, ²North Carolina State University, Raleigh, NC.

Finding patterns in large volumes of power system data is an important problem as these patterns can inform the operator about system-wide behavior and help in predicting faults. Such patterns are often strongly correlated to notions of effective distance between power substations. Our goal in this project is to develop data analysis methods by which an operator may be able to evaluate how different data sources in a large power grid are correlated with each other and relate them to inter-station distances. Our variables of analysis are voltage and phase-angle measurements lasting for a period of 3 minutes and gathered using phasor measurement units (PMU) from eight, 500 kV power substations in the western, coastal United States. The data streams are passed through a band-pass filter for noise elimination first and the relative phase angles are computed from the filter outputs. Statistical calculations are then made to determine the least-squares differences of the relative angles and their relationship to respective distances. Other graphs are plotted using different metrics for distance such as the linear distance between substations multiplied by the number of connecting transmission lines. Results thus far have shown that, depending on the fault, linear geographical distance between substations may indeed have a positive correlation to the discrepancies in phase angles. Future work will involve defining new metrics for distances that we can use to tune this correlation to match the variables more accurately.

SAT-278

PREPARATION AND MAGNETIC CHARACTERIZATION OF Ru_2XZ HEUSLER COMPOUNDS ($\text{X}=\text{Fe}, \text{Co}, \text{Mn}$; $\text{Z}=\text{Si}, \text{Ge}$)Juan Castillo, Jason Douglas, Ram Seshadri, PhD.

University of California, Santa Barbara, Santa Barbara, CA.

In this study, we are characterizing the magnetic properties of intermetallic Heusler compounds, with particular focus on the development of ferromagnetic and antiferromagnetic compounds. It has been noted that ferromagnetic and antiferromagnetic compounds that are layered together exhibit a phenomenon known as exchange bias or exchange anisotropy. Possible applications of this phenomenon are permanent magnets and stabilization of recording heads based on anisotropic magnetoresistance. The specific compounds studied are $\text{Ru}_2\text{Fe}_{1-x}\text{Mn}_x\text{Si}$, $\text{Ru}_2\text{Fe}_{1-x}\text{Mn}_x\text{Ge}$, and $\text{Ru}_2\text{Co}_{1-x}\text{Mn}_x\text{Ge}$ with $x \leq 1$, all of which exhibit Heusler crystal structures. We prepared these alloys using an arc melter and then annealed the alloys in a furnace to obtain a homogenous phase. We then analyzed the Heusler crystal structures using X-ray diffraction in coalition with optical and scanning electron microscopy. The magnetic properties such as Curie and Neel temperatures, saturation magnetization, and the coercivity are characterized using a superconducting quantum interference device magnetometer. We expect to see an increase in coercivity in the Mn substituted alloys as well as a shift in the Curie and Neel temperature. This study will expand the knowledge of magnetic properties and complex phenomena in Heusler-based materials and in particular provide a better understanding of exchange bias.

FRI-279

MODIFYING THE INTERNAL CONTROL CIRCUITRY OF THE HARVARD APPARATUS MODEL 11 SYRINGE PUMP TO ALLOW FOR BOTH INFUSION AND WITHDRAWING OF FLUIDSEdith Rodriguez, Eric Terry.

University of California, Santa Barbara, Santa Barbara, CA.

Syringe pumps are used in scientific and clinical environments to expel (infusion mode) and refill (withdraw mode) fluids from and into a syringe for specific volumes and rates. For example, in clinical environments, syringe pumps can be used to deliver drugs in a well-controlled manner over time, and in scientific experiments, they can be used to move fluids through microfluidic devices at well-defined rates. Syringe pumps that only expel fluids are more common due to their decreased cost when compared to similar syringe pumps that are able to both expel and withdraw. One such infusion-only syringe pump, the Harvard Apparatus Model 11 was modified to allow for both infusion and withdrawing of fluids by replacing the internal control circuitry with a Texas Instrument MSP430 microcontroller. The modified syringe pump was found to have accuracy and precision comparable to commercially available syringe pumps that have both infusion and withdrawing capability.

SAT-279

PACKET LOSS PREDICTION FOR A MOTION-CAPTURE (MOCAP) SYSTEM

Owen Dominguez, Gustavo Vejarano.

Loyola Marymount University, Los Angeles, CA.

Reliable wireless communications are important for performing daily life activities because of the increasing amount of electronics that use this technology. Our goal is to develop an affordable and portable motion-capture (mocap) system that uses 3 types of nonoptical sensors: accelerometer, gyroscope, and magnetometer. Such systems have myriad applications, including in the health and sports professions, where individuals such as physical therapists, athletes, and prosthetic professionals require a convenient and reliable record of human movement. While testing our mocap system, we found that the sensors were not able to transmit information without interruption, causing erroneous joint angle calculations due to packet loss. Our current investigation is determining how to predict packet loss, which will improve the accuracy of our measurements. Using a token-passing protocol, sensors attached to the limbs of a person transmit information to a receiver PC, which reconstructs the limbs' motion in real time. This allows the sensors to take turns for transmission, making it easier to detect when a sensor was not able to transmit successfully. The inclusion of a packet loss counter and RSSI (received signal strength indicator) in each transmission provides a method of measuring communication performance, enabling us to use algorithmic and mathematical analysis to identify patterns that assist in the prediction of packet loss. Through mocap system testing, we can determine the ability of our algorithms to predict the packet loss. Moreover, to test accuracy, we compare our measurements with those obtained by optical sensors, which are used as a proxy for the true values.

SAT-280

LOW COST ROBOTIC DESIGN AND MANUFACTURING

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A decade ago, robots were limited to academic research and industrial applications. Now, robots are also available for entertainment and assistant roles in many places including some homes, restaurants, and small manufacturing businesses. Widespread adoption of robots into daily life has yet to happen due to the high cost of robotic components, programming, and testing. We strongly propose that if we design a chassis at a low-enough cost, calculated relative to the electronic systems, robots will be more affordable and readily available in our daily lives. Our design methodology includes the following processes: computer aided design (CAD) of working constraints, testing of functional prototypes, and design machinability consultations with machinists. We first focused on reducing machining and electronic component costs by using commercial off-the-shelf (COTS) parts that met design constraints. Each component was manually dimensioned and CAD models were created using Autodesk Inventor Professional edition. Using the component models, a set of constraints were developed for functional prototypes. Robot prototypes were developed in-house for testing system performance and design constraints. Consultations with personnel at the university's machine shop determined the choice of durable low-cost materials and prototype machinability. The final prototype was machined by the university's machine shop with materials obtained from local and national distributors. With our process, we demonstrated that we were able to produce a chassis at less than \$750. At a cost comparable to that of current mobile computing devices, our robots can be made affordable for a wide array of applications.

SAT-274

TIME-FREQUENCY ANALYSIS OF LINEAR, TIME-INVARIANT COMMUNICATION CHANNELS

Keisha Castillo Torres, Domingo Rodriguez.

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This work centers on the use of signal processing techniques to analyze linear, time-invariant (LTI) systems used as mathematical models for wireless communication channels. Mobile communications channels exhibit a great many distortions due to a diverse number of factors, including time delay effects, frequency delay effects, and multipath aggregation effects. In many cases, the time and frequency delays occur at the same time, creating a condition known as doubly dispersive time-frequency fading. This causes the channels to behave as time varying channels instead of time invariant systems. For certain periods of time, called coherency periods, a linear, time-varying channel may be approximated by a linear, time-invariant channel, which is much easier to model. Our specific work deals with the implementation of time-frequency signal processing algorithms to study mobile communication channels in order to analyze coherency conditions. In particular, we are currently implementing discrete cross-ambiguity function

algorithms on field programmable gate array computational structures. These algorithms are very useful for studying the input and output signals of a communication channel under a unique common setting.

SAT-272

SIGNAL CORRELATION TECHNIQUES FOR DELAY-DOPPLER ESTIMATION OF UNDERWATER MOVING OBJECTS

Zaylis Zayas-Rivera, Domingo Rodriguez.

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This work deals with the development of acoustic signal correlation algorithms for the estimation of time delay and Doppler frequency parameters of underwater communication signals for linear beamforming applications. The estimation is performed by sending an acoustic querying or sounding signal, which reaches a target object and produces a return echo signal. Combined temporal and spectral correlation techniques are performed on the transmitted signal and its echo in order to estimate the desired time delay and Doppler frequency parameters. The time delay parameter is used to estimate how far the object is located relative to the querying signal's transmitter. The Doppler parameter is used to estimate the object's speed when moving with constant radial velocity, also, with respect to the querying source signal. Our specific work deals with the hardware implementation of acoustic signal correlation algorithms on field programmable gate array (FPGA) computational structures for the real-time estimation of the delay-Doppler parameters. The discrete cross-ambiguity function is being used to perform correlation techniques between transmitted and received acoustic signals in order to simultaneously compute the time delay and Doppler frequency parameters. This function has been successfully implemented on a Virtex V FPGA unit from the Xilinx Corporation under a system generator development environment.

SAT-276

FPGA FOR TARGET DETECTION IN HYPERSPECTRAL IMAGES

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Field programmable gate arrays (FPGAs) provide high performance, low development cost, and flexibility, making them an appropriate architecture for the implementation of a target detection algorithm. In particular, it may be used to accelerate data acquisition systems. We are working on the implementation of a set of core units using the hardware description language VHDL on FPGAs to implement the Reed-Xioli and matched-filter target detection algorithms. We are currently working on the Spartan FPGA architecture in order to detect desired patterns on hyperspectral images. In the long run, the algorithm will be able to detect anomalies in the images provided.

FRI-275

FPGA-BASED IMPLEMENTATION TESTBED FOR MIMO CHANNELS

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Modern mobile communication systems are using multiple antennas, at both their transmitters and receiver systems, in order to take advantage of their spatial diversity and mitigate in this manner the multipath effect produced when a transmitter signal bounces from many obstacles on its way from the transmitter to a receiver. Each bounce may introduce an additional indirect path for the signal to reach the receiver, with the possibility of introducing time delays and frequency delays that aggregate at the receiver in summative fashion. This results in what is known as the multipath fading problem. Our specific work deals with the implementation of a multiple-input, multiple-output communication (MIMO) channel to serve as a signal testbed for mobile communication systems with multiple antennas. The current MIMO system under implementation consists of 2 transmit antennas and 2 receive antennas. The implementation is being conducted on field programmable gate array devices to exploit their rapid prototyping tools and fast computational capabilities.

FRI-273

NANOSCALE 3D PRINTING: IN-SITU OPTICAL SPECTROSCOPY

Rosedanny Ortiz, J. Todd Hastings.

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This project is part of the steadily growing, world-wide body of nanoscience and nanotechnology research. This project involves the design of a laser absorption spectroscopy system that can measure the solvated electrons

generated by an electron beam entering water. This research project involves the use of optical spectroscopy in a large (~1 cm) liquid cell using very high energy electrons (MeV). This approach, however, is not suitable for use in an electron microscope. By using a small (1 μm^3) liquid cell volume of 30,000 eV energy electrons, liquid-phase, electron-beam-induced deposition (LP-EBIP) provides higher purity, faster process rates, and far greater material flexibility than its gas-phase counterpart. The research process consists of 2 parts. First, we set up a laser spectroscopy system consisting of vacuum-compatible parts and that uses lock-in detection to reduce noise and laser light level fluctuations. Second, we determined the limit of detection for an analog species with an absorption spectrum similar to the solvated electrons and identified a dye for which the red laser absorbs strongly near 630 nm wavelength. Our optical spectroscopy results shows that this system works and that the dyes are strongly absorbent. If we can detect the solvated electron concentration, we will place the set up in the electron microscope, fire an electron beam into water, and measure the change in detector voltage. This technique will further understanding of electron-beam-induced processing in liquids.

SAT-277

OPTIMIZING A WIRELESSLY POWERED AC-DC BOOSTER FOR BIOMEDICAL IMPLANTS

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Implanted medical devices (IMDs) have served to increase longevity for years. Wireless charging of IMDs decreases the need for periodic invasive surgery. One way to accomplish this is through a pulse width modulated (PWM) AC-DC boost converter that uses a full-wave rectifier to convert the voltage from a low AC input to a high DC output. To generate the appropriate PWM signal, a microcontroller measures the frequency of the AC input from a small auxiliary coil parallel to the primary receiver coil. By aligning the rising edge of the control signal with the AC input, the boosted voltage is sufficient enough to overcome the turn-on voltage of the two diodes. Previously, motor-controlled rotating magnets were used to deliver power to the implant, which resulted in an optimized output from a duty cycle of 56 to 62% for the generated sinusoidal waveform. In the current experiment, a pair of inductive coils is used to generate the AC voltage. Using a transmitter coil in place of the rotating magnets allows for high-frequency operation and an adjustable waveform. From a square wave input, the output voltage is maximized with a duty cycle of 78% for the control signal. Through this method, a DC voltage of 5 V is generated from an AC input of 200 mV. Using LTspice software and a printed circuit board to illustrate the achieved results, this research aims to prove the increased efficiency achieved by using the paired inductive coils and the optimization of the duty cycle through alteration of the PWM signal.

FRI-276

HIGH-SPEED SIGNAL INTEGRITY

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In modern technology, digital and analog interconnections conflict when operating at high frequency values (> 1 GHz). It is important for designers to understand the impact on signals due to features arising in a printed circuit board (PCB) layout. Before signals can be improved, a detailed analysis must be carried out for the conductors, the transmission lines, and different PCB materials. A particular layout could use microstrip lines instead of striplines. Different levels of performance could arise from the materials like FR4, R04350B, or Megtron6, or if the connections use a single-ended or differential lines. In this project, we describe the chain analysis that needs to be carried out to assess the effectiveness of a layout and to later use this information to devise potential topological improvements. Some of the specific tools that allow us to analyze the integrity of high-speed signals in PCB designs include an impedance-matching analysis throughout the line to obtain expected values of insertion loss, return loss, and time domain response (TDR). The use of ADS and the subprogram Line Calc make the analysis a lot easier, allowing for the finding of specific parameters needed to maintain signal quality. At the end of this process, we have understood how signals and traces interact. Further research will allow us to devise ways for improving these layouts to obtain better signal quality.

FRI-277

INCREASING AXIAL RESOLUTION IN WIDEFIELD MICROSCOPY USING DECONVOLUTION METHODS

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Optical microscopy, used alongside computational methods, has led to higher resolution images for biological imaging purposes. Although great improvements have been made in the imaging field, there still exists the difficulty of matching the axial resolution with that of the lateral resolution due to the built-in optics of any microscope. The most common method of acquiring images of a three-dimensional structure in multidimensional microscopy is to image the structure of interest in different focal planes, referred to as optical-sectioning microscopy. However, this results in unwanted contamination from adjacent planes not in focus and explains the resolution disparity. Though there have been attempts at alleviating the problem with physical modifications, as in confocal microscopy, we focus on investigating computational reconstruction methods for improving the axial resolution in images acquired with more conventional methods, as in widefield microscopy. Our imaging setup is modeled as a shift-invariant system, and we imaged nearly point sources (fluorescent beads) to obtain the point spread function (PSF) that describes the microscope's response for each point in the image. We use the knowledge of the PSF as a basis for the deconvolution algorithm to improve the quality of the acquired images. We also analyze how data from multiple angles can compensate for the reduced axial resolution and attempt to piece them all together to obtain one final image with improved axial resolution. We demonstrate our results using zebrafish as our model system.

FRI-274

SENSOR TEMPERATURE-SENSITIVITY ANALYSIS

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Over the past several decades, sensors have had a big influence on everyday objects. Commercial applications for sensor technology include pressure sensors, light intensity sensors, temperature sensors, and so forth. Sensors are extremely important in our daily lives because they are used in aircraft, automobiles, computers, cellphones, and more. The Stanford Microsystems Laboratory is developing multifunctional integrated sensors for the environment (M-FISes) that enable simultaneous monitoring of 10 parameters: temperature, humidity, light intensity, pressure, wind speed, wind direction, magnetic field, and acceleration in three axes on one 10 x 10 mm silicon die. M-FISes provide significant cost, size, and power savings because they allow us to measure ten functions simultaneously instead of having ten individual devices. One of the most important properties of a good sensor is that it is sensitive to only the measured parameter. Temperature is a parameter that affects the sensitivity of most sensors in M-FISes, so we must be able to compensate for temperature effects. To determine the temperature sensitivity for every sensor, we used an oven and exposed M-FISes to a wide range of temperatures and measured all of the sensors' outputs simultaneously. M-FISes were ideal for temperature compensation because all of the functions are integrated in a single device. By using multiple tests, we measured an average output error from each sensor due to temperature. This analysis allows us to calculate the temperature coefficient of offset (TCO) and the coefficient of sensitivity (TCS), which will be used to compensate for variations in temperature.

ENGINEERING (GENERAL)

FRI-281

DEVELOPMENT OF A COMPUTER-AIDED MODEL TO SIMULATE PHYSICAL EXPERIMENTS ON PROSTHETIC LINERSShawn O'Donnell, Esteban Ruiz.*University of Pittsburgh, Pittsburgh, PA.*

The prosthetic limb serves an essential purpose for people with an extremity amputation. It is imperative that the prosthetic limb maintain a proper fit to the user. The prosthetic liner is a vital component of a prosthesis as it ensures user comfort as well as a secure fit. The current production of prosthetic liners often results in swelling and abrasion to the residual limb area. Additionally, many prosthetic limb users experience dermatological conditions as well as buildup of bacteria, moisture, and odor. The ultimate goal is to conduct research and testing on alternative materials and fit of prosthetic liners to address the current flaws. Mechanical properties of candidate replacement materials are modeled using SolidWorks, a computer drafting and design program. Mechanical characteristics of the materials will be evaluated using the modeling software's finite element analysis (FEA) capability. Variables included in the tests will include Young's modulus and Poisson's ratio to identify shear strength, compressibility, and tensile strength. Forces will be applied to the material using the computer program. Validation of the model will be accomplished using physical testing on representative samples of the materials of interest. Mechanical forces relative to the previous forces will be placed on the material using a stationary jig and a movable piston. After review of the results, a prototype prosthetic liner will be constructed from the materials that show the highest potential for success. Finally, clinical tests must be performed on subject patients to determine the level of compatibility that the liner shows when used as advertised.

ENGINEERING SCIENCES/MECHANICS/PHYSICS

SAT-300

MOBILE CARBON DIOXIDE AND OXYGEN GRADIENT SAMPLER: ANALYZER ON THE MOVEAlejandro Prieto¹, Britton Stephens², Brian Bevirt².¹*Front Range Community College, Longmont, CO*, ²*National Center for Atmospheric Research, Boulder, CO.*

We are building a compact oxygen (O_2) and carbon dioxide (CO_2) gradient sampler for investigating the relationships between exchanges of oxygen and carbon dioxide in a variety of locations. Measurements of local $O_2:CO_2$ flux ratios can help us better understand carbon and nutrient cycling by trees and soils. Microorganisms typically use organic carbon as a form of food, consuming O_2 and producing CO_2 through the respiration process. Nitrifying bacteria acquire their energy by oxidizing ammonium (NH_4^+) to nitrate (NO_3^-). We expect CO_2 and O_2 soil flux ratios to be close to -1 unless N is undergoing nitrification. If the process of nitrification is occurring, then the ratio between CO_2 and O_2 should be shifted toward more O_2 consumption by the soil which will affect near-soil $O_2:CO_2$ gradients. More extensive measurements of $O_2:CO_2$ ratios can also help improve estimates of global terrestrial carbon fluxes. The mobility of this instrument will allow us to collect local data from different parts of an ecosystem, including respiration and photosynthesis, and in both natural and agricultural settings. The system uses infrared CO_2 and fuel-cell O_2 analyzers, each equipped with two detector cells. We minimize measurement drift by rapid switching of 2 inlet gas streams between the 2 sample cells on the O_2 sensor and by occasionally measuring air from two compressed air cylinders with known CO_2 and O_2 differences. The data acquired by this instrument will aid future analyses and contribute to testing models of CO_2 , O_2 , and N cycling.

SAT-282

FEASIBILITY OF THE LABVIEW REAL-TIME OPERATING SYSTEM FOR USE AS A TELESCOPE POINTING CONTROL SYSTEMStanley Edwin¹, Scott Sewell², Dan Marsh², Brandon Larson².¹*University of Alaska Fairbanks, Fairbanks, AK*, ²*National Center for Atmospheric Research, Boulder, CO.*

Solar telescope pointing requirements have increased over the past decade as research has driven finer and finer spatial scales. The purpose of this research is to use a real-time operating system (RTOS) to create a control system with a higher responsiveness within this spatial resolution. Existing methods for solar telescope tracking use a

traditional desktop operating system. A drawback of using traditional operating systems is the requirement to handle and process interrupts. These inherent latencies can extend the turnaround time from pointing error sensor to control feedback. We perform a quantitative comparison between Windows 7 (64-bit) and LabVIEW RTOS in controlling the position of a lever arm influenced by flow from a fan.

ENVIRONMENTAL ENGINEERING

SAT-284

CONTRAIL EFFECTS ON GROUND-BASED SOLAR IRRADIANCE

Marina Fernandez, David Larson, Carlos F.M. Coimbra.

University of California, San Diego, La Jolla, CA.

The impact of aircraft condensation trails (contrails) on ground-based solar irradiance measurements and therefore solar power plant output, has yet to be formally analyzed for use in solar resourcing and integration. This work quantifies the effects of persistent contrails on direct normal irradiance (DNI) using high-fidelity solar irradiance measurements and sky imaging. Contrails were identified using sky images from the Coimbra Solar Forecast Engine Lab's observatory at the University of California, San Diego, and then correlated to intra-minute, ground-based irradiance measurements. Selecting contrails that specifically blocked the sun allowed us to observe their effect on ground irradiance, specifically on DNI data, as opposed to more general effects on the global and diffuse irradiance. The contrail-correlated solar irradiance data was analyzed by calculating the magnitude of the irradiance drop for each contrail within specified sun-to-contrail configurations on a clear day. Results showed that contrail dissipation rates are significant factors in understanding the effects of contrails in general. Dissipative contrails affect DNI in a similar extent to that of cloud cover over a multi-minute time interval, while nondissipative contrails produce sharp drops in DNI over time intervals of 2 minutes or less. On a clear day, dissipative and nondissipative contrails can cause drops in DNI of greater than 500 W/m² and 150 W/m², respectively. These results show that contrails should be considered in both solar power plant site selection and power output forecasting.

FRI-284

KINETICS OF BISPHENOL A AND 17 B-ESTRADIOL OXIDATION BY MANGANESE (IV) OXIDES

Billionrosannae Chhouk¹, Jacqueline Meija², Matthew Ginder-Vogel², Christina Remucal².

¹*San Diego State University, San Diego, CA*, ²*University of Wisconsin-Madison, Madison, WI*.

The endocrine system refers to the complex network of hormones and receptors responsible for maintaining normal nervous and reproductive system development among many other biological processes in all organisms. Unfortunately, many synthetic compounds, termed endocrine disruptors, can mimic or block these hormones and negatively affect the organism involved. At low concentrations, endocrine disruptors are known to alter normal cellular development and cause the feminization of fish populations. This project investigates the ability of manganese oxide to degrade 2 ubiquitous endocrine disruptors found commonly in the environment: bisphenol A (BPA) and 17 β -estradiol (E2). BPA is used in plastic production, and E2 is an estrogen used in contraceptives. Previous studies have shown that manganese oxides can oxidize a wide range of organic pollutants due to their large surface areas (from 2 to 260 m²g⁻¹) and high redox potentials. However, researchers have failed to assess the changes in the mineral surface and have not been able to identify the oxidation reaction products. This project has two main objectives: use X-ray absorption spectroscopy to identify the mineralogical transformations of manganese oxides and study the oxidation rates of BPA and E2 via high performance liquid chromatography. The oxidation rates will be evaluated under various conditions including pH, salt concentrations, and dissolved organic matter concentrations. This project will provide a novel understanding of how manganese oxides can be used to detoxify and remove harmful endocrine-disrupting compounds in controlled waste-water treatment facilities to ultimately promote the health of humans and wildlife.

SAT-283

INDOOR AND OUTDOOR AIR QUALITY IN THE LATINO COMMUNITY IN BOULDER, COLORADO

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The Environmental Protection Agency has established methods and metrics for qualifying and regulating outdoor air quality; however, indoor air quality (IAQ) has not enjoyed the same level of attention. In fact, indoor levels of many pollutants are often several times higher than levels found outdoors. Indoor air pollutants can concentrate due to poor circulation within a home. Further, Americans spend most of their time indoors where they can experience exposures that may result in poor respiratory and cardiovascular health. This investigation targeted a low-income Latino community in Boulder, Colorado, and focused on the indoor air quality of their homes as well as the ambient (outdoor) air in their area. Participants were administered a survey that included questions on their health conditions and indoor air pollution sources (e.g., cigarette smoke, combusted fuel used for heat, and building materials). In addition, the indoor and outdoor air in each home was sampled for a period of 24 hours using tactical air samplers (MiniVol Airmetrics, Eugene, OR). Air samples were collected onto 2 different filters (47 mm teflon and Tissuquartz) to measure the quality of the air. The teflon filters were analyzed gravimetrically to measure PM_{2.5} (particulate matter of diameter 2.5 micrometers and below) and tested for the presence of endotoxins and proteins in the air. The Tissuquartz were analyzed for elemental and organic carbon. Early results indicated that the indoor air contained a higher concentration of pollutants than the ambient air and that there were measurable levels of endotoxins on most air samples.

SAT-285

VALORIZATION OF DISTILLERS DRIED GRAIN THROUGH ACID HYDROLYSIS AND ALKALINE EXTRACTION

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¹St. Olaf College, Northfield, MN, ²University of Wisconsin-Madison, Madison, WI.

Due to the cessation of ethanol subsidies, a need has arisen to increase the vitality of ethanol production through the valorization of distillers dried grain (DDG). DDG, the primary by-product of ethanol production, is primarily sold as animal feed for modest revenue. However, higher value products can be extracted from DDG. DDG is composed primarily of protein and fiber. Hemicellulose is a primary fiber found in DDG that animals cannot digest. This study proposes 2 mechanisms to extract the indigestible hemicellulose in animal feed and to convert it to green alternative products. Thus, the purpose of this study is twofold: convert hemicellulose monomers to furfural from DDG, and extract hemicellulose polymers from DDG to create a paper film. Aqueous solutions of furfural were produced from DDG hydrolysate using batch dehydration procedures. Results indicate that optimal conditions occur at 180 °C and 1% acid. Separately, solid hemicellulose polymers were extracted from DDG through treatment with alkali media followed by ethanol precipitation. The polymer was then casted as a film. Current testing is being performed to determine the polymer's effectiveness as a paper film. Furfural and hemicellulose polymers produce revenues up to \$0.70 and \$2.00 per pound, respectively. In contrast, DDG produces only \$0.15 per pound as feedstock. Furfural yields are currently too low to permit a significant revenue gain; however, optimization is currently being performed to maximize yield and lower reaction conditions. Furthermore, the hemicellulose film shows great promise with respect to revenue gains depending on its mechanical properties.

FRI-285

CURRENT STATUS AND PROSPECT OF RENEWABLE ENERGY STORAGE TECHNOLOGIES

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With the common goal of creating a more sustainable living global environment, scientists and engineers around the globe have been working on improving current and creating new methods to produce renewable energies. With the increasing production of renewable energy resources, there is also a drastic and increasing demand for higher energy storage capacities in order to meet public demand and also to maintain power quality and availability. In this project, we will provide an overview and introduction of current energy storage technologies which can be divided into 3 main categories: electrochemical energy storage, mechanical energy storage, and thermal energy storage. We will also describe the existing popular methods developed in each category. The pros and cons of each method will be analyzed in detail, followed with comparison between these methods. We will also look at the potential of future energy storage technologies to provide significant improvements over current technologies.

INDUSTRIAL/MANUFACTURING ENGINEERING

SAT-286

DEVELOPING WOOD PLASTIC COMPOSITES AS SUSTAINABLE COMMODITIES USING RECYCLED MATERIALSFernando Perez, Delia Valles.*New Mexico State University, Las Cruces, NM.*

Waste management is a major issue in the agricultural industry. With waste management being a major industry in the Southwest, much interest is being developed in uses for the agricultural waste produced by these processes. In this study, the authors have produced and investigated a new composite material conception based on recycled polyethylene (rPE) and wood particles obtained from agricultural waste, specifically the stalks and leaves of chili plants. The study shows a comparative analysis of grain size of wood particles versus percentage of materials and the resulting effect these variables have on the composite material when introduced to mechanical stresses. The new composite mixture was analyzed by means of statistical analysis and scanning electron microscopy (SEM) analysis. Preliminary results found that grain size and percentage of raw material affect the composite material's performance of ultimate tensile strength and yield point when introduced to mechanical stresses.

FRI-286

OPTIMIZING DISASSEMBLY OF PRINTED CIRCUIT BOARDS USING A SUPERCRITICAL CARBON DIOXIDE PROCESSFelipe Silva, John Carrell.*Texas Tech University, Lubbock, TX.*

Printed circuit boards (PCBs) are complex components present in a large variety of electronic devices. Although PCBs have well defined manufacturing technologies, the disassembly and recycling process for these devices still represents a challenge. The purpose of this work is to analyze and optimize the disassembly process of PCBs using a supercritical carbon dioxide process. An experimental design was conducted using 4 control factors each with 3 levels. The factors included temperature (160 °C, 190 °C, and 220°C), pressure (1500 psi, 3500 psi, and 5500 psi), solvent used in reaction (pure carbon dioxide, water mixture, and sodium carbonate mixture), and vessel depressurization (every 4 hours, 1 hour, and ½ hour). From performed experiments, the supercritical carbon dioxide process has been validated as providing an environmentally benign solution for disassembling PCBs for recycling. The conducted experiments have provided key effects based on tested control factors for the supercritical carbon dioxide process. Based on these effects, the optimal disassembly and recycling scenario for the super critical carbon dioxide process is with high operating pressures, high temperatures, frequent depressurizations, and the sodium carbonate mixture solvent. This optimal process showed the greatest weight reduction and thickness increase of the PCB denoting the best delamination of the PCB for disassembly and recycling.

MATERIALS ENGINEERING (INCLUDING CERAMICS/TEXTILES)

FRI-287

CHARACTERIZATION OF INDIUM GALLIUM ARSENIDE THERMOELECTRIC MATERIALS GROWN BY CHEMICAL BEAM EPITAXY AND DOPED WITH RARE EARTH NANOPARTICLESVishaal Varahamurthy, Ryan Need, Christopher Palmstrøm.*University of California, Santa Barbara, Santa Barbara, CA.*

The thermoelectric effect can play a significant role in the global effort to improve energy efficiency by converting waste heat from automobiles, households, and industrial electronics into usable electricity. Prior research has shown indium gallium arsenide (InGaAs) to be a highly effective thermoelectric material. In this study, we will characterize InGaAs materials grown by chemical beam epitaxy and doped with rare earth elements (e.g., erbium and lanthanum). In small amounts, these rare earth dopants affect the efficiency of the thermoelectric material by changing the carrier concentration. In larger quantities, the rare earths precipitate out of the matrix and form nanoparticles, which in theory can further improve device performance by reducing thermal conductivity. We will vary growth parameters such as dopant concentration, growth temperature, and background chamber pressure, and measure their resulting effects on electrical properties and thermoelectric performance using the Hall and Seebeck techniques. We predict that the

identity of the rare earth dopant will have a minor effect on the electrical characteristics of the material because the solubility of the rare earth elements in InGaAs is low and the ionization energies of the different dopants are similar. However, the varied growth conditions should have a more significant impact on thermoelectric performance through their effects on the formation, size, and distribution of the rare earth nanoparticles that precipitate during growth. By observing how these growth parameters affect the material's thermoelectric performance, we can expand our knowledge of the thermoelectric effect and facilitate research that will lead to improved energy efficiency.

SAT-290

HIGH SENSITIVITY TERAHERTZ METAMATERIAL SENSOR

Erik Bautista¹, Azucena Yzquierdo¹, Dragoslav Grbovic².

¹Hartnell College, Salinas, CA, ²Naval Post Graduate School, Monterey, CA.

The Microsystem Fabrication Laboratory at the Naval Post Graduate School (NPS) focuses on the fabrication of microelectromechanical systems (MEMS). We report on the development of a microfabrication process of a terahertz metamaterial developed to absorb high levels of THz radiation. The metamaterial was designed to 1) be simple and low-cost to implement, 2) match the resonant frequency of the illumination source while providing structural support, 3) maintain thermomechanical properties, and 4) provide optical read-out access. The design consists of a periodic array of aluminum squares separated from a homogenous aluminum (Al) ground plane by a thin film of SU-8 photoresist (dielectric layer). This metamaterial acts as an absorbing portion of a THz detector. Absorbed incident THz radiation by a detector in the absorbing structure of the metamaterial transforms it into heat that transfers to detector's bimaterial legs. Consequently, the detector's structure deforms proportionally to the absorbed power. Deformation occurs due to the difference in thermal coefficients of Al and SU-8. A quantum cascade laser (QLC) emitting THz radiation is to be used as the illuminating source in the imaging system. Indicative of its flexible design and high sensitivity, further tuning can be achieved by modifying the dimensions of the patterned squares to match the absorption frequency to the illumination source for real-time THz imaging applications for military and medical purposes. We compare the outcome of etching versus the lift-off process for patterning the upper layer of metamaterial, which was implemented previously in search of metamaterial microfabrication optimization.

SAT-287

INTEGRATION OF NATURAL DYE, ANTHOCYANIN, INTO SOLID-STATE SOLAR CELLS

Eduardo Valle, Aliaksandr Zaretski, Darren Lipomi.

University of California, San Diego, La Jolla, CA.

Anthocyanins are small molecules that are responsible for the dark purple to bright red colors of many fruits and vegetables. The major role of anthocyanins in plants is to absorb specific wavelengths of sunlight, from 520 nm to the ultraviolet. In doing so, they protect the plant from solar damage. This photosynthesizing property of anthocyanins has caught the attention of the solar cell community and has led to the development of dye-sensitized solar cells (DSSC) that use anthocyanins as the electron donor, hole producer in the cell's active layer. Current DSSCs have been able to achieve high efficiencies (~12%). The problem with DSSCs is that the electrolytic fluid cannot be preserved for long periods of time. Our goal is to create a solid organic solar cell (OSC) using anthocyanins paired with an electron-accepting compound to overcome the obstacle presented by the electrolyte. We start by extracting and purifying anthocyanins from purple corn, a crop that can be grown over large areas in many climates, via vacuum filtration and column chromatography. The purified anthocyanin (a p-type semiconductor) is then spin-coated onto glass bearing a layer of a transparent conductive polymer. An n-type small molecule is spin-coated on top of the anthocyanin layer, and a drop of eutectic gallium-indium as the top electrode completes the device. The cell will then be placed in a solar simulator to test its performance. Preliminary results suggest that anthocyanin and a derivative of C₆₀ form working solar cells, and we seek to improve them.

FRI-289

HIGH SENSITIVITY METAL-ORGANIC HYBRID TERAHERTZ METAMATERIAL

Azucena Yzquierdo¹, Erik Bautista¹, Dragoslav Grbovic².

¹Hartnell College, Salinas, CA, ²Naval Post Graduate School, Monterey, CA.

The Microsystem Fabrication laboratory, at the Naval Post Graduate School (NPS), focuses on the fabrication of microelectromechanical systems (MEMS). We report on the development of a microfabrication process of a terahertz metamaterial developed to absorb high levels of THz radiation. The metamaterial was designed to 1) be simple and low-cost to implement, 2) match the resonant frequency of the illumination source while providing structural

support, 3) maintain thermomechanical properties, and 4) provide optical read-out access. The design consists of a periodic array of aluminum squares separated from a homogenous aluminum (Al) ground plane by a thin film of SU-8 photoresist (dielectric layer). This metamaterial acts as an absorbing portion of a THz detector. Absorbed incident THz radiation by a detector in the absorbing structure of the metamaterial transforms it into heat that transfers to detector's bimaterial legs. Consequently, the detector's structure deforms proportionally to the absorbed power. Deformation occurs due to the difference in thermal coefficients of Al and SU-8. A quantum cascade laser (QCL) emitting THz radiation is to be used as the illuminating source in the imaging system. Indicative of its flexible design and high sensitivity, further tuning can be achieved by modifying the dimensions of the patterned squares to match the absorption frequency to the illumination source for real-time THz imaging applications for military and medical purposes. We compare the outcome of etching versus the lift-off process for patterning the upper layer of metamaterial, which was implemented previously in search of metamaterial microfabrication optimization.

FRI-288

INHIBITION OF FIBROSIS USING FUNCTIONALIZED BIOMATERIALS BY INVESTIGATING CELL MIGRATION OF NIH 3T3 CELLS

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With recent advancements in biomaterial science, designing and optimizing naturally derived delivery vehicles for therapeutic agents hold great potential in treatment of a wide range of diseases. A major stepping stone to the success of this research is finding a way to mitigate the foreign body response to the material used. It has been shown that biomaterials like poly-L-lysine have the potential to induce a foreign body response, resulting in fibrotic capsules that eventually lead to necrosis of the encapsulated therapeutic agent. One application of particular interest is the artificial pancreas for type I diabetes treatment in which insulin-producing cells are encapsulated in a polymer. Fibrotic tissue formation is thought to be one of the factors in the failure of this device. It is hypothesized that functionalized polymers will have an inhibiting effect on cell migration and contractile scarring, potentially limiting fibrosis. For this work, 5 ml Petri dishes were coated with either alginate or poly-L-arginine which had been functionalized with one of an array of monomers. These Petri dishes were then seeded with 15,000 NIH 3T3 cells. Cell migration was investigated using time-lapse video microscopy to track cell motion. Experimental results will be reported at the end of the project. Vascular endothelial growth factor will also be measured as it holds the potential to create new blood vessels, supplying the encapsulated cells with nutrients.

SAT-288

RESPONSIVE ENERGETIC SOL-GEL-POLYMER NANOCOMPOSITES FOR ARTIFICIAL PHOTOSYNTHESIS

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A variety of photosynthetic organizations can be found in nature. In a majority of such complexes, membrane-embedded proteins serve as scaffolds for pigments generating energetically, spatially ordered assemblies resulting in efficient light-harvesting, energy transfer, and charge separation. The ability to mimic the efficiency of natural photosynthetic systems has been a goal in biomaterials design for decades. Mesostructured and mesoporous silica made using sol-gel processing are promising host templates for encapsulation of biomolecules and creating bio-inspired assemblies. The sol-gel process involves the transition of a solution system from a liquid "sol" (colloidal) into a solid "gel." Surfactants are commonly used as templates in creating mesostructured or mesoporous silica during the sol-gel process resulting in ordered arrays. In this study, amphiphilic diblock copolymers that form micelles are being investigated as templates for forming mesostructured silica and as composite materials for creating bio-inspired artificial photosynthetic assemblies. We have designed nanocomposites that incorporate porphyrin-based chromophores and carbon-based nanomaterials in varying compositions into responsive block-copolymer micelle assemblies encapsulated in sol-gel in order to generate photo-responsive bio-inspired materials. The designed nanocomposites investigated are an initial attempt to generate responsive, ordered arrays capable of performing artificial photosynthetic processes such as light-harvesting, energy transfer, and charge-separation.

SAT-289

EXPERIMENTAL AND FINITE ELEMENT METHOD ANALYSIS OF THE MECHANICAL BEHAVIOR OF SANDWICH STRUCTURES

Sandra Diaz, Lilian Davila.

University of California, Merced, Merced, CA.

The goal of this study is to evaluate and predict the mechanical properties of sandwich structures consisting of two 6061 Al sheets and a polyurethane foam core as a function of three different foam densities (96.1 kg/m³, 160 kg/m³, and 320 kg/m³). Computer simulations and experiments are being carried out in this project in order to create an efficient procedure for future design considerations. A finite element method (FEM) program, COMSOL Multiphysics 4.3, is used to predict the critical buckling load and bending modulus of the sandwich structure when it is subjected to uniaxial compression loads and a 3-point bending test. The results are compared with previous independent experimental findings. From the FEM simulations, other mechanical properties are analyzed including the maximum von Mises stress, displacement, and volumetric strain among others. An experimental 3-point bending test is also conducted using an Instron universal testing machine to measure the mechanical properties of the sandwich structure. Predicted results show that the critical buckling load (and bending modulus) increases as foam density increases, implying that the density and strength of the foam in the sandwich structure have a direct relationship and affect the overall properties of the combined foam-sheet system. In brief, simulations and experimentation combined can be a powerful tool for the study, prediction, and design of new or advanced materials. Future work will involve assessment of the feasibility of these sandwich structures as vehicle impact absorbers, allowing future automobiles to be lighter and safer, which in return would increase fuel efficiency.

FRI-290

INDUCED NEGATIVE VISCOSITY AS A DEGREE OF FREEDOM IN THE ELECTROSPINNING OF POLYMERIC SOLUTIONS

Lina Sanchez-Botero, Alejandro Garcia, Juan Hinestroza.

Cornell University, Ithaca, NY.

This paper seeks to provide evidence for the negative viscosity effect in non-Newtonian ferrofluids and provide an avenue to investigate the new parameter of non-Newtonian behavior that is affected by both the magnetic field and shear stresses. Previous models developed by Shliomis, Felderhof, Weng, and Chen have described the phenomenon of magnetoviscosity for Newtonian (ferro) fluids from irreversible thermodynamics but, until now, there has been no work done purely on non-Newtonian ferrofluids. The induced negative viscosity effect in a polymer solution with magnetic nanoparticles is presented both from an experimental and theoretical view. As part of a new design, a linear solenoid was coiled around a ferrite hollow bar to produce higher magnetic fields. Results using a capillary rheometer indicated that the magnetic nanoparticle colloidal fluid under an AC-generated magnetic field displayed an overall reduction of viscosity under certain shear rates. Additionally, measurements demonstrate a significant reduction in viscosity of the liquid with the AC-generated field versus no field. For a Hagen-Poiseuille flow, additional measurements implementing shear also demonstrate a combination of magnetic and non-Newtonian properties. A model considering both the magnetic and non-Newtonian properties is developed, taking from the earlier models. The models of Weng and Chen, and one model of Shliomis, explore non-Newtonian behavior in Newtonian ferrofluids under a combination of magnetic fields and shear stresses, but an actual non-Newtonian fluid is not employed.

MECHANICAL ENGINEERING

FRI-293

LAYOUT DESIGN FOR HYBRID ELECTRIC VEHICLE TEST PLATFORM

Xavier Castaneda¹, Changjian Hu², Ewan Pritchard²

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Electric vehicles (EVs) and hybrid electric vehicles (HEVs) have the potential to provide efficiency benefits over vehicles with combustion engines. Current vehicle test beds available are not suitable for HEV testing purposes. An HEV test platform can provide automobile manufacturers with accessible performance tests and can also be a helpful tool for researchers to develop automobile software, components, and control strategies. The HEV test platform

consists of a chassis with hybrid drive train, a data acquisition system, a chassis dynamometer, and a MotoHawk micro controller. In this research, we mainly focus on the layout design of the hybrid drive train converted from a pure electric drive which comes from a Department of Energy project. The conversion research begins with the 3D modeling of the existing chassis components in SolidWorks. Components were first measured, sketched, and then modeled to appropriate or representative dimensions. With all parts modeled, different layouts for the chassis can be virtually assembled for further analysis. Four different designs are proposed whose benefits and difficulties are analyzed respectively. The most appropriate design was chosen after analyzing the tradeoffs of all designs. This design research provides an optimal layout of the chassis with the hybrid drive train which will benefit the future development of the HEV test platform.

SAT-295

MASS AND ENERGY BALANCE QUANTIFICATION OF BIOMASS IN A PLASMA GASIFICATION SYSTEM

Alexandro Perez-Tovar, Gerardo Diaz.

University of California, Merced, Merced, CA.

With an increasing problem of waste management and the continuous depletion of fossil fuel sources in our world, researchers are looking at different methods of alternative energy. Current research in plasma gasification shows that it is a strong candidate for managing waste and converting it into an alternative fuel source known as syngas, a hydrogen and carbon monoxide mixture. However, to fully determine if the system can be utilized as a solution to the waste management problem, several parameters have to be quantified to calculate the mass and energy balance of the system, as well as its efficiency. This project intended to obtain the performance of a plasma gasification unit currently being tested at the University of California, Merced. This was done by measuring the inputs and outputs to the system which include the rate at which biomass waste was gasified, the amount of steam being utilized, and the flow rate of syngas (including its chemical composition) produced during the gasification process. The power utilized to generate the plasma discharge was also measured. This study provides a detailed analysis of the results obtained.

FRI-291

EFFECTS OF CONFINEMENT ON FLAME PROPAGATION OF THIN FILM $Mg+MnO_2$ THERMITE

Jesus Cano, Kelsey Meeks, Michelle Pantoya.

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Thermite welds are widely used in the railway industry to provide a superior joint at endpoints of rail segments. Though thermite welds offer stronger joints compared to traditional bolted joints, there are limitations, including the need for replaceable molds and impediment by wet or inclement weather as most rails are joined on-track. Confining a thin film thermite provides a solution to thermite welding in wet weather while still providing a quality weld at crucial junctures. The effects of containment on flame propagation will be studied on a thin film of a theoretically gasless thermite reaction. A gasless reaction is ideal to reduce effects of pressurization caused by an increasing volume of aerosolized products. These effects will be observed in both an open environment and in a contained flame tube apparatus (CFTA) for magnesium (Mg) and manganese oxide (MnO_2) coatings bound together with a polyvinylidene difluoride (PVDF) and n-methylpyrrolidone (NMP) mixture. This binder will provide an optimal coating of the energetic materials. An acrylic CFTA was chosen for its relatively low conduction coefficient and inertness with this reaction. The $Mg+MnO_2$ coatings will be mixed in a Thinky centripetal planetary mixer, dried, and baked for 2 hours before being ignited. Ignition will occur using an electrically heated wire through grooves built into the CFTA. Flame propagation will be measured using a Phantom high speed camera and derived from flame distance over time. This study will provide valuable insight to confined thin film thermite reactions and a solution to on-track welding.

SAT-292

HYBRID VEHICLE SENSITIVITY ANALYSIS FOR OPTIMIZATION OF EFFICIENCY AND PERFORMANCE

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EcoCar2 is an Advanced Vehicle Technology Competition (AVTC) sponsored by the US Department of Energy (DOE) and General Motors (GM). This 3-year student program explores electric vehicle technology with primary goals of maximizing energy efficiency and minimizing vehicle emissions while maintaining consumer acceptability and safety. As the competition transitions into its third year, the goal is to refine and optimize the vehicle in this final stage of competition. This research study utilizes design of experiment techniques to conduct a parametric analysis that identifies which vehicle parameters are most influential on the system efficiency. We simulate a model of the plug-in

hybrid electric vehicle (PHEV) via Matlab/Simulink software since this is a cost effective experimentation approach to considering all factors simultaneously. A cost model is also developed to determine associated resource costs for improving each parameter. With combination of cost and parametric sensitivity, we look to find the optimal point for refinements. Hence, by establishing the relative weight of each vehicle parameter with an associated cost model, this study will guide the focus of areas that will be most beneficial in improving efficiency and performance of the Ohio State University's EcoCar2.

FRI-294

FLAMING IGNITION BEHAVIOR OF CELLULOSE FUEL BEDS BY HOT METAL SPHERES

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Flaming ignition is problematic due to the severity of unwanted fires in wild land and industrial settings that lead to casualties as well as costly damage. The present research aims to study flaming ignition behavior of powdered cellulose fuel beds by hot metal spheres. Experiments were conducted by varying the temperature, diameter, and material of the spheres. The sphere materials studied were steel 302, aluminum 2017 & 1100, copper 110, and brass 260 with sizes ranging from 2 to 16 mm in diameter. These spheres were heated to temperatures between 575 and 1,100 °C. The ignition events were filmed with high-speed video and high-speed Schlieren video to record the time required for spheres to ignite. The steel, aluminum, copper, and brass spheres have different material properties and melted at various temperatures in the ranges tested, underscoring the importance of examining these properties in the ignition process. The results will help people anticipate fires and improve fire safety regulations for industrial processes by establishing set conditions associated with increased probability of solid fuel ignition.

FRI-295

REDUNDANCY RESOLUTION OF AN AUTONOMOUS HOLONOMIC DRIVE ROBOT VIA MOORE-PENROSE GENERALIZED INVERSE

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Often, in hazardous or distant exploratory missions, humans may be substituted with robots to reduce injury or to communicate across far distances. While robots are often built to withstand extreme situations, they still require human input based on observations made either visually or electronically. This can be classified as a low level open-loop control system. Improving on this system, a higher level closed-loop system can be introduced, making the robot entirely autonomous. To accomplish such autonomous behavior, linear algebra may be used to model processes linking input and output control values. Our robot features four independently driven Mecanum wheels that provide motion in 3 directions. A 3 x 4 matrix is used to express the relationship between the 3 directions and their control over the 4 wheels. Due to the nature of the non-square matrix needed, a Moore-Penrose generalized inverse, also known as the pseudoinverse, is then employed to achieve robot autonomy. This results in modeling the robot by a 4 x 3 matrix representing the connection between the 4 inputs from the wheels and the 3 allowed directions. As a result, this allows for other applications to utilize the pseudoinverse matrix such as traction control or regulation of power consumption onboard the robot. Autonomous robots allow the removal of human input, letting the system decide on the next state of action which may increase its efficiency and reliability over time.

SAT-291

DISPERSION OF NANOPARTICLE ADDITIVES FOR LUBRICANT OILS

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Conventional engine oil lubricants contain zinc dialkyldithiophosphate (ZDDP) or other phosphorus compounds for wear protection and friction reduction. However, these phosphorous species are known to poison the catalytic converters. To help diminish this effect, studies utilizing several nanoparticle additives as ZDDP replacements have been developed. These additives are used for wear protection, significant friction decrease, and improvement of oil heat transfer. We prepared various dispersions of nanoparticle additives (i.e., Ag-C, Cu-C, and ZnO) in 2 types of engine oils. The nanoparticle dispersions were observed in a variable pressured scanning electron microscope (VP-SEM) to search for nanoparticle aggregations. Future wear and friction analysis will be completed to fully characterize these additives. (This work is partially funded by the UTSA Work Study Research Training Program.)

SAT-296

DYNAMIC PLANT DEVELOPMENT FOR CONTROL SYSTEMS AND MECHATRONICS EXPERIMENTS

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Haptics is the science of touch; the word haptics comes from the Greek word *haptikos* or *haptesthai*, meaning “to grasp or to touch.” The main purpose of this project was to engage community college students in a hands-on experience beyond the classroom and improve our engineering curriculum. Our project research entailed mechanical modifications, manufacturing, and testing of haptic paddles that have been revamped by many universities since Stanford University’s first design in the mid-1990s. The haptic paddle is a single-degree-of-freedom, force-feedback joystick that is well-suited to use as a test plant for both basic and advanced concepts in courses such as system dynamics, mechatronics, control theory, and haptics. We have worked toward improving the paddle’s manufacturability, robustness, and, most substantially, reducing data-acquisition-system costs. In addition to redesigning a number of critical paddle components and finalizing the mechanical plant design, we also developed a detailed set of instructions for manufacturing and assembling the device, thereby increasing the opportunity for other engineering departments to replicate our design. Finally, we developed, tested, and documented of a set of laboratory exercises for a control systems lab course to provide an enhanced learning experience. The haptic paddle will enable students to physically interact with simulated dynamical systems that can be correlated to the real world. We met our goals by making the device affordable, robust, and easy to reproduce.

FRI-292

THERMAL AND MECHANICAL ANALYSIS OF PCM EMBEDDED BRICK FOR IMPROVED EFFICIENCY IN COMFORT COOLING APPLICATIONS

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Thermal energy can be stored as latent heat when a substance changes from one phase to another, by either melting or freezing. The purpose of this study is to reduce the energy consumption of a building by increasing the thermal resistance to the heat flow into the space. A phase change material (PCM) can serve as latent heat storage and as a heat transfer fluid. Embedding PCM into manufactured brick for energy management can reduce the demand on comfort cooling systems, resulting in measurable energy cost savings. It is well known that insulation properties have a strong influence on the heating and cooling energy consumptions of a building. High thermal capacity and low thermal conductivity are the preferred standard for insulation materials. PCMs are classified as a captive type of insulation because they absorb heat. PCMs come in 3 groups: organic, nonorganic, and eutectic. Organic compounds include paraffin and nonparaffin organics. Inorganic compounds include hydrated salts, metals, and alloys. Eutectics are mixtures of 2 or more salts which have finite phases of matter. In this study, the thermal and mechanical properties of brick embedded with PCM are evaluated following ASTM standards for brick manufacturing. One key component under consideration is the sustainability of the new building material, especially with respect to the compatibility of the PCM and brick life cycles. Computational and experimental analysis is used to determine the effect on the thermal properties and manufacturing of brick. Additionally, the overall efficiency improvement of comfort cooling systems is estimated.

SAT-294

DESIGNING A LIFT FIXTURE AND SUPPORT SYSTEM FOR THE NAVAL POSTGRADUATE SCHOOL CUBESAT LAUNCHER

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A project at the Naval Postgraduate School is to design a shipping container for Cubesats. The container is approximately 3 cubic feet and is constructed of aluminum and must protect and transport multiple Cubesats built by other institutions from the assembly lab to the point of installation on the launch vehicle. The specific objective of this internship is to design a lifting fixture that satisfies a complex set of parameters. The current lifting fixture includes a large breakover fixture which rotates the container. Eliminating this breakover fixture would be ideal due to the time constraint for installing the container on the launch vehicle. A design will be rendered in NX 8.0, a prototype will be constructed, and finally, a fixture will be milled with the help of a machinist. The lift fixture must be light weight and durable to hold the 200 pound load. Currently, 3D drawings are complete and the prototype is under construction.

Based on the materials analysis, a suitable fixture can be made with stainless steel and aluminum. This abstract will be updated to reflect results of the completed project.

SAT-293

DEVELOPMENT OF A CONTROL LOGIC FOR AN ALUMINUM-BASED, MINI-CHANNEL SOLAR WATER-HEATING SYSTEM

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With water heating accounting for a large fraction of energy consumption in the residential and commercial sectors, researchers have continued investigating methods for designing more efficient solar water heaters. The main issue with current solar heating technologies is designing a system that effectively transfers the energy obtained from the sun to the working fluid. To address this issue, a minichannel tube solar collector was designed, built, and tested. The new design was constructed in aluminum and shows improved performance with respect to traditional copper tube-and-fin configuration. To study the performance of the solar collector, a control logic was developed to operate the water heater system, which includes a closed water/glycol loop exchanging energy with the water inside a storage tank. The data acquisition system and control logic consists of input signals for temperature measurements at the inlets, outlets, and inside the water tank for 2 separate systems (minichannel and traditional configurations) operating simultaneously. Flow rates of the working fluid pumped through the system are also recorded when solar radiation is available. The control logic turns pumps on and off depending on the solar irradiance available and discharges water from the storage tanks when a threshold temperature of 55 °C is reached. The implementation of the data acquisition and control logic includes LabVIEW programming and an interface with a field-programmable gate array (FPGA) that runs code in C-language. The data acquisition system and control logic have been successfully operating for 4 months under a variety of weather and solar irradiance conditions.

NAVAL ARCHITECTURE/MARINE ENGINEERING

FRI-297

ENGINEERING LOW COST OCEAN OBSERVATION SYSTEMS: THEIR POTENTIAL IN THE FIELD AND EDUCATION

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Global climate change has emerged in recent years as one of the forefront international issues. In order to understand the far-reaching effects of climate change, a comprehensive, long-term record of oceanographic data is required. Data sets of ocean processes are commonly collected via sophisticated shipboard, moored, and drifting instrumentation. While effective, these instruments are often too costly for smaller institutions to obtain. The financial barrier has prevented many capable institutions from joining the ocean-observing network. The objective of our project is to provide such institutions and scientists with reliable, low-cost alternatives to collect oceanic data. Presently, our project is focusing on designing and building surface drifters, moored bottom-current meters, tide gauges, and large marine animal tags. We designed the units in such a way that others can easily construct them using commonly available materials. Our drifters, for example, are fitted with bamboo frames, canvas sails, and commercially available GPS transmitters. Originally designed for trucking companies, the transmitters are more affordable than scientific models while offering a nearly equivalent level of accuracy. The instruments are subsequently tested to ensure their performance conforms to oceanographic standards. Completed instruments are deployed by volunteer vessels, namely, the local fishermen. Furthermore, blueprints of the low-cost instrument can be distributed to schools for use as a practical, yet functional, project in marine science courses. In addition to providing hands-on experience, our project will contribute new information to the ocean-observing system as well.

OTHER ENGINEERING

SAT-298

ARTIFICIAL ENZYME-POWERED MICROFISH FOR WATER-QUALITY TESTINGAllan Cortes, Jahir Orozco, Victor García-Gradilla, Mattia D'Agostino, Wei Gao, and Joseph Wang.*University of California, San Diego, La Jolla, CA.*

We present a novel micromotor-based strategy for water-quality testing based on changes in the propulsion behavior of artificial, biocatalytic microswimmers in the presence of aquatic pollutants. The new micromotor toxicity testing concept mimics live-fish water testing and relies on the toxin-induced inhibition of the enzyme catalase, responsible for the biocatalytic bubble propulsion of tubular microengines. The locomotion and survival of the artificial microfish are thus impaired by exposure to a broad range of contaminants that lead to distinct time-dependent irreversible losses in the catalase activity and hence of the propulsion behavior. Such use of enzyme-powered biocompatible polymeric (PEDOT)/Au-catalase tubular microengines offers highly sensitive direct optical visualization of changes in the swimming behavior in the presence of common contaminants and hence to a direct, real-time assessment of the water quality. Quantitative data on the adverse effects of the various toxins on the swimming behavior of the enzyme-powered artificial swimmer are obtained by estimating common ecotoxicological parameters, including the EC_{50} (exposure concentration causing 50% attenuation of the microfish locomotion) and the swimmer survival time (lifetime expectancy). Such novel use of artificial microfish addresses major standardization and reproducibility problems as well as ethical concerns associated with live-fish toxicity assays and hence offers an attractive alternative to the common use of aquatic organisms for water-quality testing.

FRI-298

PREPARATION OF POLY(E-CAPROLACTONE)-HYDROXYAPATITE COMPOSITE NANOFIBER SCAFFOLDS FOR BIOMEDICAL APPLICATIONSChristian Rogers¹, Elijah Nyairo¹, Derrick Dean², Vinoy Thomas², James Stokes¹, Manoj Mishra¹.¹Alabama State University, Montgomery, AL, ²University of Alabama at Birmingham, Birmingham, AL.

Electrospinning is a unique method that produces fibers with diameters in the nanometer range using electric potential to initiate spinning of a charged polymer solution. Nanocomposite scaffolds based on nanofibrous poly(ϵ -caprolactone) (PCL) and hydroxyapatite (HA) with different compositions (wt %) were prepared by electrostatic cospinning to mimic the nano features of natural extracellular matrix (ECM). HA was found to be well-dispersed in polymers up to the addition of 10 wt %, after ultrasonication. The composite scaffolds were characterized for structure and morphology using Fourier transform infrared (FTIR) spectroscopy, scanning electron microscopy (SEM), and differential scanning calorimetry (DSC). FTIR confirmed the presence of HA in the fibers. DSC analysis revealed that as HA in the composite scaffolds increased, the melting point slightly increased due to the good dispersion and interface bonding between PCL and HA. The ability to grow cells on these scaffolds and the effect of incorporation of the cells on the toxicity of the scaffolds is under investigation. Preliminary studies were conducted on TRAMP-C1, -C2, and -C3 cell lines derived from transgenic adenocarcinoma mouse prostate (TRAMP) mice seeded on neat PCL and PCL with different percentages of HA for 24 hours at 37 °C and 5% CO₂. The scaffolds were analyzed by MTT assay at different times to verify cell toxicity/proliferation. The data suggests that the PCL is not toxic to TRAMP-C1 cells while PCL with 1% HA gives better proliferation of TRAMP-C1 cells. This suggests that electrospun PCL provides an environment that supports cell attachment and proliferation for bioengineering applications.

HEALTH

AUDIO/SPEECH PATHOLOGY

SAT-81

EFFECTS OF AUDIOVISUAL CUES ON SPEECH-IN-NOISE PERCEPTION IN SIMULTANEOUS AND SEQUENTIAL SPANISH-ENGLISH BILINGUALSKathryn Curry, Bharath Chandrasekaran.*University of Texas at Austin, Austin, TX.*

Audiological tests are valuable for evaluating an individual's hearing abilities. However, tests that involve a speech-in-noise component may evaluate bilinguals unfairly due to a processing cost when navigating between two lexicons. In speech-in-noise tests, fluent bilinguals have been shown to perform equally with monolinguals without background noise in their first (L1) and second (L2) languages, but perform less well than monolinguals in masked settings. It has been shown that bilinguals incorporate more visual cues than monolinguals, which are thought to help confirm to the listener what the speaker is saying. Furthermore, since bilinguals differ in age of L2 acquisition, speech-in-noise processing and the incorporation of audiovisual cues may differ between simultaneous bilinguals (second language learned before age 5) and sequential bilinguals (second language learned after age 11). The purpose of this study is to assess how bilinguals and monolinguals differ in processing speech-in-noise with and without audiovisual cues. To identify possible differences in processing speech-in-noise between sequential and simultaneous Spanish-English bilinguals, we will use a 2-talker speech-in-noise test as well as the Spanish and English versions of the Hearing in Noise Test. It is predicted that bilinguals and monolinguals will perform equally in quiet, while monolinguals will perform better in noise relative to bilinguals in L1 and L2. Additionally, it is hypothesized that simultaneous bilinguals will perform less well in L1 and L2 than sequential bilinguals due to early age acquisition of both languages. The goal of this study is to help improve audiological testing for bilinguals.

HEALTH SERVICES ADMINISTRATION

FRI-81

ANALYSIS OF HOSPITAL CHARGES: COMPARING THREE SERVICES IN ILLINOISJavier Lopez, Stephen Notaro.*University of Illinois at Urbana-Champaign, Champaign, IL.*

Prices of healthcare services can vary greatly throughout regions. Factors that can influence pricing are the location of the hospital, decisions of its administrative staff, or the role of the physician within the hospital network. The purpose of this research is to observe and compare the costs of several common procedures available in 35 hospitals located across the state of Illinois throughout 6 different geographical regions of the state. Procedures were categorized into inpatient and outpatient procedures. The Healthcarereportcard.illinois.gov website and countyhealthrankings.org were used to gather data on pricing for procedures, quality of care in county, the health of residents, and other factors. It was found that some hospitals charged several hundred to thousands of dollars less than other hospitals in nearby regions. The results have implications for families, patients, and insurance companies in locating the lowest cost procedures, thus saving thousands of dollars and in helping establish consistent pricing of procedures across the state.

MEDICINE (E.G., DENTISTRY, SURGERY, OPTOMETRY, VETERINARY)

SAT-83

EFFECTS OF ALMOND CONSUMPTION ON THE POSTPRANDIAL METABOLIC RESPONSES IN HIGH-RISK PREGNANT WOMEN

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Currently, about 50% of women entering pregnancy are obese and at greater risk of developing gestational diabetes and cardiovascular diseases. During pregnancy, circulating levels of triglycerides stay elevated for a prolonged period following a meal for nutrient transfer to the fetus. Obese women, who often enter pregnancy with subclinical insulin resistance and elevated levels of triglycerides, can thus transfer an excessive amount of energy to the fetus, predisposing them to glucose intolerance and cardiovascular disease. While dietary interventions exist for the nonpregnant population, specific food plans for controlling weight gain among obese, pregnant women remain unavailable. In a cross-over, randomized-control trial, we will investigate the effects of almond consumption on satiety and the postprandial glucose and lipid metabolic response in obese, late-stage, pregnant, Latina women. The response to 2 different test meals is studied in the participants on 2 separate days. One meal contains almonds, the second contains dairy fat. Blood is then sampled over a 5-hour period to measure the response of hormones involved in hunger and satiety: ghrelin and leptin, respectively. The women will also complete a satiety questionnaire at fasting, 0.5 hours postprandial, and then every hour over a 5-hour period. The findings from this study will identify the effect of two different types of fat, a saturated dairy fat and an unsaturated nut fat, on postprandial metabolism and satiety in pregnancy.

SAT-84

HEART RATE VARIABILITY AND CORTISOL DIURNAL PROFILES IN PSYCHOGENIC MOVEMENT DISORDER PATIENTS

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Psychogenic movement disorders (PMD) are abnormal movements not explained by organic lesions in the nervous system such as tremors, myoclonus, or dystonia. This project aims to study cortisol levels and heart rate variability (HRV) as biomarkers of stress and autonomic function in patients with PMD. Cortisol is the final effector hormone of the hypothalamic pituitary adrenal (HPA) axis and functions as a measure of stress. The secretion of cortisol is altered in patients with depression, a trauma history, and other psychiatric disorders. HRV is a measurement of beat-to-beat variation in heart rate. It is controlled by parasympathetic and sympathetic nervous system input. In previous studies, a reduced HRV has been linked to increased cardiac morbidity and mortality. Reduced HRV has also been connected to patients with depression, anxiety disorders, and other psychiatric illnesses. In this study, subjects were hospitalized overnight for continuous electrocardiogram (ECG) recording, and saliva samples were taken 5 times throughout the duration of their stay. Based on the data, PMD patients showed a reduced HRV in comparison to healthy volunteers that was statistically significant. HRV did not appear to correlate with depression. In addition, PMD subjects' cortisol levels were higher than those of healthy volunteers, although this was not statistically significant. The data analysis is in an interim stage; data collection is not complete.

FRI-82

MEDICAL COMMUNICATION PREFERENCES OF PEDIATRIC PATIENTS

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In 2005, approximately 29 million children (0 to 17 years) were admitted into emergency departments nationwide. Little research exists regarding child and parental preferences concerning medical communication and associated barriers. The purpose of this project was to better define parental and child factors which may affect successful medical communication practices in a pediatric emergency department (PED) patient. A convenience sample of children ages 9 to 17 years presenting to the PED for care of noncritical conditions and their parents were eligible. Two prospective surveys, one for parents (DTI) and a similar survey adapted for children (DTIp), were developed. Both captured demographic information and general medical communication preferences. The DTI was also designed to measure a parent's threshold for disclosure using escalating clinical vignettes. The DTIp seeks to determine whether children wish unintended outcomes to be disclosed to them and by whom. A total of 358 adults and 322

children completed the survey. Fifty-six percent of the children wanted to give the reason for their visit, while 68% of parents wished to do so themselves. If a painful procedure is necessary, 46% of children preferred that their doctor inform them, while parents wanted both doctor and parent to inform the child (66%). When an error occurred, parents wanted to be told independent of severity (100%), but 49% did not want their child informed. Forty-four percent of children preferred that the disclosure of error be made by both medical provider and parents. In general, children wish to be involved in medical discussions, including disclosure of unanticipated outcomes. Further study is needed to characterize cultural differences in the disclosure process.

SAT-82

PHYSICAL ACTIVITY AND ITS ASSOCIATION WITH METABOLIC SYNDROME AMONG OBESE ADOLESCENTS

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Metabolic syndrome (MetS) affects almost 30% of obese US adolescents. Little is known about the influence of physical activity on MetS among obese adolescents. We hypothesized that obese adolescents who are more physically active will not meet the criteria for metabolic syndrome. We enrolled 21 boys and girls (9 boys, 12 girls), aged 8-17 years with BMI >95th percentile for age and sex. Data collection included height, weight, waist circumference, systolic and diastolic blood pressures, fasting triglycerides, high-density lipoprotein cholesterol, and glucose. Physical activity was measured using the physical activity questionnaire (PAQ-child or PAQ-adolescent). Possible scores range from 1 to 5 where 5 is maximum physical activity. Means and standard deviations were calculated. Statistical analyses were performed to determine the relationship between physical activity and metabolic syndrome among males and females. Statistical significance was set at $P < 0.05$. Preliminary results reveal that 14 participants had PAQ >2.5, and 9 had MetS (5 boys, 4 girls). Among boys with PAQ scores > 2.5, 5 had MetS; 2 boys with PAQ < 2.5 did not have MetS. There were 7 girls with PAQ > 2.5; 5 of these did not have MetS. Boys did not differ from girls for any of the metabolic syndrome criteria or for BMI. Obese girls who are more physically active may be less likely to develop MetS compared to obese boys. Early interventions to increase physical activity among obese adolescents, especially girls, could have significant public health implications.

FRI-84

ORAL ITRACONAZOLE AND ARSENIC TRIOXIDE FOR BASAL CELL CARCINOMA TREATMENT

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The Hedgehog (Hh) signaling pathway, when activated, regulates embryonic development. Post-embryonically, Hh signaling is activated during tissue homeostasis through effects on stem or progenitor cells but is downregulated in most normal human tissues. However, aberrant activation of Hh signaling is known to underlie most basal cell carcinomas (BCC). Currently, the most common treatment is surgical excision which is costly, deforming, and dangerous. Therefore, development of molecules blocking the Hh pathway could be beneficial for patients with basal cell carcinoma. Oral itraconazole and arsenic trioxide (ATO) have been identified as Hh pathway inhibitors. Our goal is to identify how itraconazole and ATO either as single agents or in combination inhibit the growth of BCC tumors *in vivo*. We created mice with BCC allografts using a fresh, single-cell suspension of BCC cells to establish subcutaneous tumors in NOD/SCID mice. Palpable tumors were observed in 1 month. These tumors were then treated with oral itraconazole and ATO. Tumor size was measured weekly and BCC tumors were collected for measuring *GLI mRNA* (Hedgehog target gene) via Q-PCR. The combination treatment of itraconazole and ATO inhibited tumor growth compared to control cyclodextrin. In addition, the combination treatment inhibited tumor growth more potently than either itraconazole or ATO alone. The additive inhibitory effect of the itraconazole and ATO allows for the use of lower doses of each drug. The combination of lower drug doses can maintain or improve antitumor efficacy while decreasing the likelihood of adverse toxicities from the drugs.

FRI-83

TREATMENT OF ACUTE AGITATION IN EMERGENCY DEPARTMENTS USING B52 THERAPY IS INFREQUENT AND CAUSES A HIGH PROPORTION OF PATIENTS TO FALL ASLEEP

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Acute agitation is a common problem in emergency departments (EDs) and can be treated using first-generation antipsychotics (FGAs) such as haloperidol or droperidol. Anecdotally, EDs commonly treat acute agitation by administering the B52 drug cocktail, which includes an anticholinergic (e.g., Benadryl), an FGA (e.g., 5mg haloperidol), and a benzodiazepine (e.g., 2mg lorazepam). However, the ED-prescribing patterns of these medications, the need for additional medications after treatment with this combination, or the rate of sedation in patients have been poorly described in the literature. We used a structured, retrospective chart review to assess and analyze medication dose and combinations, vital signs, patient alcohol use, restraint use, and patient sleep status of all ED patients treated with B52 therapy from 2004 to 2010 in 2 university EDs. Of 1,253 cases of agitation treated with FGAs, only a minority (2.3%) received B52 therapy. The most frequent B52 therapy combination included IM haloperidol, lorazepam, and diphenhydramine. Many patients (32%) had ingested alcohol and the majority of patients (71%) were placed in restraints. Of the patients with complete vital signs (64%), we found no effect of ethanol on drops in systolic blood pressure, heart rate, or oxygen saturation ($p = ns$). Regardless of ethanol, a large proportion (57%) were sleeping within 3 hours after B52 treatment ($p = ns$). Despite the notion that B52 combination therapy is popular in the ED, the use of this treatment is rare. When used, slightly more than half of patients fall asleep after administration, potentially hindering psychiatric evaluation or discharge.

NURSING

FRI-85

BARRIERS AND SOLUTIONS TO MAINTAINING AND ACHIEVING A HEALTHY WEIGHT IN SCHOOL-AGED CHILDREN: A QUALITATIVE STUDY AND ANALYSIS

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Childhood obesity affects 1 in 3 American children and has both short-term and long-term physical and psychological health consequences. Recognizing barriers that prevent children from obtaining and maintaining a healthy weight can facilitate the development of effective programs. The purpose of this study was to conduct key informant interviews and review the scientific literature regarding barriers and solutions to overcome the health disparity of obesity. A total of 8 key informant interviews were conducted with 2 school nurses, 2 community clinic nurses, 1 registered dietitian, and 3 parents. Data from the interviews were extracted using recurrent themes and common responses from the interviewees. Barriers identified included limited access to healthy foods, limited physical activity opportunities, and unhealthy parental behaviors. Solutions identified included increasing physical activity opportunities, limiting access to unhealthy foods, and modeling healthy behaviors to children. Increasing access to parks, school playgrounds, recreational facilities, and physical education could increase physical activity in children. Funding school nutrition programs, serving more fruits and vegetables in schools, and removing unhealthy foods from the menu can limit children's access to unhealthy foods. Educating parents about the importance of physical activity and healthy eating could encourage parents to model healthier behaviors to children. The next steps are to develop programs that incorporate the qualitative information from this study. Working with members of the community will be an important first step. The perspectives of key stakeholders such as teachers, administrators, policy makers, and children should also be considered.

SAT-85

IMPROVING ATTITUDES TOWARD BREASTFEEDING PEER COUNSELING PROGRAMS IN LATINAS

Isabel Contreras, Donna Plonczynski.

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Breastfeeding initiation rates and duration are lower in low-income women such as Latinas. This is important because many Latinas may not be educated concerning the benefits and importance of maintaining breastfeeding for at

least one year. The purpose of this project is to measure the attitudes of Latinas on breastfeeding peer counseling, comparing those with contact with peer counselors (PC) to those without contact. English-speaking Latinas from greater Elgin, Illinois, will participate in the study by answering a questionnaire. Latina responses will be compared to non-Latina responses on questions concerning demographics and attitudes toward breastfeeding. Nurses at Sherman Hospital will distribute the questionnaire to appropriate participants. We expect attitudes toward breastfeeding to improve following contact with PC, thus increasing the initiation and duration of breastfeeding. The results demonstrated that, out of 96 participants, 76.2% of Hispanics are more likely to breastfeed and/or maintain longer duration than non-Hispanics. There were also low numbers for contact with a PC in the Hispanic group, so there is not a clear answer if there was an impact by the PC in the Hispanic population. The next step would be to have a culturally and language-appropriate PC address the needs of this under-served population.

OTHER HEALTH/MEDICAL SCIENCES

FRI-86

ROTARY TASK MOMENT ANALYSIS OF THE LOWER EXTREMITY AFTER TOTAL KNEE ARTHROPLASTY

Kimberly Cole¹, Lauren Ferris¹, Linda Denney², Lorin P Maletsky¹.

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The purpose of this research is to compare the vertical component of a healthy individual's knee moment while rotating and leaning onto the knee with the knee moments of those who have received a total knee arthroplasty (TKA). Lower extremity rotations involving height are a part of everyday tasks such as lifting items and reaching high shelves. Studying the effects of a TKA on this task would add to the literature on knee replacement characteristics and provide a data basis for future research to improve the quality of life of TKA recipients. To record the data, subjects stood on force plates and performed a "crossover" task by moving sagittally and transversely at the same time to push a button that recorded the start and stop times of their task. Twenty-three subjects participated; 12 healthy subjects were the controls, and 5 left- and 6 right-TKA recipients also contributed. Graphs of lower extremity rotation over time suggest that the task durations for the subjects with a replaced knee were longer than the controls'. Further analysis is in its preliminary stages. Data from 2 subjects were disqualified due to calibration errors. Future experimental improvements can include testing more subjects, calibrating force plates and buttons more often, and noting the dates of arthroplasty. Individuals who underwent TKA may have adapted to their replaced knees individually and modified their posture accordingly, suggesting that patients would benefit from personalized care.

SAT-86

NORTHERN ILLINOIS UNIVERSITY STUDENTS WITH DISABILITIES—PERSPECTIVES ON LIFE, FAMILY, AND COLLEGE

Shareny Mota Reyes, Greg Long.

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The two primary objectives of this research project were to empower and educate. Using a participatory action research (PAR) model, a sample of NIU students with disabilities was interviewed by the researcher. PAR is an approach that includes the subjects in the development and implementation of research that affects them. One goal was to empower students with disabilities by seeking their input in the development of interview questions as well as their subsequent responses. Prior research as well as anecdotal evidence indicates that students with disabilities face additional challenges to success in college. For example, many teachers lack background knowledge about students with disabilities, especially those who have invisible disabilities. This is particularly true regarding the importance of disability laws, accommodations, etiquette, and first-person language. Students' responses to the interviews were reviewed to gather information and ideas for effective strategies to solve the issues that they confront. This information will subsequently be used to create video tutorials as well as content for an AHRs 200 (disability in society) massive open online course currently under development. This project has helped us gain knowledge about people with disabilities and improved our comfort around them. We also obtained experience in qualitative research methodology, gained a greater perspective on using media to project community involvement, and became more aware of diversity on campus.

PHYSICAL THERAPY/REHABILITATION/THERAPEUTIC SERVICES

FRI-87

THE EFFECT OF KINESIO TEX TAPE ON STRENGTH IN THE QUADRICEPS MUSCLE IN DIVISION 1 SOCCER PLAYERS

Shannon Meggs, Sarah Strand.

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Kinesio Tape (KT), developed by Dr. Kenzo Kase in the 1970s, has revolutionized athletics throughout the world. Its unique ability to stretch up to 75% of its original length and not restrict movement has resulted in the use of this tape in a multitude of sports ranging from swimming to running. It has been theorized that it helps to stabilize loose joints and relieve strain on damaged soft tissue while also promoting better blood and lymphatic flow. We investigated the potential for Kinesio Tex Tape to increase quadriceps strength measurements in the subjects' dominant leg over a period of 2 weeks. The quadriceps muscle is a powerful knee extensor and is important for squatting, jumping, running, and walking. The subjects' muscular strength was tested using 5 different methods: isokinetic dynamometer (Humac Norm®), single hop test, triple hop test, vertical jump test, and the functional movement screen. Research participants were split into three groups: Kinesio Taping, placebo taping, and no taping. The Kinesio Tape group was taped using methods described by Dr. Kenzo Kase for the quadriceps muscle, while the placebo group also used KT, but it was applied transverse to the quadriceps muscle group. The transverse application of KT to the quadriceps muscle is not shown to have any effect on blood flow. The results of this research may have implications on whether KT is useful for increasing strength.

SAT-87

DELAYED AND ABBREVIATED ENVIRONMENTAL ENRICHMENT CONFERS BENEFITS SIMILAR TO CONTINUOUS EXPOSURE AFTER TRAUMATIC BRAIN INJURY

Anna Greene, Anthony Kline, Elizabeth Ogunsanya, Vincent Matiolla, Jacob Leary, Jeffrey Cheng, Christina Monaco. *University of Pittsburgh, Safar Center for Resuscitation Research, Pittsburgh, PA.*

Environmental enrichment (EE) consists of increased living space, complex stimuli, and social interaction that promotes exploration and confers improvements in behavioral outcome after experimental traumatic brain injury (TBI) vs. standard (STD) housing. However, as a model of rehabilitation, continuous EE is not clinically relevant due to the timing parameters of the typical EE. Specifically, TBI patients typically receive rehabilitation after the critical care period and then only for 3 to 6 hours per day. Thus, to mimic the clinic, the goal of this study was to determine whether delaying EE by 3 days and providing only 6 hours per day would provide similar benefits to continuous EE. To address this rehabilitation relevant issue, isoflurane-anesthetized male rats were subjected to a cortical impact (2.8 mm depth at 4 m/s) or sham injury and randomly assigned to TBI+EE (continuous), TBI+EE (3-day delayed, 6 hr/day), and respective sham controls. Motor function (beam-balance/beam-walk) was assessed on post-operative days 1 to 5. Spatial learning/memory (Morris water maze) was evaluated on days 14 to 19. The data showed that EE, regardless of timing, improved motor and cognitive function compared to STD housing ($p < 0.0001$). Moreover, there were no differences between the TBI+EE (continuous) and TBI+EE (3-day delayed, 6 hr/day); $p > 0.05$. These data demonstrate that delayed and abbreviated EE produces motor and cognitive benefits similar to continuous EE after TBI and thus may be a rehabilitation-relevant EE paradigm. Ongoing studies are evaluating the effects of longer delays in implementing EE after TBI.

PUBLIC HEALTH (INCLUDING ENVIRONMENTAL HEALTH/EPIDEMIOLOGY)

SAT-89

LEVELS, TRENDS, AND DETERMINANTS OF COVERT USE OF CONTRACEPTION IN SUB-SAHARAN AFRICA

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In sub-Saharan African (SSA) countries, substantial numbers of married or in-union women use contraceptives without the knowledge of their partners. Covert use is not ideal but is employed due to threats of violence, societal repercussions, and partner tension. Four hypotheses are explored here: covert use declines as contraceptive prevalence increases; covert use is more common when there are substantial differences in age and/or schooling

of partners; injectable contraception, where available, is the method of choice among covert users; and covert use is greater among older women and women in rural areas. We used DHS couple data from 8 SSA countries that had experienced at least a 10% increase in contraceptive use throughout 5 years or more. Also, we required for our analyses that these surveys include both partners' responses regarding current contraceptive use. Covert use was then estimated by cross-tabulating the response of both sexes regarding current female modern-method usage. Results are in progress, but we expect that educational differences, age differences, rural residency, and older age are determinants of covert use. Of the modern methods, we anticipate that injectable contraception is most commonly used. We also predict that increased societal acceptance of contraception, approximated by a contraception prevalence rate, decreases the need for covert use. Thus, bivariate tabulations of couple data will display several relationships between women's demographics and covert contraception use. These findings will aid contraceptive program personnel in assessing covert use and the demand for certain methods in SSA countries.

SAT-88

EXPLORING THE ASSOCIATION BETWEEN PERCEIVED SWEET TASTE INTENSITY AND NON-NUTRITIVE SWEETENER CONSUMPTION

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Nonnutritive sweeteners (NNS) are commonly used dietary tools which provide sweetness in foods and beverages without adding significant calories. The objective of our study was to determine whether perceived sweet taste intensity was associated with NNS consumption and to explore differences in perceived sweet taste intensity and NNS consumption among race, weight, age, and gender subgroups. We hypothesized that perceived sweet taste intensity would be inversely associated with NNS consumption. Forty healthy adults underwent a taste test and completed a semiquantitative NNS consumption questionnaire. During the taste test, 3 different concentrations of sucralose were applied to the tongue and then expectorated. Participants were asked to identify and rate the sensation on a 100 mm visual analog scale. Descriptive statistics were performed and t-tests and chi-squared tests were used as appropriate. Perceived sweet taste intensity was inversely related to body weight ($p = 0.047$, $c = -0.317$). There was also a trend ($p = 0.1146$) toward elevated perceived sweet taste intensity among participants who self-identified as non-Hispanic white, as compared to those who identified as nonwhite. There was no association between sweet taste perception and NNS consumption, nor were there differences in NNS consumption or sweet taste perception based on race, age, weight, or gender. Contrary to our hypothesis, more intense sweet taste perception was not associated with lower consumption of NNS-containing foods and beverages. The inverse relationship between perceived sweet taste intensity and body weight has been previously reported and supports the validity of our taste testing measures.

FRI-89

IMMUNIZATION PROTECTION IN CHILD CARE

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Outbreaks of vaccine-preventable diseases have occurred frequently in child care settings over the last decade. Many outbreaks have occurred in unimmunized or under-immunized groups of children. Little is known about parent attitudes toward immunizations in child care programs. For our study, we are conducting a parent survey in 10 childcare programs in Utah. This survey is intended to describe parents' attitudes about the role of childcare providers and programs in ensuring that children enrolled in the program are up to date for required vaccines. The survey will also determine if parents are concerned about their child being at risk for vaccine preventable disease if they attend a childcare program with unvaccinated children and if certain parent characteristics are associated with their attitudes. We are conducting a cross-sectional survey study of parents of children 6 years and under enrolled in childcare centers in Utah. Parents will be asked to return the survey by mail or in a drop-box at the childcare center. The survey will be distributed at the participating childcare centers 2 times with a 2 week interval between each distribution. For the second distribution, only parents who have not previously returned a survey will be asked to complete a survey. Data from returned surveys will be entered into the University of Utah's RedCAP database. The following statistics for each survey response will be calculated as applicable: means, standard deviations, frequencies, and percentages. Study outcomes will guide future immunization strategies for children enrolled in childcare programs.

FRI-88

DEPRESSED ADOLESCENTS DEMONSTRATE DIFFERENCES IN LIMBIC AND FRONTAL COGNITIVE REGIONS

Kim Tran, Jing Wu, Tony Yang.

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Neuroimaging studies for adolescents are expanding on studies from adult populations, which show connections between cognitive networks of people with major depressive disorder. Similarly, the main purpose for this study is to investigate the interactions between brain networks of depressed adolescents and healthy normal controls through a stop-signal task using an fMRI scanner. Relative to matched controls, adolescents with depression are hypothesized to show differences in limbic and frontal cognitive regions in anxiety-induced situations. For this study, blood-oxygenation, level-dependent (BOLD) fMRI is used to examine the brain activity of depressed adolescents and that of matched, healthy adolescents. The subjects undergo a stop-signal task that consists of rating happy or fearful faces as males or females, with stop signals in between. Preliminary results from the BOLD data indicate that possible differences between affective networks and cognitive networks influence depressive behavior in adolescents. In particular, hyperactivity in the amygdala is found in a stop-signal task where external affective cues were dissonant from internal feelings. Additionally, preliminary results indicate hypoactivity in the medial frontal gyrus, as it fails to suppress the hyperactivity of the amygdala in depressed adolescents. These results expand on the current findings of depression research in adults. Hence, the study seeks to give additional support to current data suggesting that there is a connection between different regions of the brain. This is an important step to understanding how depression in adolescents can stem from their inability to self regulate negative emotions in anxiety-induced situations.

SAT-92

HEALTHY WOMEN: HEALTHY NATIVE NATION – LESSONS LEARNED IN AN AMERICAN INDIAN/ALASKA NATIVE FASD PREVENTION PROJECT

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Prenatal alcohol exposure results in a spectrum of permanent disabilities called fetal alcohol spectrum disorders (FASDs). FASD rates vary among populations as a result of varying patterns of alcohol consumption and factors influencing these patterns. The present project seeks to obtain information useful to designing an effective intervention and to test the efficacy of a culturally targeted SBIRT (screening, brief intervention, and referral to treatment) intervention. In conducting our project we have encountered and overcome various hurdles including gaining the trust of the community, recruitment, and retention. A culturally targeted web-based SBIRT intervention will reduce risky alcohol consumption among AI/AN women of childbearing age. AI/AN women between 18 and 45 years of age were recruited from three AI/AN health clinics in Southern California. A web-based SBIRT intervention was culturally targeted using focus groups and key informants. Awareness raising events were held on local reservations. The tribal IRB approved all protocols. Participants were recruited, randomized into intervention or control, and followed up by telephone at 1, 3, and 6 months. At each step, input from local Native women and the community was crucial. Local AI/AN staff was hired and trained. A certificate of confidentiality was obtained. Project participation at local events increased trust and identification with the project. Recruitment locations and incentives were changed. Retention was improved by changing contact methods and incentives. Projects working with AI/AN communities may need to incorporate unconventional methods and may benefit from our experiences.

SAT-90

A SYSTEMATIC REVIEW OF IMMUNODEFICIENCY-RELATED VACCINE DERIVED POLIOVIRUS CASES WORLDWIDE

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¹*University of Central Florida, Orlando, FL*, ²*Division of Pediatric Infectious Diseases, Stanford University, Stanford, CA*.

In 1988, the World Health Organization unveiled a plan to eradicate poliomyelitis. Worldwide vaccine strategies rely on oral poliovirus vaccine (OPV) because it is cost-efficient, easy to deliver, and can increase herd immunity. OPV has successfully decreased wild-type poliovirus, but as we near eradication, new problems related to OPV

use are emerging. Patients with immunodeficiencies have a weak immune response to OPV, the live, attenuated polio vaccine. They can have prolonged intestinal replication of the vaccine virus to form new, mutated virulent strains known as vaccine-derived polioviruses (VDPVs), which can result in symptoms of acute flaccid paralysis that are normally caused by the wild-type virus. This phenomenon may prevent polio eradication as it can reintroduce paralysis-causing mutants into polio-free communities. Despite the recognition that immunodeficiency-related vaccine derived poliovirus (iVDPVs) jeopardizes eradication, its determinants are still not well understood. We conducted a systematic review of all recorded cases of iVDPVs from the 1960s to present. We developed search strings for scientific databases to detect all previously published iVDPV cases. We evaluated trends such as age, vaccine history, immune disorder, gender, and percent divergence of the virus. We hypothesized the patient's type of immunodeficiency and location of residence will be the main risk factors for formation of iVDPVs. Additionally, we proposed that the increase in iVDPV cases recorded in the last decade, especially in middle and low income countries, may have been due to increased surveillance technologies. This study will help determine appropriate vaccine strategies and global policies needed after polio eradication.

FRI-91

A QUALITATIVE ASSESSMENT OF LATINA MOTHERS' PERCEPTIONS AND BELIEFS ABOUT HEALTHY EATING AND PHYSICAL ACTIVITY AND FACTORS THAT WOULD FACILITATE PARTICIPATION IN OBESITY PREVENTION PROGRAMS

Erika Fimbres¹, Andrea Medina¹, Jazmin Ruiz¹, Adrian Chavez¹, Lorena Flores¹, Samantha Bustillo¹, Monica Gutierrez¹, Valentina Hernandez², Tony Tarango³, Frank Ray³, Sonia Vega-López¹, Noe C. Crespo¹.

¹Arizona State University, Phoenix, AZ, ²Mountain Park Health Center, Phoenix, AZ, ³South Mountain Community Center, City of Phoenix Parks and Recreation Department, Phoenix, AZ.

Little is known about the features of pediatric obesity prevention programs that would be appealing to Latina mothers and their children. The purpose was to gather qualitative data among Latina mothers regarding factors that would facilitate participation in obesity prevention programs. We conducted a focus group in Spanish with 4 Latina mothers of 6 -to 11-year-old children. Topics of discussion included healthy eating, physical activity, barriers for making healthier choices, and desirable factors for enrolling themselves and their children in programs. All mothers perceived that their children engaged in sufficient physical activity and followed a healthful diet. Barriers to making changes to food preparation included their child's food preferences. All mothers indicated achieving their physical activity by walking, whereas their children's was achieved through sports. The hot summer weather was viewed as a barrier to engaging in more physical activity and although they expressed preference for having access to indoor recreation space, the cost of a membership was a barrier given they wanted to enroll the entire family into programs. Mothers indicated preference for programs that allowed both parents and other family members to participate, and indicated wanting more information about nutrition and ways to motivate their children to eat healthier and participate in sports. All parents stated they would participate if such programs existed and were close to their homes. The focus group data provided key recommendations to develop future childhood obesity prevention programs tailored to Latino families.

SAT-91

NATIVE COMIC BOOK PROJECT

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Tribal communities often lack access to high-quality healthcare, prevention programs, cancer education, cancer screening tests, and cancer clinical trials. As a result, American Indians and Alaska Natives experience the worst cancer-related disparities and the poorest survival rates of all racial and ethnic groups in the US. Comic books have long been used as educational tools to improve public health. In 2008, the Native Comic Book Project was launched as a youth-focused community education project of Native People for Cancer Control, a community network program center funded by the National Cancer Institute. The purpose of this project is to use comic book creation as a way to educate Native youth about cancer, especially methods of cancer prevention. Along with basic art skills, participants learn about traditional foods and wellness, nonceremonial tobacco use, human papillomavirus, and obesity prevention. Modeled after Dr. Michael Bitz's Comic Book Project, the Native Comic Book Project has been adapted for both urban and reservation-based youth by incorporating Native storytelling and traditional values. Its ultimate goal is to promote healthy decision making for Native youth and their communities. We are currently conducting a formal evaluation of this project by using pre and postintervention assessments to measure knowledge, habits, and decision making among youth participants regarding tobacco use, healthy eating, exercise, and human papillomavirus. Data

will be analyzed in winter 2013. The Native Comic Book Project has been implemented at 10 sites and has enrolled 55 participants. Future planned activities for research and education include developing more youth-oriented health interventions.

FRI-90

COMMUNITY-BASED CHILDHOOD OBESITY INTERVENTIONS: AN UPDATED LITERATURE REVIEW OF SUCCESSFUL STUDIES

Monica Gonzalez, Carly Labombard, Andrian McGhee, Curtis Ellsworth, Alberto Florez, Monica Gutierrez, Gabriel Shaibi, Sonia Vega-López, Noe C. Crespo.

Arizona State University, Phoenix, AZ.

Childhood obesity is an important public health challenge. Interventions that focus on lifestyle changes (i.e., nutrition and physical activity behaviors) show promise for reversing the current obesity trends. A systematic literature review of intervention studies in children was conducted to identify the characteristics of study components/strategies that contribute to a significant reduction in body mass index (BMI). We conducted a systematic search of published studies in PubMed and other databases using several key terms to identify potential studies. Inclusion criteria were participants were 3 to 18 years old, studies were conducted within the United States or Canada, intervention was conducted outside regular school hours, and the intervention led to statistically significant reduction in child BMI or BMI percentile. Forty-eight studies were identified, and 14 met the inclusion criteria for further review. Intervention length ranged from 10 weeks to 2 years, the frequency ranged from 1 to 3 times per week, and the duration ranged from 1 hour to 2.5 hours per session. All of the intervention studies included a physical activity program, 8 of the studies involved a nutrition education component, 12 of the interventions had parental involvement, and 6 of the interventions had some type of behavioral modification component. The most common setting for implementing intervention activities involved school grounds (n = 9). This study has identified key features of successful interventions that may be used as best-practice recommendations for future interventions. Future research should also examine other community settings such as recreation centers.

HUMANITIES

HISTORY (EXCEPT HISTORY OF SCIENCE)

SAT-198

BROWN BEFORE 42Mariano Nava, Adrian Burgos.*University of Illinois, Urbana-Champaign, Urbana, IL.*

This paper examines the 1942 and 1943 Major League Baseball (MLB) seasons, a period when the MLB maintained a restrictive color line system. During this time, black newspapers discussed differently than white newspapers the Latino pitcher/catcher duo of Hiram Bithorn and Salvador Hernandez of the Chicago Cubs. The Cubs' hiring of the two Latinos as "temporary help" was quite similar to what significant components of the US economy were doing during World War II, as seen with the Bracero Program. Examining media coverage of Bithorn and Hernandez sheds light on a story that is rarely told: that of being "brown" in a seemingly black and white world. Books, newspaper articles, and online archives are used to gather contemporary coverage to examine this chaotic time period. Looking at the conditions in which these Latino players were incorporated into the Major Leagues will clarify why the Cubs, like other teams around the league, hired, then later released, them. This project contributes to the research in Latino/a studies regarding the blurring of the color line in the Midwest, the basis on which Latino labor is incorporated, and the impact of US public perception of Latino labor on the position/acceptance of Latinos in the public venue of professional sports.

OTHER HUMANITIES

FRI-198

IDENTIFYING BARRIERS ASSOCIATED WITH ABORTION ACCESS AMONG LATINA WOMEN IN SOUTH TEXASAna Laura Rivera¹, Kristine Hopkins².¹*University of Texas at Austin, Austin, TX*, ²*Population Research Center, The University of Texas at Austin, Austin, TX.*

Currently, there is insufficient information to help characterize the barriers that exist in a Latina woman's ability to access abortion and also insufficient data revealing the number of Latinas having abortions in South Texas. In our research, we plan to investigate the challenges women encounter in South Texas in obtaining an abortion. We want to examine how stigma plays a role in the Latino community as women seek an abortion. Lastly, we will analyze the impact of the only abortion clinic there is in the Valley serving four counties. In order to investigate the barriers to abortion experienced by Latinas in South Texas, our study will include in-depth interviews with Latinas who seek an abortion at Whole Women's Health Clinic in McAllen, Texas, and an analysis of federal and state laws that restrict access to abortion. We hypothesize that our investigation will reveal that Latina women in South Texas face economic, cultural, and political obstacles when pursuing abortion. Examples of these obstacles include being unable to afford doctor visits, lack of transportation to see a doctor, difficulties in taking time off work, and lack of childcare assistance. After our final observations, field study, and research, we will provide recommendations as to what is next for young women in Texas and what can be done to fight against the stigma of abortion. We will also discuss 21st century views of abortion among Latinos.

MATHEMATICS & STATISTICS

APPLIED MATHEMATICS

FRI-391

FAST GENERATION AND TRACKING OF GPS DILUTION OF PRECISION REGIONS USING LEVEL SETSAna Perez-Gea¹, Joseph Papac², Walter Cai³, Scott Manifold⁴, Nora Stack⁵.¹*Instituto Tecnológico Autonomo de Mexico, Mexico City, MX*, ²*University of California, Los Angeles, Los Angeles, CA*, ³*Cornell University, Ithaca, NY*, ⁴*University of California, Riverside, Riverside, CA*, ⁵*St. Mary's College of Maryland, St. Mary's City, MD*.

GPS is a valuable tool and, as such, the optimization and accuracy of the techniques to measure the performance of satellites are of paramount importance. Two major measures relating to performance are visibility and dilution of precision (DOP). Visibility is defined by regions that share a direct line of sight with sufficiently many satellites in orbit. The current system to determine the visibility and DOP of these satellites is accurate and useful; however, it is time consuming. Our hypothesis is that implementing level set methods (LSM) to measure visibility and DOP will prove to be more time efficient and equally as accurate as the systems that are currently used by analysts at The Aerospace Corporation. Our team members have been provided with several different programs in Mathematica and C. We have translated the coded formulations into MatLab, while simultaneously reviewing the necessary orbital mechanics and basic LSMs. We have tested static LSMs, calculating the level set functions at each time step, as well as dynamical LSMs, where the changes in regions of coverage are handled implicitly. Challenged with the task of improving GPS performance, LSMs have been used to test visibility and DOP. We are expecting the LSMs to be more efficient than previous methods but to be affected by a loss of mass and additional noise. The choice of LSMs for optimizing the performance of GPS systems should be made considering the best combination of time efficiency and noise.

SAT-389

MODELING POSITIONS COUPLED TO F508, SITE OF CHIEF CF-CAUSING MUTATION

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Texas Tech University, Lubbock, TX.

Cystic fibrosis is a complex genetic disease caused by deletion of F508. Currently, there are no known mechanisms that explain how common mutations interact to inhibit efficient protein folding. These mutations join together to have a coupling effect on the protein folding machinery. Analyses of the amino acid sequence data could illuminate the mutations' coupling interactions. Modeling this coupling effect is a profound mechanistic problem in illuminating this disease. In standard polynomial regression, the coefficients of each term are a function of the degree of the polynomial that we choose to fit. Therefore, the coefficients do not have independent biological meaning, and it is impossible to use polynomial curve fitting and obtain a function that precisely reveals the properties of the ambiguous dataset. We must rely on functions that are independent of each other and can be analyzed separately to give meaning to the coefficients. This is the basis of orthogonal polynomials. With regards to this disease, our goal is to build functions that capture the intrinsic properties of the amino acid sequences affected by the chief mutation of CF so we can assess the mutation's coupling effect. Our ultimate goal is to develop a method that conserves intrinsic biological properties of any phenomenon being tested while simultaneously capturing its quantitative properties. We hope this will illuminate the interactions between, not only different variables in genetic diseases, but in a wide variety of phenomena, such as quantitative properties of interactions of different cancer drugs.

FRI-395

ASYMMETRIC INTRAGUILD PREDATION BETWEEN *PROTOPERIDINIUM* AND *HETEROCAPSA* IN THE PRESENCE OF A MUTUAL PREDATORLaura Asaro¹, Joanna Myers², Carlos Vera³, Alan Wirkus-Camacho⁴, Baojun Song⁵.¹*East Central University, Ada, OK*, ²*University of North Carolina at Asheville, Asheville, NC*, ³*University of Puerto Rico at Mayagüez, Mayagüez, PR*, ⁴*Herberger Young Scholars Academy, Glendale, AZ*, ⁵*Montclair State University, Montclair, NJ*.

Studies on the mussel *Mytilus edulis*, resident off the coast of Ireland in 1995, showed high levels of contamination by the azaspiracid toxin in harvested individuals. The genus *Protoperidinium*, previously thought to be harmless, was

found to be responsible for the high levels of azaspiracid toxin found in the mussels. Hence, reducing the ratio of *Protoperidinium* to *Heterocapsa* algae may turn out to be an effective mode for reducing mussel toxin contamination. In order to study this possibility, a nonlinear system of ordinary differential equations was introduced to model the dynamics of 2 dinoflagellate species and their most common predator. The model accounts for the fact that the toxin producing *Protoperidinium* preys on the nontoxic *Heterocapsa* while both ingest and, therefore, compete for the nutrients available in the system. The system supports multiple equilibria. A bifurcation analysis is conducted on the model that identifies at least 2 modes of coexistence: equilibrium or oscillatory. The impact of interventions, such as modifying nutrient flow, to reduce the levels of the azaspiracid toxin and observe their effect on the persistence of the system are considered and evaluated.

SAT-394

SUBSTANCE ABUSE VIA LEGALLY PRESCRIBED DRUGS: THE CASE OF VICODIN IN THE USA

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An estimated 2 million residents in the United States are abusing Vicodin, the nation's most commonly prescribed pain reliever; the majority of abusers are those who had, at one time, used it under medical supervision. The goal of this project is to identify and evaluate a class of most effective strategies for reducing the overall prevalence of Vicodin abusers among those who had been introduced to the drug for legitimate medical reasons. The doctor-patient environment system involves multiple pressure points, and our goal is to identify the most effective prevention measures under clearly identified scenarios via the use of population-level mathematical models. Initially, an ordinary differential equation's compartmental model that follows, at the population level, the transition of individuals from medically supervised Vicodin users into total recovery is formulated and analyzed, under the documented assumption that relapse rates are high. The stability of equilibrium solutions is investigated, and sensitivity analyses are conducted on the effectiveness of intervention methods to determine which strategy will have the greatest impact in reducing the number (prevalence) of Vicodin abusers among the population of those who were exposed to this pain reliever via a legitimate prescription.

SAT-390

A HYBRID MODEL FOR RECOMMENDER SYSTEMS

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In the spring of 2013, Baidu, Inc. hosted a competition for teams to develop new algorithms for movie recommendation systems. The purpose of the competition was to develop better models for rating prediction and suggest methods for incorporating social media data into the prediction models. Our team was sponsored by Baidu, Inc. to develop a new statistical model for movie recommendations that used the knowledge gained from the top competitors of the competition. We developed a hybrid model that used various machine-learning techniques to synthesize the best performing models from the competition, Feature-Based Matrix Factorization, Ridge Regressions, and Factorization Machines, into a single prediction model. Our model satisfied 3 desired properties: computational viability, incorporation of social media data, and a higher degree of prediction accuracy than any model on its own. Computational viability is important for the realizability of the algorithm in industry was achieved through a parallel implementation. The incorporation of social media data provides Baidu, Inc. a method for improving prediction accuracy and was accomplished through feature-engineering. Lastly, we provided a mathematical proof to show that our hybrid model's predictive accuracy must be equal or better than the predictive accuracy of any of its components.

SAT-392

COMPARING BASIS PURSUIT, LS-CS, AND MOD-CS METHODS FOR COMPRESSED SENSING

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Compressed sensing is the problem of solving certain systems of equations with more unknowns than equations. Mathematically, compressed sensing tries to recover the sparse n -vector x from the equation $y = Ax$, where A is an

$m \times n$ matrix with $m < n$. Unique solutions to this problem can often be found due to the fact that x is sparse. A simple way of approximating sparsity is to find the solution to x with minimal one-norm. This method is known as compressed sensing via basis pursuit (CS). Additional methods of solution can be used if some set T is known a priori to be approximately the support of x , where the support is defined as the set of all indices corresponding to nonzero entries of x . One such method is LS-CS, which uses least-squares approximation to obtain an initial estimate for x on T , and then uses CS on the error residual. Another method for sparse recovery with a support estimate T is known as modified-CS, in which the one-norm of x is minimized on the complement of T . It is hypothesized that modified CS will reconstruct x with the smallest error and that LS-CS will reconstruct x with a smaller error than CS. We will present numerical results of simulations testing these hypotheses and other related results.

FRI-393

MOSQUITOS AND WATER QUALITYPatrick Morgan¹, Helena Puche².¹DePaul University, Chicago, IL, ²University of Illinois at Chicago, Chicago, IL.

Mosquitos, specifically the Asian tiger mosquito (*Aedes albopictus*) and the common house mosquito (*Culex pipens*) are common vectors of the West Nile Virus, and are also known to prey on humans and animals for blood. While obtaining blood, the mosquitos transfer the virus to their prey. This is especially dangerous to infants, the elderly, and those who have weakened immune systems. Mosquitos are found typically near their breeding ground, laying eggs in stagnant water which grow to become larvae. Larvae of mosquitos are known to tolerate certain water conditions from water temperature to the amount of oxygen available. The purpose of this project was to determine if water sources near drainage pipes were optimal for mosquito growth. For that purpose, 500 mL water samples were collect from 2 lakes and 2 ponds at the Dupage Forest Preserves at drainage pipes and 100 meters from each pipe. Specifically, we identified all of the macroinvertebrates in these locations and compared them using the Shannon-Wiener diversity index. Macroinvertebrates are small aquatic organisms that include mosquito larvae. Differences found in the macroinvertebrate fauna were found between locations of drainage pipes and areas without drainage.

SAT-393

THE INFLUENCE OF SOCIO-ECONOMIC CONDITIONS ON NARCOTIC CASES IN CHICAGO COMMUNITIESMaryam Khan, Shana Kachaochana, Anuj Mubayi.

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Crime is an integral part of societies; however, level of crime varies between regions. A complete criminal-free community may be difficult to attain because of the complexity involved. It is important to understand and identify the mechanisms that drive crime. In reality, crime is a dynamic process where incidences grow or decline based on population characteristics, interventions, and policies. Previous studies have shown that acts of crime are more prevalent in metropolitan areas. Furthermore, by better understanding spatial-temporal dynamics, we can lessen its impact. The aim of this study is to use statistical models to evaluate the impact of socio-economic factors such as wealth, unemployment rates, and educational levels and how they may play a role on the dynamics of Chicago's narcotics crime. This study identifies various factors that may influence crime patterns and proposes multi-factor statistical procedures via multiple regressions method to describe the relationship between the input data and the output variables. Our goal is to suggest control policies that have long-lasting effects in controlling crime rates based on changing socio-economic status. This analysis will be able to forecast the probability of occurrence of crime in a community as a function of relevant community-related factors in the past few years. Our further objective is to investigate the impact of socio-economic factors on change in crime rates in each of the 77 community areas of Chicago, therefore providing a systematic procedure for possible intervention methods to lower the rate of narcotic crimes in the city of Chicago.

FRI-388

MODELING THE EFFECTS OF MOLECULAR CROWDING ON CEREBELLAR LONG-TERM DEPRESSIONHorace Deans, Fidel Santamaria.

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Molecular crowding occurs in the presence of a large number of non-reacting macromolecules and can influence the efficiency of biochemical reactions. We want to understand how crowding affects the biochemical reactions underlying cerebellar long-term depression (LTD). To this end, we built a Monte Carlo (MC) simulation based on an earlier mass-action model. LTD is quantified by the reduction in the number of a type of glutamate receptors (AMPA)

in the synapse. The expression of LTD is described in our model by a calcium-dependent positive-feedback loop involving the activation of PKC and subsequent AMPAR phosphorylation. We modeled the intracellular volume and plasma membrane of a single Purkinje cell dendritic spine. The model tracked the position and biochemical state of all molecules involved in cerebellar LTD after the release of calcium ions (Ca^{2+}). Our MC model replicated the observed Ca^{2+} dependence of cerebellar LTD and exhibited LTD initiation after PKC activation. To simulate crowding, we then implemented the presence of large concentrations of non-reactive macromolecules. A classical approach would suggest that the presence of crowding would result in an increase in the amount of Ca^{2+} needed to induce LTD, producing a rightward shift of the LTD curve. Instead, our simulations showed an increase in maximal LTD, earlier LTD, and a steepening of the sigmoidal curve that replicates experimental results. Overall, our results show that there is a strong influence of molecular crowding in the activation of biochemical signals in synapses. (Partially funded by NIGMS MBRS-RISE GM060655, NSF HRD-0932339, and EF 1137897.)

FRI-390

THE DYNAMICS OF OFFENSIVE MESSAGES IN THE WORLD OF SOCIAL MEDIA: THE CASE OF CYBERBULLYING AND TWITTER

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The 21st century has redefined the way we communicate, our concept of individual and group privacy, and the dynamics of acceptable behavioral norms. The messaging (tweets) dynamics on Twitter, an important internet social network, has opened new ways/modes of spreading information and, as a result, cyberbullying or the spread of offensive messages has become a growing, persistent, and prevalent problem. The aim of the analysis carried out in this project is to identify and evaluate conditions that would dampen the role of small-group (tweeters) cyber bullying dynamics on Twitter. This is explored by the introduction of a rating system that may help hinder the spread of offensive messages. A discrete-time nonlinear compartmental model is introduced. We examine the stability of the equilibrium solutions and measure the interactions between communities and their change of status from unaware of the impact of a negative tweet (ignorant), to that of an offender, or indifferent to the posting of an offensive message. We hope that the analysis of this dynamic model will shed some insights into the viability of new models of self-sustaining methods of reducing cyberbullying in public social networks.

SAT-388

BIOMIMETIC PATTERN RECOGNITION FOR CANCER DETECTION

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Biomimetic pattern recognition (BPR) is a classification process using a constructed biological structure. BPR is derived from the Principle of Homology-Continuity, which assumes members of the same class are biologically evolved and continuously connected. Recently, BPR has been successfully used in voice, facial, and iris recognition. In our study, we develop two BPR algorithms using proximity extension and two classification schemes. We investigate the performance of the proposed BPR methods to detect cancer using DNA microarray data. A sample, normal or cancerous, consists of thousands of expressed genes which are regarded as single nodes in a hyper-dimensional space. Assuming the PHC, nodes of the same class can be topologically assembled into a complex skeleton-like structure and can be further covered with a tissue-layer to form a biological body. The resulting product can subsequently be used for classification. Performance for the algorithms are studied based on leukemia, bladder, liver, and colon cancers. Our results indicate that the proposed BPR has an increase in recognition rate when compared to previous techniques. BPR has shown to be a promising approach for cancer detection using DNA microarray data.

FRI-392

ADAPTING A NPZD MODEL TO BIOLUMINESCENT LAGOON DYNAMICS

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Puerto Rico has 3 of the 10 most famous permanent bioluminescent bays in the world. These bioluminescent bays represent important ecological and socio-economic resources to the local economy and are associated with dense

aggregations of the dinoflagellate *Pyrodinium bahamense*. Dynamic nutrient-phytoplankton-zooplankton-detritus (NPZD) models are important tools to help us understand the relative roles of nutrients and food web dynamics to system productivity. The goal of this study is to adapt a NPZD model to predict *Pyrodinium bahamense* biomass changes through time, within the specific environmental conditions of the Laguna Grande coastal lagoon. This dynamic model is parameterized with measurements of primary and secondary production, grazing rates, and nutrients fluxes determined during 2012 and 2013. To describe and explore the dynamics of *P. bahamense*, we established two size classes of phytoplankton, assuming the larger size class is dominated by the bioluminescent dinoflagellate. Because the lagoon has a persistent bioluminescent bloom, we used assumptions of steady-state conditions in our model to explore the factors that might contribute to a system where *P. bahamense* biomass is optimized. This model could be a very useful tool to monitor and manage this lagoon's unique natural resource.

FRI-394

DYNAMICS AND CONTROL OF INVASIVE SPECIES: THE CASE OF THE RASBERRY "CRAZY" ANT COLONIES

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This project is motivated by the costs associated with travel and international trade which come from the documented risks associated with the accidental and/or deliberate introduction of non-native invasive species of plants, animals, or pathogens into regions where they have no natural enemies. The spatiotemporal dynamics related to the invasion and spread of *Nylanderia fulva*, commonly known as the raspberry crazy ant, are explored via the use of models that focus on the reproduction of ant colonies. The impact of spatial correlations on the dynamics of invasion is investigated numerically and analytically with the aid of a mean field (MF) model and a pair approximation (PA) model, the latter of which accounts for adjacent cell level effects. The PA model approach considers the limited mobility range of *N. fulva*; that is, the grid cell dynamics are not strongly influenced by non-adjacent cells. Geographical heterogeneity and the role of spatial control measures are handled through the use of a lattice that accounts for cells that cannot be colonized (asphalt and others), quality of the cell (suitability for colonization), and the use of obstacles (chemicals or alternative modes) that temporarily restrict or stop specific cell colonization. The model determines the rate of growth of colonies of *N. fulva* under distinct cell spatial architecture. Numerical results and qualitative conclusions on the spread and control of this invasive ant species are discussed.

SAT-391

CONTROLLING THE SPREAD OF LYME DISEASE IN A TWO-PATCH MODEL WITH VARIABLE HUNTING

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Borrelia burgdorferi is a spirochete bacteria which causes Lyme disease, a common arthropod-borne disease that infects mammals such as mice, deer, and humans. It is especially prevalent in the Northeastern United States. It is spread by *Ixodes Scapularis*, a species of tick that feeds primarily on deer and mice. These ticks, in turn, bite humans, thereby spreading the infection and causing significant health problems among the general population. Reducing the population of ticks feeding on both large mammals and small mammals would reduce the spread of Lyme disease to the human population. A 2-patch model is used to describe the dynamics of the spread in 2 generic adjoining regions/states. One region does not allow hunting of deer, whereas the other permits regulated harvesting. In order to feasibly arrive at this solution, we modeled the spread of Lyme disease through 2 populations on separate patches with varying hunting restrictions using a 6-dimensional, 2-patch SI model. We then performed stability analysis and determined the sensitivity and bifurcation of equilibrium points in order to find the ideal hosts on which to introduce restrictions to tick proliferation.

MATHEMATICS (GENERAL)

FRI-406

PERMUTATION PATTERNS FOR REAL VALUED FUNCTIONS

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Consider the sequence $[x; f(x); f(f(x)) = f_2(x); \dots; f^{(n-1)}(x)]$ where f is a real-valued function and $n \geq 2$. We can associate a permutation to every such sequence by comparing it with $x_1 < x_2 < \dots < x_n$, where $x_i = f^{(j-1)}(x)$ for some $j = 1, 2, \dots, n$. Permutations that arise from these sequences are called allowed permutations, and those that do not are called forbidden permutations. For example, the logistic map, $f: [0; 1] \rightarrow [0; 1]$ is defined by $f(x) = rx(1-x)$, where $0 \leq r \leq 4$, for any x . We focus on enumerating the number of forbidden permutations for the logistic map and other functions, including trigonometric functions. For example, for the $n = 3$ case, we have found that the one-line permutation (321) is a forbidden permutation for the function $\sin(\pi x)$.

SAT-397

EXACT SOLUTIONS TO THE KORTEWEG-DE VRIES EQUATION

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We analyze certain exact solutions to the Korteweg-de Vries equation, which is a nonlinear partial differential equation with important applications in propagation of surface water waves in shallow and long canals and acoustic waves in ionized gases. We present a formula for the so-called n -soliton solution, the solution containing n solitary wave components (solitons) interacting with each other only when they are close to each other. The n -soliton solution formula uses as input 3 constant matrices A , B , C with sizes $n \times n$, $n \times 1$, and $1 \times n$, respectively. It is expressed in terms of matrix exponentials, and it is valid for any positive integer n . We relate the mathematical parameters in the n -soliton solution to the velocities and widths of individual solitons and to the eigenvalues of the matrix A . We further analyze solitons and their interactions by using Mathematica animations. Exact solutions such as multisoliton solutions are important not only physically but also mathematically, as they may be used to test the accuracy of computational methods developed for solving nonlinear differential equations numerically.

FRI-398

CONVERGENCE OF INFINITE EXPONENTIALS IN THE COMPLEX PLANE

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Consider an infinite exponential in the complex plane defined to be the limit of a sequence of exponential towers with finitely many exponents. We know that if the exponents are equal and within a region known as the Baker-Rippon region, then this infinite exponential converges. This poster presentation will show generalizations of previous results characterizing the convergence of exponential towers in the complex plane. Specifically, we are investigating the domain of convergence of the tower with nonconstant exponents, a question which is closely related to the stability of fixed points. We also hypothesize that in the case of constant exponents, uniform convergence occurs on any compact set within the Baker-Rippon region. Lastly, we are exploring the relationship between the rate of convergence of the tower and the rate of convergence of the exponents in special cases. We investigate these problems numerically using Matlab and then provide proofs. Note that this investigation constructs the tower "top-down" (changing the base of the tower) while others construct it "bottom-up." It appears that this approach has not been thoroughly explored.

FRI-401

CENSORED DATA AND COMPLETION METHODS

Aracely Alcalá, Evan Breikss, Cristina Retamoza, Javier Rojo.

Rice University, Houston, TX.

In survival analysis the Kaplan-Meier estimator takes into account censored data. Censored data can result from a subject leaving a study before its completion or the inability to record the desired outcome during the length of the study. As Kaplan-Meier takes into account subjects that may have once been entirely excluded, much more information seems to be retrieved from the experiment. Our research examines the operating characteristics

presented by the Kaplan-Meier estimator. For instance, when the last data point of a study is censored, the survival curve will come to a halt. Literature proposes various methods for retrieving information that may lie beyond the last given point. Thus, we compared the various methods proposed by R.D Gill, B. Efron, and Brown et al. Then, we explored the possibility of changing the initial starting time of our Kaplan-Meier distributions; that is squaring or applying a function to the distributions and noticing if any major changes occurred to its properties. Lastly, we compared the Kaplan-Meier estimator to the empirical estimator, which entirely excludes censored data, in order to determine the difference in bias and variance.

SAT-404

NUMBER OF PERMUTATIONS WITH SAME PEAK SET FOR SIGNED PERMUTATIONS

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A signed permutation is a sequence $\pi_1, \pi_2, \dots, \pi_n$ such that each $\pi_i \in \{-n, \dots, -1, 1, \dots, n\}$ and $\{|\pi_1|, |\pi_2|, \dots, |\pi_n|\} = [n] = \{1, 2, \dots, n\}$. Let B_n be the group of all signed permutations of $[n]$. A signed permutation has a peak in a position $i = 2, \dots, n-1$ if $\pi_{i-1} < \pi_i > \pi_{i+1}$. Let $P(\pi)$ be the set of peaks of π , $P(S, n)$ be the set of signed permutations $\pi \in B_n$ such that $P(\pi) = S$, and $\#P(S, n)$ be the cardinality of $P(S, n)$. We show $\#P(\emptyset, n) = 2^{2n-1}$ and $\#P(S, n) = p(n) 2^{2n-|S|-1}$ where $p(n)$ is some polynomial. We also consider the case in which we add a zero at the beginning of the permutation to also allow peaks at position $i = 1$.

FRI-399

ON A CLASS OF PERMUTATION POLYNOMIALS OVER FINITE FIELDS

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A polynomial $f(x)$ defined over a set A is called a permutation polynomial if $f(x)$ acts as a permutation over the elements of A . We study the coefficients a and b that make polynomials of the form $F_{a,b}(x) = x^{(p+1)/2} + ax^{(p+5)/6} + bx$ be permutation polynomials over the finite field F_p , $a, b \in F_p^*$. We show that this family of polynomials is rich in permutations, and that the amount of permutation polynomials for any p is divisible by 6. Our approach in studying $F_{a,b}(x)$ is to use the division algorithm to consider $x = \alpha^n$ where $n = 6k + r$, $r = 0, \dots, 5$. If $F_{a,b}(x)$ is a permutation, this partitions F_p^* into 6 classes: $F_{a,b}(\alpha^{6k+r})$ for $r = 0, \dots, 5$ each with $(p-1)/6$ elements. We also conjecture that, given a finite field F_q , the number of permutation polynomials of the form $G_{a,b}(x) = x^{(q+1)/2} + ax^{(q+d-1)/d} + x$ is divisible by d if d is even.

FRI-404

MUSIC OF GROUPS

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We use math every day without even realizing it; it is no surprise that this discipline has some relationship with music. This relationship can be observed with the theory of groups. A group refers to a nonempty set which defines a binary operation that must meet certain conditions. This research seeks to investigate the behavior of changes in tones, representing them as elements of a group. For the research, a regular dodecahedron was used, where the vertices represented the 7 musical notes, each with their correspondent sustained notes. We worked with this figure rotating it about its center axis and reflecting by joining the vertices and passing through the center. Rotations and reflections represent each element of the group, allowing the formation of 12 reflection elements (identified with S) and 12 rotation elements (identified with R). Then, the changes were taken in shades of fragments of songs and their composition as elements of a group. The result of these compositions showed a particular behavior that we plan to continue observing: if the resulting element of the group was composed of a rotation and a pairing (e.g., the elements R^2, R^4, R^6, \dots) all other rotations that were proved par, so too would happen if it were odd (e.g., the elements R^1, R^3, R^5, \dots) or if it was a reflection. Even though mathematics is routinely applied to other branches of science, it can also apply to music. This research is a demonstration of that, establishing a close relationship between these 2 disciplines.

SAT-401

THE ALGEBRA OF BLOCK PERMUTATIONS

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A set partition of $[n] = \{1, 2, \dots, n\}$ is a collection of nonempty disjoint subsets of $[n]$, called blocks, whose union is $[n]$. A block permutation of $[n]$ consists of two set partitions A and B of $[n]$ having the same number of blocks, and a bijection $f: A \rightarrow B$. We consider the set $BP_n = \{f: A \rightarrow B \mid f \text{ is a block permutation}\}$. The elements in BP_n can be visualized as graphs having two rows of n -labeled vertices, corresponding to A and B . The connected components of each row are determined by connecting the vertices within each block of A and B . We then connect each block of A to the block of B that it maps to under f . The product gf of 2 block permutations $f: A \rightarrow B$ and $g: C \rightarrow D$ of $[n]$ is obtained by gluing the bottom of a graph representing f to the top of a graph representing g , and connecting each block of A to a block in D . We show that BP_n is closed under this operation, and hence is a monoid. We have found a set of generators and seek to find a presentation for BP_n . We also describe a Hopf algebra structure on BP_n .

FRI-402

AN UPPER BOUND ON THE NUMBER OF ARCS IN A DIGRAPH GIVEN ZERO FORCING NUMBER

Jason Hu¹, Leslie Hogben².

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A simple directed graph (digraph) is a mathematical diagram that contains vertices and arcs, which represent individual objects and the connections between them, respectively. Given a digraph, we can always find a zero forcing set, defined as a set of vertices that can be colored blue, such that after repeated application of the color change rule, the entire graph becomes blue. The color change rule specifies that for any blue vertex b , if w is the only white vertex that b points to, then w should be colored blue. The size of the smallest zero forcing set that can be defined on a particular graph G is then called its zero forcing number, $Z(G)$. In our research, we have found an upper bound on the number of arcs that a digraph G can have in terms of n (the number of vertices in the graph) and $Z(G)$ (the zero forcing number). In addition, we have created a technique to construct graphs realizing the maximum number of arcs, given n and $Z(G)$. Related results are also presented.

SAT-398

IMPACT OF CLIMATIC VARIABLES IN PREDICTING INCIDENCE OF VISCERAL LEISHMANIASIS

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Leishmaniasis is a vector-borne disease that is caused by a protozoan parasite belonging to the genus *Leishmania*. Visceral leishmaniasis (VL) is the most severe form of the disease; the parasite affects the internal organs. VL is transmitted between humans through the bite of the vector, sandflies. The distribution of disease is based on the vector abundance and survival in the environment. Temperature and humidity plays an important role in survival, development, and activity of sandflies. The dynamics of VL in Bihar, India are essentially driven by climate. The objective of the study is to develop and analyze a mathematical model that can predict the incidence of VL based on various climatic factors. Climate and incidence data from 2000 to 2007 are obtained and analyzed in 3 epidemiologically different regions of Bihar, India: Gaya, Patna, and Bhagalpur. Using seasonal autoregressive moving average (SARMA), a time series analysis, we were able to study how much each climatic factor can explain incidence in Bihar. We used Akaike information criterion (AIC) to provide the best model. Auto-correlations were carried out to determine any potential dependency in the independent variables. A lag of 3 months in average temperature is considered to best explain VL incidence. The study results will be helpful in identifying best times during the year to distribute resources for implementing control programs.

FRI-397

INFINITELY MANY SOLITON SOLUTIONS TO THE KORTEWEG-DE VRIES EQUATION

Edward Duran, Tuncay Aktosun.

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The Korteweg-de Vries equation is a nonlinear partial differential equation with important applications in propagation of water waves and of acoustic waves in plasmas. We investigate solutions containing n solitary wave components (solitons) to the Korteweg-de Vries equation. We express n -soliton solutions by providing a compact formula that uses

three constant matrices A , B , and C of sizes $n \times n$, $n \times 1$, and $1 \times n$, respectively. The compact formula is transformed into another equivalent form so that the limit $n \rightarrow +\infty$ can be applied, yielding an expression for infinitely many soliton solutions. This is done by exploiting the relationship between the eigenvalues and the matrix trace and the relationship between the eigenvalues and the determinant, which provides the proper mathematical justification for the limit $n \rightarrow +\infty$.

SAT-405

THE LATTICE OF SET PARTITIONS AND TRANSITION MATRICES OF SYMMETRIC FUNCTIONS

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Brick tabloids are combinatorial objects, introduced by O. Eggecioglu and J. Remmel, through which the transition matrices between the bases m , e , p , and h of the commuting symmetric functions may be defined. There is an alternative way to describe the transition matrices using symmetric functions in noncommuting variables and the lattice of set partitions. Our goal is to study functions on the lattice of set partitions that arise as entries in the transition matrices. Our research explores the relationship between brick tabloids and functions on the lattice of set partitions. For example, we study $N_\lambda(\mu)$, the number of set partitions of type μ that are larger than or equal to a set partition of type λ , and $n_\lambda(\mu)$, the number of set partitions of type μ that are less than or equal to a set partition of type λ .

SAT-403

CALCULATION OF THE MAPPING CLASS GROUP OF A GENUS 2 SURFACE

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A useful tool for studying an object with symmetry is the automorphism group of the given object. For example, one might consider the space of homeomorphisms from a genus 2 surface to itself. This group is too big to study, but a quotient of it, the mapping class group, is a more tractable object. One goal of our project is to calculate the mapping class group for a genus 2 surface, S . Supposing we endow S with extra structure, then there are different mapping class groups depending on whether one is concerned with homeomorphisms, diffeomorphisms, or biholomorphic maps. We will study the different mapping class groups which arise.

SAT-396

DO TRANSITIVE TOURNAMENTS MINIMIZE GRAPH COSTS?

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Let G be an undirected graph and let T be a tournament on the same vertex set as G . Define the cost of G relative to T to be the sum of two-step paths in T from u to v plus two-step paths from v to u for any pair of vertices u and v . In our research, we determine, for several classes of graphs, which tournaments minimize the cost. Pelsmayer, et al, conjecture that for each graph there is a transitive tournament that minimizes the graph's cost. We prove that a transitive tournament minimizes the cost for complete graphs, nearly complete graphs, paths, star graphs, and cycles.

SAT-402

ALGORITHMIC CONSTRUCTION OF PERMUTATIONS OF HIGH DISPERSION

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Given a collection of objects, a permutation is a function that reorders the objects into a potentially new arrangement. An example of a permutation of the first 5 positive integers is $(3, 5, 1, 2, 4)$. Here the number of objects being permuted is called the block length of the permutation. We investigate the notion of dispersion, which measures the extent to which objects are "scattered" or "dispersed" under the action of a permutation. Dispersion is a numerical value between 0 and 1, where larger values indicate a low level of redundancy in linear patterns found in a graph of the permutation. The purpose of our two-fold investigation is to shed light on the behavior of dispersion as block length increases and to construct permutations with dispersions as large as possible. For small block lengths of at most 12, we compute the average value of dispersion via computer for all permutations of a given block length. The calculation is intractable for large block lengths, so we produce estimates using sampling techniques. Empirically, dispersion appears to follow a distribution with mean 0.81 and extraordinarily small standard deviation. This small standard deviation poses an obstacle to finding permutations with large dispersion via pseudo-random sampling, so

we developed and analyzed heuristic algorithms to overcome this challenge. Permutations play a role in applications such as coding theory, experimental design, and radar equipment, so our research has the potential to impact our understanding of some fundamental questions in these areas.

SAT-400

ZERO FORCING NUMBER IN A GRAPH AND ITS ORIENTATION

Kathryn Manternach¹, Leslie Hogben².

¹Central College, Pella, IA, ²Iowa State University, Ames, IA.

A graph $G = (V, E)$ is a collection of vertices V and edges E where an edge is an unordered pair of vertices. An orientation G' of a graph G is the same collection of vertices, but, if $\{i, j\}$ is an edge in G , we can have directed edge (i, j) or (j, i) but not both, where (i, j) means there is an arc from vertex i to vertex j . Matrix A corresponds to oriented graph G' if, for i and j distinct, the entry a_{ij} is nonzero exactly when (i, j) is a directed arc in G' . Note that the diagonal entries in A are free. The maximum nullity $M(G')$ is defined to be the largest possible nullity over all real matrices corresponding to G' . For an oriented graph G' , the zero forcing number $Z(G')$ is the minimum number of blue vertices needed to force all vertices in G' blue according to the color change rule. The color change rule is, for oriented graph G' with vertices initially colored blue or white, a blue vertex b forces a white vertex w blue if w is the only white out-neighbor of b . We investigate $M(G')$ and $Z(G')$ for an oriented graph G' and its underlying, unoriented graph G (the parameters $M(G)$ and $Z(G)$ have related definitions), including establishing that, for certain families of graphs, it is always possible to find an orientation G' of G so that $Z(G') = Z(G)$ and $M(G') = M(G)$.

FRI-400

TOWERS OF REPEATED EXPONENTIAL SEQUENCES

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Euler proved which numbers have convergent, iterated exponential towers. That is, given a real number x , he looked at the convergence of a sequence where the n^{th} term in the sequence is x exponentiated by itself n times. We have generalized this question from dealing with a constant number x to considering any sequence of positive real numbers. We provide results about regions of convergence, existence of certain types of sequences, and relationships between a sequence and its sequence of exponential towers.

SAT-406

ON THE SCHUR POSITIVITY OF DIFFERENCES OF PRODUCTS OF SCHUR FUNCTIONS

Nadine Jansen¹, Jeremy Meza², Rosa Orellana³, Jeremiah Emidih⁴, Samuel Ivy⁵.

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The Schur functions are a basis for the ring of symmetric functions indexed by partitions of nonnegative integers. A symmetric function f is called Schur positive if, when expressed as a linear combination of Schur functions, $f = \sum c_{\lambda} s_{\lambda}$, each coefficient c_{λ} is nonnegative. We wish to investigate expressions of the form $s_{\lambda}^c s_{\mu} - s_{\mu}^c s_{\lambda}$ (1) where λ partitions n and μ partitions $n-1$, and the complements s_{λ}^c and s_{μ}^c are taken over a sufficiently large $m \times m$ square. We give a necessary condition that if (1) is Schur positive, then μ is contained in λ . Furthermore, we show how conjugating partitions preserves Schur positivity. Lastly, we incorporate the Littlewood-Richardson rule to show that particular classes of λ and μ are never Schur positive.

FRI-396

SPECTRAL PROPERTIES OF WEIGHTED CAYLEY DIGRAPHS

Christopher Cox¹, Hannah Turner², Gregory Michel³, Sung Song¹, Katy Nowak¹.

¹Iowa State University, Ames, IA, ²Ball State University, Muncie, IN, ³Carleton College, Northfield, MN.

From a subset S of a finite group G , we can define the Cayley digraph of G with connector set S to be the directed graph $\text{Cay}(G, S)$ with vertex set G and arc set (x, xs) for some s in S . Naturally arising from this definition is the Cayley isomorphism (CI) property. A Cayley digraph $\text{Cay}(G, S)$ is said to be a CI graph if, for every subset T in G such that $\text{Cay}(G, T)$ is isomorphic to $\text{Cay}(G, S)$, there exists a group automorphism of G that maps S to T . If no such group automorphism exists for any $\text{Cay}(G, T)$ isomorphic to $\text{Cay}(G, S)$, the graph is called a non-CI graph. Finally, if every Cayley graph of G is CI, the group is called a CI group. In this presentation, we provide a new view of Cayley

digraphs by studying the adjacency matrix of the weighted Cayley graph obtained by weighting the edges of the digraphs corresponding to group character representations of G . Given a non-CI group, we examine the spectra of the weighted adjacency matrices of two isomorphic non-CI graphs and investigate the relation between the CI property of Cayley graphs over G and the spectra of the weighted adjacency matrices of the graphs. We present our findings on the spectral properties of the weighted Cayley digraphs and show how they can be applied to better understand the CI property and the structures of finite groups in general. In particular, we show how to determine if each isomorphism class of Cayley graphs of G are CI classes or not.

SAT-399

EGYPTIAN FRACTIONS, THE GREEDY ODD ALGORITHM, AND GROUPOIDSAndres Vindas Melendez¹, Julia Bergner².¹University of California, Berkeley, Berkeley, CA, ²University of California, Riverside, Riverside, CA.

There has been a vast amount of research performed on Egyptian fractions and groupoids separately. In the recent past, Baez and Dolan defined the notion of groupoid cardinality; it is a topic that can be used to see the connection between Egyptian fractions and groupoids. A recent paper by Bergner and Walker shows that any positive rational number occurs as the groupoid cardinality of some groupoid, and this problem can be reduced to the question of whether any positive rational number has an Egyptian fraction decomposition. This result, obtained through the use of the greedy algorithm, implies the fact that any positive real number is the cardinality of a groupoid with no 2 components having the same cardinality. However, if a different algorithm is used, the decompositions are not alike. This research seeks to investigate the differing decompositions that are obtained when applying the greedy odd algorithm. For example, under this algorithm, some rational numbers might have infinite decompositions or repeated summands. These results can be used to explore groupoids that have a particular cardinality relating to the outcomes of the greedy odd algorithm.

FRI-405

CHROMATIC SYMMETRIC FUNCTIONS OF TREES AND UNICYCLESDamien Gonzales¹, Arman Green², Candice Price³, Caprice Stanley⁴, Rosa Orellana⁵.¹University of California, Berkeley, Berkeley, CA, ²Morehouse College, Atlanta, GA, ³United States Military Academy, West Point, NY, ⁴George Washington University, Washington, DC, ⁵Dartmouth College, Hanover, NH.

Given any simple graph, there is a corresponding symmetric function called the chromatic symmetric function (CSF). Introduced by Richard Stanley in 1995, the CSF of a graph $G = (V(G), E(G))$ is defined as follows: $X_G = \sum_{\kappa} \prod_{v \in V(G)} X_{\kappa(v)}$ where the sum is over all proper colorings κ of G . A proper coloring is a labeling of a graph such that no 2 adjacent vertices have the same label. In 2008, Scott presented several open problems in graph theory. In our poster, we investigate these open problems and generalize some of his results. Our goal is to find necessary conditions for any 2 graphs that will ensure that they have the same CSF. We first consider 2 special types of graphs: trees and unicycles and write a program in SAGE to compare the CSF for any simple graph and compile a library of graphs with a small number of vertices alongside their CSFs.

FRI-403

MIDDLE SCHOOL STUDENTS' OPINIONS REGARDING STEM BEFORE AND AFTER A SUMMER ROBOT CAMP EXPERIENCELeanne Cohn, Chrystal Johnson, Gregg Gold.*Humboldt State University, Arcata, CA.*

Science, technology, engineering, and mathematics (STEM) are critically important fields. A number of studies have looked at various metrics, including how many students enroll in STEM courses, how many of them drop out, etc. However, as far as we know, research has not been conducted looking at students' potential attitude changes toward STEM in the context of attending a summer camp devoted to a highly STEM oriented subject (robots). Here, we administered a paper-based entrance and exit survey regarding STEM attitudes to middle school participants in a summer robot camp. Our data will be statistically analyzed to determine the extent to which robot camp had an effect on participants' attitudes towards STEM subjects. Hopefully analysis will show us a positive correlation between STEM camp attendance and positive changes in participants' attitudes towards STEM. We are hopeful this research will provide evidence that camps like this will motivate and encourage students to have more positive attitudes toward STEM.

OTHER MATHEMATICS

SAT-407

SUBGROUP STRUCTURES ON CAYLEY GRAPHS AND THE CAYLEY ISOMORPHISM PROPERTY

Hannah Turner¹, Sung Song², Christopher Cox², Katy Nowak², Gregory Michel³.

¹Ball State University, Muncie, IN, ²Iowa State University, Ames, IA, ³Carleton College, Northfield, MN.

For a finite group G and a symmetric subset S of G , the Cayley (undirected) graph $\text{Cay}(G, S)$ is the graph whose vertex set is G and such that two vertices x and y are adjacent if y is xs for some s in S . A group G is said to have the Cayley-isomorphism (CI) property if for any 2 isomorphic Cayley Graphs $\text{Cay}(G, S)$ and $\text{Cay}(G, T)$, there exists an automorphism of the group that sends S to T . We know that if a group G has a subgroup H that does not show the CI property, then G also does not have the CI property. In this poster, we analyze CI and non-CI subgroups of a non-CI group G and we characterize certain Cayley graphs of G where the connector sets generate these subgroups. We study the relation between the particular non-CI isomorphism classes of non-CI groups and their non-CI subgroups, and we also characterize irreducibly non-CI groups, those non-CI groups for which every subgroup of the group is CI.

FRI-407

CLASSIFICATION OF THE CAYLEY GRAPHS OF SYMMETRIC GROUPS

Gregory Michel¹, Hannah Turner², Christopher Cox³, Katy Nowak³, Sung Song³.

¹Carleton College, Northfield, MN, ²Ball State University, Muncie, IN, ³Iowa State University, Ames, IA.

In this poster, we completely classify the Cayley graphs of the symmetric group on 4 letters. We characterize all possible Cayley graphs that come from symmetric subsets and we identify the individual classes of isomorphic graphs for which the Cayley isomorphism (CI) property holds. In studying the CI property, we analyze whether or not certain graphs are connected, planar, bipartite, edge-transitive, and/or strongly regular. We further investigate whether some of the strongly regular graphs can be decomposed by a pair of directed regular graphs, especially into a pair of directed strongly regular graphs, doubly regular tournaments, or normally regular digraphs that are realized as directed Cayley graphs of the same group. By analyzing patterns among the isomorphism classes, we can generalize certain properties for arbitrarily large symmetric groups.

STATISTICS

FRI-409

STUDY OF THE HILL ESTIMATOR

Maria Correa¹, Rebekah Starks², McKenna Mettling³, Javier Rojo⁴.

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Heavy-tailed distributions are used for modeling in many of the popular fields, for example telecommunications and finance. Thus, the development and study of methods to estimate the tail index for these distributions is highly significant. For our research, we studied the well-known Hill estimator developed in 1975 by Bruce M. Hill. We studied its accuracy and flaws, which include Hill horror plots, by using various heavy-tailed distributions and real datasets to create simulations in R studio.

SAT-409

RANDOM PROJECTIONS VS. PRINCIPAL COMPONENTS ANALYSIS FOR DIMENSION REDUCTION IN SURVIVAL ANALYSIS

Adrian Carballeira¹, Noel Martinez², Kourtney Howell³, Javier Rojo⁴.

¹University of Arizona, Tucson, AZ, ²University of Texas at El Paso, El Paso, TX, ³Xavier University of Louisiana, New Orleans, LA, ⁴Rice University, Houston, TX.

In recent years, scientists have exponentially increased the amount of data that can be gathered from a given experiment. The "curse of dimensionality" along with computational restrictions can hinder attempts to extract meaningful information from the data. Principal components analysis is one common way to reduce dimensionality. Alternately, the Johnson-Lindenstrauss theorem guarantees that, given the number of data points and a specified error tolerance, there exists a mapping, realized as a linear transformation, into a lower dimension with the property

that pairwise distances between points in the original data set are preserved up to a small error bound. We compare several suggested lower bounds and types of random projection matrices found in the literature and see that these bounds are quite conservative. We use the software R to generate different random projection matrices to determine which type of random projection matrix most frequently upholds the conclusions of the Johnson-Lindenstrauss theorem. Also using R, we use both random projections and PCA to reduce data in order to estimate survival curves for randomly-generated data and compute bias and mean squared error in order to compare these 2 methods. Knowing which dimension reduction method yields more accurate results allows scientists to analyze summarized data without losing precision, a much more computationally efficient task.

SAT-408

ESTIMATING TAIL INDICES: THE ACCURACY OF THE ROJO1 ESTIMATOR

McKenna Mettling¹, Maria Correa², Rebekah Starks³, Javier Rojo⁴.

¹Regis University, Denver, CO, ²St. Mary's University, Texas, San Antonio, TX, ³University of Arizona, Tucson, AZ,

⁴Rice University, Houston, TX.

The focus of our project is to investigate the accuracy of the current estimators used for finding the tail indices for heavy-tail distributions. After studying both the Hill and Pickands estimators and discovering that both had certain flaws, we noticed there is no true consensus on which of the classical estimators we should use for research. Therefore, for the final portion of our project, we decided to test a completely new estimator called Rojo1. The Rojo1 estimator is a new estimator proposed by Rojo for measuring tail heaviness by estimating the tail index using concepts from the extreme value theory. The Rojo1 estimator is defined to be $\log(n)/\log(X_n)$, where n is the sample size and X_n is the largest-order statistic. The Rojo1 estimator can be used in many applications, including finance and environmental science. We hoped to explore the accuracy of Rojo1 by testing the computational work and the theoretical properties. We have found that the estimator works well when looking at the bias and MSE of our estimates, and we found Rojo1 to be a useful estimator for tail indices of heavy-tailed distributions. We have just begun to understand the possibilities that Rojo1 can provide us for estimating tail indices; however, there is more theoretical research still left for this estimator. (This work was supported by the RUSIS project, directed by Javier Rojo, through NSF REU site grant DMS-1156847 and NSA REU grant H98230-12-1-0284.)

FRI-408

TESTING FOR TAIL BEHAVIOR WITH REFINED SPACING

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¹Harvard College, Cambridge, MA, ²Rice University, Houston, TX, ³University of Arizona, Tucson, AZ, ⁴St. Mary's University, TX.

The ideas of extreme spacing and blocking were applied to test the hypotheses about tail-heaviness of underlying distributions previously described by Rojo and Ott. The gap between the greatest observations of the underlying distribution was used in constructing a test statistic for tail heaviness. The tests were also run with blocked data, yielding a substantial increase in power. In the case of blocked data, a test statistic was found for each block and then all test statistics were combined into one. In an attempt to further improve Rojo and Ott's method, a weighted sum of individual block test statistics was considered. Through a simulation in R, values from distributions were generated and then placed into blocks consisting of equal numbers of observations. Within each block, the values were ordered ascendingly and the difference between the two greatest values was used to calculate the test statistic for that block. A weighted sum of all the test statistics was then used for the defining test statistic. While this new method did yield high power with certain distributions, it was not the case for all, and Rojo and Ott's method of blocking without weights yielded better results. While this method has yet to prove a better option, further manipulation with the amount of blocks or the value of the weights for each block may yield a better system for classifying tail-heaviness. (This work was supported by the RUSIS project, Directed by Javier Rojo, through NSF REU site grant DMS-1156847 and NSA REU grant H98230-12-1-0284.)

PHYSICAL SCIENCES

ASTRONOMY/ASTROPHYSICS

SAT-200

THE DISCOVERY OF UNEXPECTED ULTRAVIOLET EMISSION FROM THE DETACHED SHELL AROUND THE EVOLVED STAR U HYDRAEEmmanuel Sanchez¹, Rodolfo Montez Jr.², Sofia Ramstedt³, Keivan Stassun².¹*Florida State University, Tallahassee, FL*, ²*Vanderbilt University, Nashville, TN*, ³*Uppsala University, Uppsala, SE*.

Most of the ingredients necessary for life are produced in stars during the late stages of their life. During the late stage known as the asymptotic giant branch (AGB), carbon, oxygen, and nitrogen are produced and released into the universe via dense stellar winds. In the AGB star U Hydrae, a substantial amount of material seems to have been lost during a single episode which lead to the formation of a cold, detached shell made of carbon-rich dust. The cold dust emits primarily in the far infrared range of the electromagnetic spectrum, however, using ultraviolet observations taken by the Galaxy Evolution Explorer (GALEX) satellite, we have discovered energetic ultraviolet emission coming from the detached shell and the AGB star. The origin of this energetic emission from the cold, detached shell is unusual but may be due to shocks as the detached shell moves away from the star, excitation of hydrogen molecules, or scattering of light from nearby stars. We use imaging and photometric analysis of the ultraviolet emission to determine the origin of this emission. We intend to follow up this study with a wider sample to study the influence of such energetic emission on the enriched stellar material.

FRI-200

SCATTERED LIGHT MEASUREMENTS FOR ADVANCED LIGO'S OUTPUT MODE CLEANER MIRRORSAdrian Avila-Alvarez, Joshua Smith, Cinthia Padilla, Fabian Magaña-Sandoval.*California State University, Fullerton, Fullerton, CA*.

The Advanced Laser Interferometer Gravitational-Wave Observatory (LIGO), with sites in Livingston, Louisiana, and Hanford, Washington, and its international partners, Virgo, GEO600, and KAGRA, are being built to detect gravitational waves, a phenomenon theorized by Einstein in his theory of general relativity (GR). Direct predictions of GR, gravitational waves are ripples in space-time that propagate at the speed of light and are created by violent astrophysical processes. The gravitational-wave detectors are all based on the Michelson interferometer, which has an input laser, a beam splitter, and 2 perpendicular arms with mirrors at each end. However, their configurations have significantly more complexity to augment their sensitivity. Higher order spatial modes can create "junk light" that decreases the shot-noise limited sensitivity of the detectors. To combat this, each LIGO detector has an output mode cleaner (OMC) at its detection "dark port". Scattered light from the OMC mirrors can reduce the shot-noise limited sensitivity of the instruments, and add noise via stray and counter-propagating light. Thus it is important that the light scattering from the OMC mirrors in Advanced LIGO be minimal. This poster will describe measurements of the scattered light from sample Advanced LIGO OMC mirrors.

SAT-201

QUASARS PROBING QUASARSJose Lopez, Jason Prochaska.*University of California, Santa Cruz, Santa Cruz, CA*.

Quasars are the brightest objects in the Universe, and it is believed that they are powered through the infall of matter onto a supermassive black hole, which is at the center of a massive galaxy. They can be used to answer three of the most important research subjects being studied by cosmologists today: when and how was the universe reionized, how did supermassive black holes grow over cosmic time, and what shuts off star formation in massive elliptical galaxies. These questions can be addressed by observing close pairs of quasars with an angular separation of less than 1'. Quasars allow us to study the rarefied matter between Earth and the quasar that is in absorption. Through the use of spectroscopy, the redshift of these quasars can be obtained to answer the questions addressed above. Programs have been created which help us process data obtained at various observatories. We then go on to analyze the data and determine if there is any oxygen (OIII) present in those quasars in the infrared wavelength. The device we are currently working with, the Palomar TripleSpec, will allow us to pin down the redshifts of the background quasars.

ATMOSPHERIC SCIENCES/METEOROLOGY

FRI-202

THE CAUSES OF *IN SITU* METHYL CHLORINE ENHANCEMENT IN SOME ANTARCTIC ICE CORESIsis Frausto-Vicencio¹, Kristal Verhulst², Murat Aydin², Eric Saltzman.¹College of the Sequoias, Visalia, CA, ²University of California, Irvine, Irvine, CA.

Methyl chloride (CH_3Cl) is a naturally occurring ozone-depleting gas. CH_3Cl is the most abundant halocarbon in the atmosphere with a global mean abundance of 550 parts per trillion. The sources of CH_3Cl are mainly natural including tropical vegetation, oceans, and biomass burning. CH_3Cl is sequestered from the atmosphere primarily through reaction with hydroxide with additional loss via microbial degradation in soils and the oceans, resulting in an atmospheric lifetime of about one year. Ice cores can provide a long-term record of the natural variability of atmospheric CH_3Cl . Atmospheric CH_3Cl is well-preserved in polar ice cores at cold high-altitude sites. Measurements from warm sites provide evidence for *in situ* production of CH_3Cl in ice cores. The goal of this study is to determine the potential causes of *in situ* CH_3Cl production in some Antarctic ice cores. We will examine CH_3Cl in three different Antarctic ice cores (Taylor Dome, Siple Dome, and West Antarctic Ice Sheet Divide) to investigate links between the *in situ* CH_3Cl production and the impurity content as well as other physical characteristics of ice cores. Measurements are predominantly from the last 10,000 years. Air is extracted from the ice cores using a dry-extraction technique and analyzed with a gas chromatograph coupled to a high-resolution mass spectrometer. The results of this research will establish the likely causes of CH_3Cl production in ice cores. This study will provide a basis to assess the viability of studying long-term atmospheric CH_3Cl variability using ice core data.

SAT-203

LINKS BETWEEN REGIONAL MONSOON CIRCULATION AND LOCAL HYDRO-CLIMATE IN SOUTHEAST ASIAManuel Hernandez Jr.¹, Caroline Ummenhofer², Kevin Anchukaitis².¹Texas A&M University, College Station, TX, ²Woods Hole Oceanographic Institute, Woods Hole, MA.

The Asian summer monsoon, consisting of 3 major subsystems, is characterized by a distinct seasonal precipitation onset that affects the regions of India, the Indochina peninsula, and East Asia. Current monsoon indices for Southeast Asia and the Indian subcontinent capture the large-scale circulation patterns and, in turn, the hydro-climate of the specified area affected by the Asian Monsoon System. However, their skill in representing regional circulation features and links to the local hydro climate are less understood. Here, we assessed the variability within the Dynamical Indian Monsoon Index, the East Asian Western North Pacific Index, and the South Asian Monsoon Index and their links to regional climate features over Southeast Asia, using various observations and reanalysis products at monthly resolution and an extended 1300-yr pre-industrial control run with the Community Earth System Model (CESM). The monsoon indices in the model compared well with those in the reanalysis, with similar statistical properties. Furthermore, composites of precipitation, sea surface temperatures (SST), wind fields, and moisture advection during years with an extreme monsoon index (i.e., top and bottom 10%) were explored for the three monsoon indices in the reanalyses and model, respectively. Composites demonstrate large-scale changes in Indo-Pacific SST, circulation, and moisture advection in Southeast Asia, consistent with effects on seasonal precipitation within the region. Our analysis further investigates the paleo climate of Southeast Asia through the CESM control run to identify natural cold SST periods and their effects on circulation and precipitation patterns to understand extended drought periods identified in tree-ring chronologies in Southeast Asia.

FRI-201

DETECTION OF POLYCYCLIC AROMATIC HYDROCARBONS IN ENVIRONMENTAL SEDIMENT SAMPLESAdrian Gomez, Krishna Foster.

California State University, Los Angeles, Los Angeles, CA.

Water is one of the most vital substances on Earth and is the key ingredient for all possible life. As more and more pollution is being released into the atmosphere, the need for clean water is becoming a greater concern for the human population. Polycyclic aromatic hydrocarbons (PAHs) are virtually everywhere and are abundant in sediments, which are directly in contact with life-sustaining surface waters. The objective of this study is to detect PAHs in sediment samples from Ballona and Fern Dell Creeks. These sediment samples were first extracted with the accelerated solvent extractor (ASE) as well as Soxhlet using a hexane and acetone mixture. Then the samples were analyzed using a gas chromatography-mass spectrometer (GC-MS) as well as the high-performance liquid chromatography (HPLC) equipped with UV-vis and fluorescence detectors. The GC-MS allows the separation of compounds by mass-

to-charge ratios and will be used for identification. The HPLC will be used as a complementary detection technique. The data obtained will be compared to PAH standards which will allow us to correctly identify if our samples contain these contaminants or not. Water is able to permeate through sediment making this a vital detection analysis because PAHs are all carcinogenic compounds, and so much of creek runoff goes to habitable plant life that this may hyper-accumulate these bioavailable compounds.

SAT-204

DETERMINING THE VERTICAL DISTRIBUTION OF VOLCANIC PLUMES FROM 2004 TO 2013

Jonathan Martinez, Steven Massie.

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The goal of this research is to determine the statistics of volcanic injections of sulfur dioxide (SO_2) into the atmosphere during 2004 to 2013. We analyzed data from the Smithsonian Global Volcanism Program as well as satellite data from the Ozone Monitoring Instrument (OMI) to obtain a statistical distribution of volcanic plume heights and SO_2 column amounts during 2004 to 2013 organized as a function of latitude. Along with this data, a global average of tropopause heights as a function of latitude was used to determine where the volcanic plumes entered the stratosphere. Our analysis indicates that SO_2 column amounts increase as the height of the volcanic plume increases for most of the troposphere. The research focuses on small volcanic eruptions during what is known as a quiet time of no large volcanic eruptions. This allows for the determination of the effects and contributions of the smaller volcanic eruptions injecting SO_2 into the stratosphere. Once in the stratosphere, the SO_2 released by the volcanos oxidizes to form sulfuric acid (H_2SO_4), which is the key ingredient of sulfate aerosols. These aerosols have been observed to exist in the stratosphere for up to 2 years, and they have impacts on our climate such as cooling the troposphere. This research will help to distinguish the natural volcanic contributions of SO_2 in our atmosphere from anthropogenic sources of SO_2 such as those due to thermal power plants.

SAT-202

HOW PRE-STORM AND INFLOW REGION DATA COMPARE AND INFLUENCE CONVECTIVE TRANSPORT OF CHEMICALS TO THE UPPER TROPOSPHERE

Meghan Applegate¹, Mary Barth².

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Ozone in the upper troposphere is considered a greenhouse gas, which can contribute to climate change. Convection in thunderstorms can carry ozone precursors upward from the boundary layer into the upper tropospheric region. Production of nitrogen oxides associated with lightning in the storm can also play a role in the transformation of the upper troposphere chemical composition. Data from the Deep Convective Clouds and Chemistry (DC3) Field Campaign were used to compare pre-storm to inflow data using 4 different storm events in diverse regions. This was done by creating vertical profile and time series plots of concentration and altitude. Inflow times, which were found using flight notes and flight tracks with Catalog Earth were highlighted in these plots. These plots were made for each of the 14 chemical species of interest including ozone and its precursors. This comparison allowed us to determine whether the pre-storm data can be used for the analysis of convective transport and scavenging of trace gases in the upper troposphere.

FRI-203

PACIFIC NORTHWEST ECOSYSTEM RESPONSES TO ATMOSPHERIC CHANGES IN THE 21ST CENTURY

Gabriela De La Cruz Tello¹, Gordon Bonan².

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The Pacific Northwest is important for various reasons, one of which is its role in the carbon cycle. The carbon cycle regulates carbon pools and fluxes throughout the Earth system. Currently, the Pacific Northwest is a carbon sink; its rate of carbon uptake is greater than its rate of release. Therefore, investigating what will happen to this carbon sink is necessary for understanding future environmental change. We used the Community Land Model version 4 (CLM4CN) and ran 8 simulations with varying atmospheric changes. Half of the simulations were run with present climate, using Qian atmospheric forcing data for 1948 to 2004, and half were run with climate from 2075 to 2100, with the atmospheric forcing data coming from the Representative Concentration Pathways 8.5 scenario (RCP8.5). One run from each group was forced with an increased carbon dioxide (CO_2) concentration of 937.87 parts per million (ppm); another was forced with an increased tropospheric ozone (O_3) concentration projected at the year 2100 with the Community Atmosphere Model (CAM) and RCP8.5 scenario; the third included a combination of increased O_3

and CO₂ concentrations; and the fourth was a control. We are using the National Center for Atmospheric Research Command Language (NCL) to analyze these simulations. We expect carbon pools to increase in scenarios where carbon fertilization plays a large role due to increased CO₂, and we expect changes due to increased tropospheric O₃ and climate change. Our results will show which simulations will be most favorable in maintaining the Pacific Northwest's status as a carbon sink.

CHEMISTRY (EXCEPT BIOCHEMISTRY)

SAT-23

DEVELOPMENT OF SMALL-MOLECULE INHIBITORS OF CYTOKINE-INDUCED BETA CELL APOPTOSIS WITH IMPROVED METABOLIC STABILITY

Angel Placeres, Stephen Scully, Alicia Tang, Bridget Wagner.
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Diabetes is a metabolic disorder characterized by high blood glucose levels. It affects 8.3% of the population in the United States and is one of the leading causes of death. In type 1 diabetes (T1D), autoimmune destruction of pancreatic beta cells leads to lowered production of insulin, an essential hormone for the regulation of glucose. To discover novel therapies for T1D, our group screened for small molecules that inhibit immune-mediated death of beta cells for the recovery of insulin levels. BRD0476, a small molecule developed by diversity-oriented synthesis (DOS), was found to be an effective inhibitor of cytokine-induced beta-cell apoptosis. In the present study, we describe the design and synthesis of analogs of BRD0476 with increased metabolic stability. This is associated with the susceptibility of compounds to undergo biotransformation for the selection and development of drugs with favorable pharmacokinetic properties. In particular, we describe the design of naphthyl analogs with incorporation of electron-withdrawing groups to prevent oxidative metabolism mediated by CYP450 enzymes. The development of biologically active analogs of BRD0476 that are metabolically stable may prove to be a novel intervention for the treatment of type 1 diabetes.

FRI-19

RECOGNITION OF SACCHARIDE BIOMARKERS VIA A FLUORESCENT PROBE BASED ON BORONIC ACID APPENDED BIPYRIDINIUM SALTS

Isaac Banda, Angel Resendez, Kelsey Clarke, Bakthan Singaram.
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Gastrointestinal barrier dysfunction is now recognized as an early event in the pathogenesis of several problematic diseases such as inflammatory bowel disease (IBD), Parkinson's disease, Crohn's disease, celiac disease, and type 1, 2 diabetes mellitus. Gastrointestinal permeability can be assessed noninvasively by analyzing saccharide biomarkers in urine such as sucrose for upper GI permeability, lactulose and mannitol for small intestine permeability, and the synthetic sweetener sucralose for colon. Current methods for analyzing these biomarkers require expensive and time-consuming instrumentation such as high performance liquid chromatography/mass spectrometry (LC/MS). Currently, there is a need for rapidly quantifying these biomarkers in a high-throughput, low-cost effective manner. Using a 2-component system that utilizes a fluorescent probe that serves as the reporter signal and boronic acid substituted bipyridinium salts that serves as the receptor, the detection of the saccharide biomarkers mannitol and lactulose were examined in a buffered solution. Results indicate the bis-substituted viologen receptor has a greater fluorescence restoration whereas the mono-substituted viologen has slightly higher discriminatory properties.

FRI-24

KINETIC SPECTROPHOTOMETRY AND FLUORESCENCE FOR NEW QUANTIFICATION OF ROCKET FUEL RESIDUES

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Residues from rocket launching are unavoidable by-products of human space exploration. These residues are usually oxidizing species. To quantify them has significance to drinking water compliance, waste minimization, and hunting for life-sustaining exoplanets. In this work we developed a new assay for these oxidants by using fluorescence direct and indirect determination. Our results showed that the indirect approach (i.e., fluorescence quenching) is more sensitive

than the direct luminescence. We systematically examined the staining dyes and pigments used in cell biochemical study and their fluorescence and found thiazine-containing dyes are quenching upon introducing the oxidants. By utilizing kinetic analysis, this quenching can be developed into a new assay for the oxidants. The preliminary study revealed the complicated responding mechanism. While these oxidants (analytes) can directly oxidize these dyes, they actually play a role more like the quenchers to the existent fluorescence of the dyes impacted by a stronger third oxidizer agent. The follow-up study optimized the analytical system. The highest sensitivity has been obtained in acidic media with ternary component system matrix. Our new protocols for nitrite and hypochlorite are representative and can be extended into other oxidizers which adds new meaning to the existent analytical arsenal in addressing environmental protection and space exploration. [This work was supported by NASA-TSGC-NIP, SACP-UARP, Starter-award of UARP, and Welch Grant (BJ-0027)].

FRI-23

STUDY OF THE THERMOTROPIC AND LIGHT-EMITTING PROPERTIES OF POLYPYRIDINIUM SALTS DERIVED FROM NAPHTHDINE

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A novel polymer was synthesized from 4,4'-(1,4-phenylene)bis(2,6-diphenylpyrilium) tosylate and 3,3'-dimethylnaphthidine. Tosylate counterion was exchanged with triflimide, 1-naphthalene sulfonate, and 2-naphthalene sulfonate to yield 4 polypyridinium salts. The structures and purities of those polymers were established by Fourier transform infrared (FTIR), Fourier transform nuclear magnetic resonance (FTNMR), and elemental analyses. Molecular weights of those polymers were determined by gel permeation chromatography (GPC). Their thermotropic properties were studied by using thermo gravimetric analysis (TGA) and differential scanning calorimetry (DSC). Their light-emitting properties were determined by UV-visible (UV-Vis) spectroscopies and fluorescence. The results show more liquid crystalline phases during melting transitions, electroluminescent properties, and improved solubility in polar solvents of those polypyridinium salts. The results also show that the thermotropic properties of these polymers can be tuned by the nature of the counterions. On the other hand, the light-emitting properties of those polymers are independent from these counterions, and thus the emission maxima of those polymers are not influenced.

SAT-16

PREPARATION OF PROTEIN-BRANCHED GLYCOPOLYMER CONJUGATES

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Protein-polymer conjugates are of interest in the development of new biologically-based therapeutic agents. Currently, protein-poly(ethylene glycol) (PEG) conjugates are employed in the treatment of hepatitis and cancer. We have recently reported the conjugation of trehalose-based synthetic glycopolymers to proteins. The protein-trehalose polymer conjugates were demonstrated to retain biological activity after being exposed to extreme environmental conditions that are known to decrease protein activity, such as prolonged heating and multiple lyophilization cycles. Polymer architecture may influence the activity of bioconjugates. Most polymers used for conjugation to proteins are limited to linear architectures, and there are few examples of the preparation and study of protein-branched polymer conjugates. Our research is focused on developing a methodology for the preparation of branched trehalose glycopolymer-protein conjugates. The strategy involves a 2-step approach. First, a linear polymer scaffold containing multiple atom transfer radical polymerization (ATRP) initiators will be grafted to the protein. The linear scaffold will be prepared by nitroxide-mediated co-polymerization (NMP) of styrenyl trehalose monomer and an ATRP-initiating monomer. Second, ATRP will be employed to graft styrenyl trahalose from the protein-polymer scaffold to produce the branched glycopolymer conjugate. The branched and linear glycopolymer conjugates will be compared with respect to activity and stability to elucidate the effects of polymer architecture on these parameters.

FRI-22

MESOPOROUS MATERIALS FOR THE DESULFURIZATION OF JET FUEL

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Jet fuel with ultra-low sulfur content is a promising feedstock for use in hydrogen fuel cells. Current desulfurization techniques, such as hydrosulfurization, are ineffective on these fuels which has given rise to the field of adsorptive

desulfurization. Mesoporous inorganic materials loaded with metals that have high affinities for sulfur have been shown to be promising for desulfurization. We can synthesize these materials using surfactants as templating agents and metal alkoxides as precursors; the templates are then removed, leaving a porous material that can be loaded with a metal such as silver. Various metal-loaded mesoporous materials were created for testing against a model jet fuel to ascertain which metals and frameworks had the highest adsorption capacities. Mesoporous silica loaded with silver was found to be a promising sorbant for desulfurization of jet fuel.

SAT-9

COMPUTATIONAL STUDIES OF MANGANESE-ENHANCED MAGNETIC RESONANCE IMAGING CONTRAST AGENTS

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Manganese-enhanced magnetic resonance imaging (MEMRI) agents are emerging in the market as alternative contrasting agents to the more commonly used Gd complexes. These manganese-based complexes are increasingly used in imaging, from the nervous system to the kidneys, due to the metal shortening the T_1 as well as the T_2 relaxation times of surrounding water. Manganese chloride ($MnCl_2$) is commonly used in brain imaging due to the agent being able to identify cytoarchitecture within the brain, as studied in rats. Although $MnCl_2$ is not FDA approved, a contrasting agent on the market that is approved is manganese dipyridoxaldiphosphate, or mangafodipir ($MnDPDP$). This complex is commonly used for imaging the liver or cardiac ischemia. To further understand these complexes, we examined various properties of these two agents using Gaussview 09 and Gaussian 09. Both molecules were optimized and had their frequencies found at ground state using the density functional theory with the functional B3LYP and basis state SDD. We found that $MnDPDP$ was highly polar with a dipole moment of over 10 debye, while $MnCl_2 \cdot 4H_2O$ was nonpolar having a dipole moment of 0 debye. When comparing our computed data with experimental results, we found that our infrared spectra had very similar peaks and almost identical fingerprints to the literature. Along with the similar IR spectra, the bond distances and angles were over 95% in agreement to those found experimentally. We are further analyzing our complexes in order to better understand their chemical nature.

FRI-20

NEW PLATINUM(II) COMPLEXES FOR THE INVESTIGATION OF COPPER-MEDIATED DEGRADATION IN PT-BOUND RNA CLICK REACTIONS

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Small-molecule binders, such as the platinum(II) [$Pt(II)$] anticancer drug cisplatin, can be used to probe cellular RNA structures and functions. We are focusing on the functionalization of Pt complexes with azide and alkyne moieties that may allow for the subsequent purification and high-throughput sequencing of Pt-RNA adducts in the copper-catalyzed Huisgen cycloaddition reaction. Because of the reactive nature of the necessary Cu catalyst, it is speculated that Cu is facilitating observed RNA degradation in model reactions, thus lowering the efficiency and usefulness of the post-treatment click modifications. Three new Pt(II) complexes that vary in linker length from the platinum center to the copper-catalyzed click reaction site will be synthesized to probe the possible influence of click-mediated Cu recruitment on cleavage of the oligonucleotide. This will allow for further investigation of additional and undesired copper-mediated reactivity and improved yield of Pt-bound RNA click reactions.

SAT-6

SIZE SELECTION OF HIGH DIELECTRIC NANOPARTICLES

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High dielectric materials are of special interest in the production of electronic components such as in the manufacturing of transistors. Barium titanate ($BiTiO_3$) nanoparticles have a strongly size-dependent dielectric constant that is lucrative for such materials. In this work, $BiTiO_3$ nanoparticles were sorted according to size using filtration methods that changed their surface energy by silanation. These student-friendly methods are a cost effective way to size select particles for further study. These methods are of benefit to low budget labs or smaller universities that may be hindered by the absence of more accurate means to characterize particle size such as scanning electron microscopy.

FRI-5

SYNTHESIS OF SELF-ASSEMBLING BISCAVITANDS FOR MOLECULAR RECOGNITION AND GUEST COMPLEXATION

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Cavitands are container molecules that can bind or entrap smaller compounds. This study aims to synthesize a series of side-by-side biscavitands with linkers varying in flexibility to control their conformations. Resorcin[4]arene cavitands serve as attractive frameworks for developing hexacarboxylic acid biscavitands due to their versatile structure. The biscavitand can potentially self-assemble into capsules through non-covalent electrostatic interactions such as hydrogen bonding. A thorough route utilizing conventional organic synthetic methods has been developed to incorporate functionality at specific locations on the resorcin[4]arene for self-assembly and molecular recognition. Characterization of these compounds will be completed using nuclear magnetic resonance spectroscopy. The conformational changes, guest complexation, and molecular recognition of functionalized biscavitands have not been well studied. By studying the physical properties of these compounds, we can better control conformational changes and guest complexation of future versions. These physical attributes make resorcin[4]arene biscavitands suitable for potential applications as sensors, molecular switches, drug delivery carriers, or toxic remediations.

FRI-12

RISPERIDONE, AN ATYPICAL ANTIPSYCHOTIC, INCREASES THE EFFICACY OF CIPROFLOXACIN BY FUNCTIONING AS AN EFFLUX PUMP INHIBITOR IN *STAPHYLOCOCCUS AUREUS*

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With the increase of multidrug bacterial resistance, the options for clinical treatment are becoming more limited. Ciprofloxacin, one of the most prescribed fluoroquinolones, has become less effective due to resistance by efflux pump in *Staphylococcus aureus*. In recent studies, it has been found that antipsychotics have efflux pump inhibition properties. The objective of this study is to test whether risperidone (RIS), an FDA-approved second-generation antipsychotic, is an efflux pump inhibitor (EPI) in *Staphylococcus aureus*, as well as examining its synergistic relationship with ciprofloxacin (CIP). Disk diffusion tests and a fractional inhibitory concentration (FIC) assay were performed to determine synergy between RIS and CIP. The accumulation and efflux of ethidium bromide (EtBr) in the presence of RIS was assessed. Results show that a disk with up to 200 ug of RIS produced no bacterial inhibition. In the presence of 4 ug/mL of CIP, 20 ug of RIS inhibited bacteria. The FIC value obtained showed synergism between CIP and RIS. The MIC of CIP dropped from 8 to 2 ug/mL in the presence of 64 ug/mL of RIS. EtBr accumulation peaked with 40 ug/mL of RIS. With 50 mg/mL of RIS, EtBr efflux was completely blocked. In conclusion, RIS is an EPI in *S. aureus* 1199B. The synergistic relationship between CIP and RIS increases the susceptibility of *S. aureus* 1199B to ciprofloxacin. Risperidone may potentially be used as adjuvant to CIP treatment in the clinic. (Supported by NIH R25GM055246.)

SAT-15

MANGANESE PHTHALOCYANINE AS A NEW FUNCTIONAL LAYER FOR THE DETECTION OF SMALL ORGANIC COMPOUNDS IN BROAD-RANGE MEDIA

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Porphrin and phthalocyanine have received increasing attention in agriculture, the dye industry, and photovoltaic design. In this work we have prepared manganese phthalocyanine (MnPc)-coated glassy carbon (GC) electrodes and studied their electrochemical behavior. MnPc is highly insoluble in water which makes it an ideal candidate for the heterogeneous catalysis (i.e., possible sensory implication). Our approach is the direct coating of MnPc from its organic solvent with controllable amount deposition. The resulting modified electrode is stable in the air and aqueous solution for at least 3 days. The film can withstand 500 cyclic voltammetric scans. For its potential application, we found MnPc/GC displayed catalytic oxidation to various small organic compounds including alcohols and monosugars. Further examination showed that this response can occur in wide-range pH media, not like the reported predominantly-alkaline media response. This new discovery expands the current sensing scope for alcohols and sugars into both ambient and extraordinary conditions. Preliminary analytical characterization of the proposed sensing was carried out and the operation parameters were optimized. Further mechanistic study is under way. [This work was supported by NASA-TSGC-NIP, SACP-UARP, Starter-award of UARP, and Welch Grant (BJ-0027).]

FRI-17

DISTRIBUTION OF HEAVY METALS IN MORPHOLOGICAL TISSUES OF *SAGITTARIA LANCIFOLIA*, SURFACE WATER, AND SEDIMENTS FROM THE CAÑO TIBURONES WETLAND

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The Caño Tiburones wetland in Arecibo, Puerto Rico, have been exposed to contamination by aqueous effluents produced by industrial activities, waste disposal sites, including the Arecibo Regional Landfill and other illegal dumps; the Barceloneta Wastewater Treatment Plant near the reserve; local or municipal sewage; and agricultural activities, among others. The present work provides quantitative information about concentration levels and distribution of heavy metals such as manganese (Mn) in the aquatic plant *Sagittaria lancifolia* sediment, and surface water from the Caño Tiburones wetland. The research was carried out per yearly season: winter, summer, fall, and spring. Three sampling sites were selected in the wetland "Zanja fria" zone. For each sampling site, three plants, three sediment samples, and one sample of surface water were collected. *Sagittaria lancifolia* was divided into the root, stem, and leaf and were treated using a microwave-assisted method. Sediment was treated with EPA method 3050b and surface water with EPA method 200.1; each sample was analyzed using FAAS. Levels in the plant tissue ranged from 20 to 80 ppm in the leaf, 6 to 20 ppm in the stem, and 30 to 80 ppm in roots. In the water and sediment samples, results were 0.5 to 2 ppm in superficial water and 1 to 10 ppm in sediment. Standard reference materials were also used to ensure the reliability of the method used for digestion. Physicochemical parameters per yearly season were also collected using Vernier LabQuest. The use of *Sagittaria lancifolia* for phytoremediation is discussed using the BAF. More heavy metals will be analyzed in the future.

FRI-1

SYNTHESIS AND COMPARISON OF TWO TRIPODAL LIGANDS BEARING NITROGEN AND SULFUR DONORS AND THEIR COORDINATION WITH RU(II)

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Despite the toxicity of carbon monoxide (CO), this gaseous molecule is endogenously produced in the human body via the catabolism of heme by heme oxygenase. Once viewed as a toxic byproduct, CO has now been found to confer antiapoptotic, antiinflammatory, and regulatory properties when delivered in controlled doses. These recent findings on the biological relevance of CO have prompted our research group to synthesize photoactive CO-releasing molecules (photo CORMs) as a means of controlled CO delivery for therapeutic use. The project involves synthesis and characterization of two Ruthenium carbonyls as potential photo CORMs. To modulate the light-activated CO releasing capacities of the resulting metal complexes, we designed two tripodal ligands: (2-quinolylmethyl)-[2'-(methylthio)phenyl]imine (qmtpm) and (2-quinolylmethyl)-[2'-(methylthio)phenyl]amine (qmtpa), both bearing nitrogen and sulfur donors. The coordinating ability of qmtpm and qmtpa with Ru(II) centers will be examined. Characterizations of these photoCORMs will be performed using ¹H NMR, electronic absorption, and infrared spectroscopy (IR). CO release in solution will be measured via a myoglobin assay. These methods will allow us to determine the binding aptitude, light absorption parameters, and CO-releasing properties of the resulting complexes. The difference in photosensitivity of our resulting compounds will indicate the significance of a meridional binding ligand (qmtpm) versus a facial binding ligand (qmtpa). The potential of these photoCORMs for therapeutic applications will be highlighted.

FRI-3

OXIDATION OF NITROGEN HETEROCYCLIC COMPOUNDS USING MOLYBDENUM(VI) OXIDE AS A CATALYST

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In the present work, the oxidation of quinoline and 1,2,3,4-tetrahydroquinoline to form quinoline 1-oxide and 1-oxo-1,2,3,4-tetrahydroquinolinium, respectively, was achieved through a simple oxidation reaction. The oxidation of the compounds was achieved through the use of decahydronaphthalene as a solvent and molybdenum (VI) oxide as a catalyst without the addition of any peroxide or organic acid. The reaction was studied at different temperatures ranging from 140 °C to 180 °C. The reaction mixture and products were analyzed using GCMS to confirm that the oxidation products of the quinoline and 1,2,3,4-tetrahydroquinoline reactions were quinoline 1-oxide and 1-oxo-1,2,3,4-tetrahydroquinolinium. Additional analysis techniques included FTIR and RAMAN. XRD analyses were also used to confirm the catalyst remained unchanged after the reaction. In addition, studies of the reaction kinetics will be presented for the reaction performed at 140 °C, 150 °C, 160 °C, 170 °C, and 180 °C.

SAT-17

SHOWALTER LIMIT OF THE BELOUSOV-ZHABOTINSKY REACTION

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The ferroin-catalyzed Belousov-Zhabotinsky (BZ) reaction is the prototype excitable chemical reaction system. In oscillatory reagent mixtures with sufficiently high concentrations of proton (H^+) and bromate (BrO_3^-), the unstirred BZ reaction produces spontaneous blue waves of oxidation in a red, reduced, low ferriin medium. This occurs after an induction period of approximately 3.5 minutes in reagent mixtures with initially added bromide (Br^-). At lower $[H^+]$ and $[BrO_3^-]$, the reaction only produces these waves in response to stimuli, such as local reductions of $[Br^-]$. The boundary between auto-oscillatory and excitable dynamics, where excitations do or do not occur spontaneously, known as the Showalter limit, is usually stated in terms of the product of $[H^+]$ and $[BrO_3^-]$. In experiments, varying initial $[H^+]$ and $[BrO_3^-]$ caused variations in induction periods, oscillation periods, and excitability. In particular, we found the Showalter limit more dependent on initial $[BrO_3^-]$ than on initial pH. Oscillation periods appear more dependent on initial pH. In addition, theoretical work explored how nonlinear chemistry affected oscillation periods by sinusoidally oscillating input conditions (specifically pH) to elicit changes in the system. Theoretical data generated using WinPP, an ordinary differential equation solver, were produced using the Oregonator model and will be further compared with experimental data this summer. The results of these experiments have the potential to offer a further understanding of pattern formation in many biological processes. The patterns that form during the BZ reaction mimic those of many biological processes, including irregular nerve signaling during heart arrhythmia and bacterial cell signaling.

FRI-21

THEORETICAL STUDIES OF CO(SALEN) COMPLEXES WITH GREEN CHEMISTRY APPLICATIONS

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Ionic liquids and their properties have advanced the world with their multiple applications in green chemistry. Task-specific ionic liquids (TSIL) are ionic liquids that have been functionalized so they can perform specific functions, such as the chelation of metal ions. Our study focuses on two cobalt (III) complexes, referred to as Co(salen) complexes, which are prepared from the coordination of Co(III) and 2 imidazolium-based TSIL compounds. It is important to study these complexes because they have significant applications in the recycling of metals from ore, such as uranium, gold, nickel, copper, and rhenium in a process called hydrometallurgy. They also possess catalytic properties that facilitate the oxidation of benzylic alcohols to aldehydes without over-oxidation to the corresponding carboxylic acids. The Co(III) complexes were studied using a computational approach employing density functional theory in combination with the B3LYP functional. Two basis sets were used in our calculations: 3-21G and SDD. Our calculations yielded equilibrium geometries, molecular properties, and infrared spectra. The highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO) energy gap corresponds to 3.5 eV, suggesting these compounds are chemically stable. The computed dipole moments are greater than 5.8 Debye, which indicates these compounds possess a highly polar chemical nature. The computed IR spectra were found to be in good agreement with the experimental spectra, confirming that our proposed molecular models are good representations of these complexes.

FRI-6

CHARACTERIZATION AND SEPARATION OF BRANCHED AMINO ACID BASED SURFACTANTS USING CAPILLARY ELECTROPHORESIS

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Five branched amino acid based surfactants have been synthesized and used to separate chiral enantiomers as pseudostationary phases in capillary electrophoresis. Three reactions were used for the synthesis of the dipeptide and tripeptide surfactants: the formation of N-hydroxysuccinimide esters, the formation of peptide bonds, and the deprotection of tert-butyl esters. Nuclear magnetic resonance (NMR) spectroscopy and high-performance liquid chromatography (HPLC) were used to check the purity of the surfactants. These surfactants were used to separate enantiomers of 8 chiral analytes in capillary electrophoresis. Preliminary studies showed separation of the enantiomers of 3 of the 5 analytes.

SAT-4

EFFECTS OF FIBER ALIGNMENT ON MECHANICAL PROPERTIES AND MOLECULAR STRUCTURE OF ELECTROSPUN POLYURETHANES

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Electrospinning has recently emerged as a promising technique for tissue engineering because of its ability to produce nanofibers with differing porosities, surface area, fiber diameter, and fiber alignment. These properties of nanofibers can be altered through the use of varying parameters during the electrospinning process such that biomimetic nanofibers similar to the extracellular matrix (ECM) found in biological systems are obtained. Although these biomimetic nanofibers have multiple applications throughout tissue engineering, the potential application for this project is the formation of ligament scaffolds. The parameters used throughout the electrospinning process must first be determined in order to obtain nanofibers similar to those found in the ECM of natural ligaments. The objective of this study was to investigate the effects of fiber alignment on the mechanical properties and molecular structures of 3 electrospun polyurethanes: Tecoflex®, Carbothane 3575®, and Carbothane 3585®. Fiber alignment can be manipulated by varying the rotational speeds of the fibers' collection. Three differing speeds were used (798 rpm, 4462 rpm, and 5900 rpm) in order to obtain nonaligned, semialigned, and completely aligned nanofibers. The alignment was confirmed using scanning electron microscopy (SEM), while mechanical testing was used to determine the effects of alignment on the enhancement of mechanical properties of the nanofibers. Spectrophotometric analysis, such as FTIR ATR and Raman spectroscopy, was used to explain the effect of the alignment on the nanofibers from a molecular level.

SAT-8

EXTERNAL ELECTRIC FIELD MEDIATED ADSORPTION OF GLUCOSE OXIDASE

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Enzyme adsorption to solid surfaces constitutes one of the immobilization processes used in the development of new platforms for biosensors in analytical chemistry. The advantage of enzyme adsorption to a solid substrate is that less biological activity will be lost when compared with the enzyme in solution. This work describes the effect of external applied potentials (500 mV, 650 mV, 800 mV, and 950 mV) on both the adsorption of glucose oxidase (GOD) to optically transparent carbon electrodes (OTCE) and the biological activity of the enzyme. Adsorption experiments were followed in real time by a variable-angle spectroscopic ellipsometer as a function of the potential applied, solution pH, ionic strength, and protein concentration. The potential applied at the interface resulted in 2 different behaviors. On the one hand, the effect of the electric fields at 800 and 950 mV significantly increased the adsorbed amount of GOD (Γ_{GOD}) on the OTCE but caused the loss of the enzyme activity. On the other hand, the Γ_{GOD} did not change the amount of enzymes adsorbed to the OTCE at open circuit potential (OCP). However, the enzymatic activity reached a maximum value after switching the potential from OCP to 500 mV. In conclusion, high potentials increased the amount of enzymes adsorbed to the OTCE but decreased the activity of the enzymes. At 500 mV, the adsorption levels did not change but the enzymatic activity was increased. These preliminary results show a good potential for the development of more sensitive biosensors. (This research was partially supported by UTSA MBRS-RISE GM060655.)

SAT-22

A NEW METHOD TO QUANTIFY HOMOCYSTEINE

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Homocysteine is a nonprotein amino acid. High levels of homocysteine have been linked to cardiovascular disease, Alzheimer's disease, neural tube defects, and osteoporosis. To determine homocysteine levels is therefore significant in preventive medicine and neurotoxicity. In this work, we presented a new analytical method for determining homocysteine levels by using voltammetry. In alkaline media, homocysteine exhibits anodic oxidation. This oxidation is significantly enhanced when aliquot amounts of transition metal ions are introduced. Especially when cobalt (II) ions are present, homocysteine oxidation displays a well-defined anodic peak that showed concentration dependence. We present a new assay for homocysteine based on this discovery. Various factors, including transition metal ions, other sulfur- and nitrogen-containing amino acids and surfactants were examined for their possible impact on this response. Our study revealed that homocysteine possesses the most sensitive and selective response in the proposed media.

Optimization of the analytical system and calibration with various standards of homocysteine was performed. Development of a real sample application is currently under way. [This work was supported by NASA-TSGC-NIP, SACP-UARP, Starter-award of UARP, and Welch Grant (BJ-0027).]

FRI-18

N-HETEROCYCLIC CARBENE SUPPORTED IRON CATALYSTS

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Established processes involving iron catalysis are currently known but not well understood. The development of well-defined iron catalysts will allow probing of relevant reaction mechanisms affording the necessary information to optimize processes of interest. Several N-heterocyclic carbene (NHC)-supported FeCl_2 complexes and their alkylated derivatives have been synthesized under an inert atmosphere and characterized by NMR, UV-vis, X-ray crystallography, and cyclic voltammetry. The NHC ligand is chosen for its steric and electronic tunability. Experiments involving the chlorination or saturation of the backbone are used to influence the sigma-donor properties of the ligand. However, saturating the backbone tends to affect the steric properties as well. Further investigations will explain the effects of these ligand modifications on catalytic activity. A primary focus will revolve around low coordination species stabilized by the bulk of the 2,6-diisopropylphenyl NHC derivative. These compounds are of particular interest for their binding site availability, and their functionality as a catalyst in Kumada-type couplings will be explored and reported. (Partially supported by UTSA MARC-U*STAR GM007717.)

SAT-24

OPTIMIZING THE LUMINESCENCE INTENSITY OF POROUS SI QUANTUM-DOT NANOPARTICLES

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Porous silicon (pSi) has many physical properties that can be exploited for very useful applications such as drug delivery, *in vivo* imaging, and chemical sensors. Porous silicon, through an electrochemical process, may be etched and processed to become photoluminescent. One activation step that is used in making pSi particles luminescent involves a 2-week long incubation period. The process by which the particles become luminescent is not very well understood and requires further investigation. Through optical spectroscopy measurements along with surface charge measurements, we can monitor the size, oxidation, and charge of the pSi particles as they change during the activation step. Efforts carried out will help explain the process by which pSi become luminescent. With this research, we could better understand the mechanism by which pSi becomes luminescent and identify the best method to obtain highly luminescent pSi nanoparticles.

SAT-21

RHENIUM AND MANGANESE PHOTOACTIVE CORMS SUPPORTING 2-PHENYLAZO PYRIDINE LIGANDS

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Carbon monoxide (CO) has always carried a negative connotation as the silent killer. Surprisingly, it has recently been shown to elicit antiinflammatory, antiproliferative, and vasoregulatory effects. It is in our interest to synthesize photoactive CORMs (carbon monoxide releasing molecule) in order to administer CO in a controlled manner since targeted and controlled delivery of exogenous CO has been shown to aid in a plethora of ailments and maladies. Although the mechanisms of these salutary effects are not well understood, the syntheses of CORMs has been underway as possible therapeutic agents. Using a "smart design approach", we have recently synthesized photoactive CORMs that use metal-to-ligand charge transfer (MLCT) transitions to release CO on illumination with visible light. The synthesis of 2 metal-based photoCORMs and their structural characterization through infrared spectroscopy, nuclear magnetic resonance, and electronic spectroscopy will be described in this report.

FRI-9

MODIFICATION OF CONFORMATION, PACKING, AND ELECTRONIC STRUCTURE OF CONJUGATED POLYMERS FOR ORGANIC SOLAR CELLS USING STRONG ELECTRON ACCEPTORS

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The focus of this research is to obtain a molecular-level understanding of the relationship between the conformation and packing of conjugated polymers and their ability to transport charge. This relationship plays a significant role in determining the overall power efficiency of an organic photovoltaic cell (OPV). However, the desired conformation and packing of a conjugated polymer for OPVs is very difficult to control using the current solution-based processing strategies where polymers are simply blended with an electron acceptor (i.e., fullerenes) to achieve the photovoltaic affect. This research takes a new approach to influence conformation and packing by using small molecule dopants that tune structure via charge transfer interactions with the polymer. We study the prototypical solar cell polymer poly[2-methoxy-5-(3,7-dimethyl-octyloxy-1,4 phenylene vinylene) (MDMO-PPV) doped with strong electron acceptor dichloro-dicyano-benzoquinone (DDQ). Resonance Raman spectroscopy is the primary physical technique used in our research to report changes in polymer ground- and excited-state structural characteristics. It is hypothesized that DDQ induces long-range order in MDMO-PPV which should favor enhanced charge transfer. Preliminary Raman data suggests that DDQ induces planarity in MDMO's conformation, and future research will entail device studies to show how MDMO's morphology and ability to transfer and transport charge is affected by small molecule doping. Because the conformation and packing has a significant impact on determining the final OPV efficiency, this research will provide much needed data on the extent of tunability afforded by molecular doping approaches to control polymer conformation and ability to transport charge.

FRI-2

DEVELOPMENT OF AFFINITY MEMBRANES FOR THE PURIFICATION OF PLASMINOGEN ACTIVATOR

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Plasminogen activators (PAs) are important therapeutic proteins used as emergency thrombolytic agents for the treatment of thrombovascular disorders such as myocardial infarction and stroke. The separation and purification of these proteins from complex mixtures of cell cultures is a challenging task due to the lack of efficient and suitable processes available. In order to develop a new, efficient method for the purification of plasminogen activators, our research was directed toward the development of an effective and accessible affinity membrane-based isolation process that could selectively bind the molecule of interest in a single filtration step. Regenerated cellulose (RC) membranes were chemically modified with spacer arms carrying epoxide or aldehyde moiety, which reacted with the hydroxyl moiety of the cellulose membrane. Spacer arms of different length (5, 7, and 14 atoms) were tested in order to optimize the process. The spacers were further reacted with two different selective ligands for PAs (para-aminobenzamidine (pABA) and L-Lysine). The modified membranes were characterized in term of epoxide content, ligand density, and further used for the purification process. Results showed a 40-fold purification in a single-step separation of PA from cell lines HEK-293 conditioned media using these affinity membranes, irrespective of the length of the spacer arm. The system was also showed to be very stable and could be reused several times, achieving 90% of the PA binding capacity of the membranes even after 5 cycles of use.

FRI-10

N, N-DIMETHYLACRYLAMIDE-BASED HYDROGELS FOR RECEPTOR CONJUGATION ONTO GLASS NANOPORES

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Monomers containing carboxyl or boronic acid functional groups were incorporated into hydrogels, which were analyzed for their properties of hydrophobicity and covalent attachment onto a functionalized quartz surface. The purpose of these experiments was to fabricate a bench-top method for covalent attachment of various receptors that can be used in miniature electrical sensors. One device that can measure analyte-to-receptor interaction is a solid-state nanopore. Ion current through the device can be modulated by charge and physical blockage at the pore. Using radical polymerization, we have synthesized a copolymer of N,N-dimethylacrylamide (DMAA) with either 2-carboxyethyl acrylate (CEA) or N-3-acrylamidophenylboronic acid (AAPBA), which can conjugate amine-

containing proteins or bind monosaccharides, respectively. By modulating polymer composition and initiator conditions, hydrophobicity of the gels and polymer chain length can be controlled. The gels were analyzed for their ability to covalently attach to quartz slides through measurements of their surface contact angles. Immobilization of biomolecules to the hydrogels was measured by fluorescence and by modulation of ionic current within a glass nanopore. The nanopores were fabricated using quartz capillary tubes, which offer many practical properties that include reproducibility, low-cost, miniature size, and sensitivity. Principally, fabrication of such a device can further benefit biomedical research regarding saccharide detection, protein-protein interactions, and intracellular sensing applications.

SAT-18

DEVELOPMENT OF PEPTIDES AS ISLET-NEOGENESIS STIMULATING DRUGS FOR THE TREATMENT OF DIABETES

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Continuing loss of islet β -cell mass in the pancreas is universal in all types of diabetes. Recent studies have shown that a 15 amino acid peptide segment of the islet-neogenesis associated protein (INGAP) is capable of inducing the formation of new islets in the pancreas. Administration of the INGAP peptide (INGAP-P) to nondiabetic and diabetic animal models is associated with increased β -cell mass, reversal of hyperglycemia, and differentiation of duct cells into neoendocrine cells. The mechanism of islet neogenesis via INGAP and INGAP-P has not been well characterized. Our work aims to study the roles of kinases in INGAP-initiated signal transduction that leads to β -cell proliferation. Activation of kinases such as ERK1/2, Akt, PKA, PKC, and CAMKII will be investigated to reveal clues as to the primary signaling events following the interaction between INGAP-P and its receptor(s) on the β -cell surface. Currently, we focus on the organic synthesis of INGAP-P as well as the materials for solid-format kinase assays. Peptides used in this work were synthesized by solid phase peptide synthesis using Fmoc chemistry. These synthesized peptides were then purified by HPLC, and their identities were characterized by mass spectroscopy. The next stage of the project includes MTS proliferation assay of islet cells treated with INGAP-P and controls and kinase assays using cell lysates. The temporal order of kinase activation will be investigated to disclose the composition of signal transduction in INGAP-P mediated islet cell proliferation.

SAT-19

AN ENVIRONMENTALLY FRIENDLY SYNTHESIS PROCEDURE FOR NITROGEN-CONTAINING MOLECULES

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Due to the prevalence of nitrogen containing molecules within the carbon framework in pharmaceuticals, our group has developed novel approaches to the construction of such molecules using readily available starting materials and benign reagents while minimizing the production of waste by-products. We discovered that, under mild reaction conditions, 5 mol % CuCl, 1.25 mol % pyridine, THF, air, and room temperature, the starting hydroxamic acid oxidizes to form an acylnitroso compound *in situ*. We hypothesize that these mild reaction conditions will allow for the expansion of acylnitroso chemistry to include numerous reaction platforms. This presentation will report our efforts in this area and the development of an asymmetric acylnitroso aldol reaction using Evans' chiral auxiliary.

FRI-25

NEW FABRICATION OF THICK FILM IN TACKLING SENSING UNDER EXTREME CONDITION

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A novel, thick nickel hydroxide $\text{Ni}(\text{OH})_2$ film for the analytical determination of different compounds was prepared. The film formation involves a 2-step process: the fabrication of nickel hexacyanoferrate (NiHCF) and the subsequent conversion of NiHCF into nickel hydroxide film. The first step was realized by immersing the glassy carbon (GC) electrode into a solution mixture of supporting electrolyte, nickel(II) salt, and potassium hexacyanoferrate, with a voltammetric scanning between 0.0V and approximately +0.6 V for 3 or more cycles. The resultant NiHCF film/GC was rinsed and then placed into 0.1 M NaOH with voltammetric scanning in the same potential window as above. The finalized deposits on the GC surface were visible, dense, and homogeneous. Comparing with the literature-published $\text{Ni}(\text{OH})_2$ film made by others and our own approaches reported earlier, this current proposed method resulted in a thicker film deposit. This study also possesses the uniqueness of using a surface film conversion approach, which

has broadened the existing film-making arena. The modified electrode has been found to have several applications including electrocatalysis of amino acids and carbohydrates. [This work was supported by NASA-TSGC-NIP, SACP-UARP, Starter-award of UARP, and Welch Grant (BJ-0027).]

FRI-13

ISOLATION OF FLAVONOIDS IN ALFALFA EXTRACT AND THE FORMATION OF GOLD NANOPARTICLES

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Nanoparticles are used throughout scientific fields of study, ranging from nanotechnology to medicine. The reduction of gold ions to produce nanoparticles in live plants has been used for quite some time. Scientists are able to produce not only gold and silver, but other transition metal nanoparticles to be used in industry without harmful effects to the environment. One way to produce these nanoparticles and reduce the gold ion would be to find and isolate the reducing agent within a live plant. In order to isolate the reducing compound, an alfalfa biomass was set to reflux and an alfalfa extract was created by vacuum filtration. After the filtration, the extract was separated using a flash chromatography system and 1:1.5 ratio of ethyl acetate and methanol solvent, respectively. After the completed separation, the fractions were dried using a vacuum pump system. The fractions were then analyzed by UV-Vis spectroscopy, gas chromatography, and nuclear magnetic resonance spectroscopy. Many compounds were detected, but one particular compound was isolated. The suspected compound is a flavonoid with a mass of 393 grams per mole. Once the reducing compound is identified, the compound should be oxidized by gold ions and bring the gold ions to a lower valence.

FRI-11

CHARACTERIZATION OF A PROTEIN PHOTORECEPTOR IN ITS LIGHT-ADAPTED STATE USING ATOMIC FORCE MICROSCOPY

Blair Sorenson, Daniel Westcott, Kenneth Nicholson, Brian Lampert, Justin Thomas, Alexandra Sakols, Sarah Vorpal, Emina Stojkovic, Stefan Tsonchev.

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Bacteriophytochromes (BphPs) are red-light photoreceptors found in photosynthetic and nonphotosynthetic bacteria that have been recently engineered as infrared fluorescent tissue markers. Light-induced, global structural changes are proposed to originate within their covalently linked biliverdin chromophore and propagate through the protein. These changes are believed to be reversible during the protein's photoconversion between two spectrally distinct light absorbing states. RpBphP3 (P3), from *Rhodospseudomonas palustris*, undergoes reversible photoconversion between red (Pr) and unique near-red (Pnr) light-absorbing states and is naturally fluorescent, unlike classical BphPs that undergo reversible Pr/Pfr photoconversion. Due to size and photosensitivity of BphPs, structures of the intact proteins have not been resolved by NMR and/or X-ray crystallography. We have used fluid cell atomic force microscopy (AFM) to investigate the structure of intact P3 in its light-adapted state. Unlike other characterization techniques, AFM allows individual dimers to be imaged under biologically relevant conditions with individual domain resolution. Currently, we are using the Gwyddion software to analyze and compare measurements of single dimers on mica. Averaging the images of multiple dimers has been found to improve domain resolution and to help further complete dimensional analysis of P3. Future work includes imaging the truncated version of P3 and directly comparing the structure with the full length P3. Also, we will image the dark adapted state of the protein. The goal is to gain insight into the mechanism of the unique P3 photoconversion and fluorescence, which may be used to design a novel, biologically inert infrared fluorescent tissue marker.

FRI-15

THE EFFECTS OF STEREOCHEMISTRY AND N-METHYLATION ON PERMEABILITY AND BIOAVAILABILITY OF SYNTHESIZED CYCLIC HEXAPEPTIDE PRODUCTS

Alexandra Ponkey, William Hewitt, Scott Lokey.

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Cyclic peptides are at the forefront of efforts to pursue "undruggable" therapeutic targets. The targets of conventional small-molecule synthetic drugs are generally limited to enzyme-active sites and receptors, whereas cyclic peptides, which are both larger and more complex, have the potential to interact with more challenging biological targets such as allosteric binding sites and protein-to-protein interactions. The permeability and bioactivity exhibited by these compounds provides potential access to a relatively untapped realm of drug discovery. Our overall goals

are to find permeable cyclic peptide scaffolds by varying both stereochemistry and N-methylation, and to broaden our understanding of the true potential of these cyclic peptide molecules. Split-pool hexapeptide libraries were synthesized using solid phase peptide synthesis (SPPS) and will be tested for passive permeability through parallel artificial membrane permeability assay (PAMPA). The hope is to identify hits in PAMPA and to further explore these compounds. Identified hits will be determined through recursive deconvolution followed by resynthesis to run more specified tests of permeability and bioavailability.

SAT-7

SYNTHESIS OF ALKYLTHIO BENZENE DERIVATIVES VIA SIMULTANEOUS DIAZOTIZATION AND NUCLEOPHILIC DISPLACEMENT

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P-phenylene vinylenes (PPV) are conducting polymers incorporated into LEDs and play a role in the optical properties of the polymer itself. Hence, for the introduction of these functional groups, various synthetic routes have been proposed. Arene diazonium salts have widespread applications in organic synthesis because they contain an excellent leaving group that can be replaced by a nucleophile. Reported here is the synthesis of alkylthiobenzene derivatives by simultaneous diazotization of aromatic amines and nucleophilic displacement. The method is fairly general and results in moderate yields for aromatic amines containing strong electron withdrawing or electron releasing groups. Product yields were comparable regardless of the steric hindrance of the thiol or functional groups. This procedure also allows for the incorporation of tertiary alkyl-thio groups, a problem often faced by other synthetic routes involving metal catalyst or gas-phase conditions. The products were characterized by ^1H -NMR and ^{13}C -NMR.

SAT-20

SYNTHESIS AND CHARACTERIZATION OF THE THERMOTROPIC PROPERTIES OF POLYMERIZABLE CATIONIC SURFACTANTS

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Two novel polymerizable cationic surfactants were prepared from (12-Acryloyloxydodecyl)trimethylammonium bromide with sodium bis(2-ethylhexyl)sulfosuccinate (AOT) and sodium dodecyl benzene sulfonate (DBS), respectively. Their structures and purities were established using a combination of techniques involving Fourier transform nuclear magnetic resonance (FTNMR) and Fourier transform infrared (FTIR) spectroscopies along with elemental analyses. Characterization of their thermotropic properties using thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC) shows that these molecules have a high thermal stability and are ionic liquids. Furthermore, hot stage polarized light microscopy (HSPLM) done on these molecules shows them existing as liquid crystals at room temperature with varying mesophase structures.

SAT-25

CARBON DOTS REDUCE FIBRILLATION OF INSULIN AND AMYLOID BETA

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Carbon dots are tiny carbon nanostructures, up to 10 nm in diameter, with a wide range of potential uses. Because of their structure and size, carbon dots can easily pass through the blood brain barrier and other membranes within the human body. This, in addition to their nontoxicity, makes them a valuable prospect for biomedical applications. Our carbon dots are prepared by heating a mixture of polyethylene glycol and glycerol to above 320 °C, adding citric acid, and maintaining the reaction for 4 hours. These are then characterized through fluorescence spectroscopy, ultraviolet spectroscopy, and atomic-force microscopy. The resulting carbon dots are hydrophilic in nature and readily soluble in a water-based solution containing insulin or beta amyloid. The proteins are then incubated with carbon dots at 37 °C (body temperature) in a phosphate-buffered solution with a pH of 7.4. This is done in order to mimic body conditions where fibrillation occurs naturally. The carbon dot/protein mixtures are then analyzed using atomic-force microscopy and circular dichroism to evaluate the presence and extent of fibrillation. Previous research has shown specifically that quantum dots, a structurally similar but biologically toxic relative of carbon dots, can aid in the reduction of protein fibrillation. Our goal is to show that carbon dots can yield similar results, allowing for further research with carbon dots and possible treatment methods for diseases such as Alzheimer's dementia and Parkinson's disease.

FRI-4

SILVER NANOPARTICLES SUPPORTED BY RICE HUSK SILICA: SYNTHESIS, CHARACTERIZATION, AND CATALYTIC APPLICATION

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Herein, a facile method has been developed for the synthesis of silver nanoparticles (Ag NPs) supported by the silica obtained from rice husks (RHs). In this research, (3-aminopropyl)triethoxysilane (APTES) was used to modify RH silica, while silver nitrate and sodium borohydride (NaBH_4) were used as Ag precursor and reducing agent, respectively. It was found that the amino groups of the modified silica could help attach Ag precursors to the surface of the silica and also stabilize the synthesized Ag NPs. Transmission electron microscopy (TEM), X-ray diffraction (XRD), and Fourier-transform infrared (FT-IR) spectroscopy were used to characterize the products. The results showed that Ag NPs with a diameter of ca. 10-15 nm were well dispersed on the surface of RH silica. Catalytic experiments showed that the silica-supported Ag NPs exhibited high catalytic activity toward the reduction of 4-nitrophenol in the presence of NaBH_4 .

SAT-14

EXPLAINING THE MECHANISM OF DOMAIN FORMATION USING MOLECULAR DYNAMICS SIMULATIONS OF COARSE-GRAINED DIPALMITOYLPHOSPHATIDYLCHOLINE LIPID BILAYERS CONTAINING CHOLESTEROL

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It has been observed that domains form in ternary systems involving a high melting point lipid, low melting point lipid, and cholesterol. It is speculated that these lipid rafts play a key role in cellular signaling, trafficking, and structure. Domains vary in size and composition, which may allow for the initiation of specific signaling cascades. Although the formation of different phases in lipid bilayers has been directly observed by other groups, the mechanism is unknown. Experiments have shown that spatial heterogeneities do not form in the absence of cholesterol, hinting that cholesterol's higher solubility in saturated lipids relative to unsaturated lipids may play key roles in the mechanism. Due to the difficulty in directly observing the process by which these lipid rafts form, we believe that using coarse-grained molecular dynamics simulations of a lipid bilayer model containing cholesterol is the most feasible approach for determining the mechanism of domain formation. We speculate that cholesterol in one leaflet of the lipid bilayer may influence behavior of cholesterol in the opposite leaflet. In order to probe this proposition, we will use the Martini force field coarse-grained lipid model to construct lipid bilayers containing cholesterol in both leaflets in order to run the molecular dynamics simulations. We will then analyze the simulation in order to measure correlations of cholesterol motion within and across leaflets.

SAT-10

ANALYSIS OF SURFACE PLASMONS USING NANOWIRES INCORPORATED INTO FIELD EFFECT TRANSISTORS

Christopher Siefe, Jose Navarrete.

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Surface plasmon resonance is a phenomenon which causes electron oscillations via the propagation of electromagnetic waves at a metal-dielectric interface. In a nanoscale material where the surface area-volume ratio is high, these surface plasmons can decay into hot electrons, which can be used for various means. This research aims to better understand the fundamental science behind surface plasmons for applications of a number of devices. By assembling tin(IV) oxide nanowires decorated with gold nanoparticles into a back gate field-effect transistor, we can analyze the current density on the nanowire's surface when illuminated with different wavelengths of light (400 to 1200 nm) and biased with various gate potentials. We will also be investigating the effects of nanowire lengths on the current. We can determine any current that runs through the nanowire in our field effect transistor as a result of the surface plasmon resonance in the gold nanoparticles on the nanowires. By finding which wavelengths receive the highest current reading for this interface, we can compare our values to other known environments. We expect to see that the current density on the surface of the nanowires will be most affected by wavelengths of light that match surface plasmon resonance in gold and by greater gate bias. With this research, we can apply the concepts of surface plasmons to improve current devices and find new applications for surface plasmons.

SAT-12

QUANTUM MECHANICAL STUDIES OF GADOLINIUM(III) LIGANDS USED IN MRI CONTRAST AGENTSRafael de la Flor, Maria Benavides.*University of Houston-Downtown, Houston, TX.*

Determining the structure and the chemical stability of polydentate coordinate complexes used in MRI contrast agents is essential in the field of diagnostic medicine. Chelation complexes using gadolinium(III) metal, a paramagnetic lanthanide, produce ideal signal intensities in diagnostics (MRI) that have made their use in radiology a staple and also justifies their importance for computational research. Gadolinium(III) complexes show variable imaging qualities depending on the ligands attached to the central atom and the diagnostic application for which they are used. Our study focuses on determining the structures and molecular properties of three ligands, MS-325-L, COPTA, and EOB-DTPA, used in the preparation of the three Gd(III) complexes already used in commercial clinical applications. Our calculations were performed using density functional theory (DFT) with the B3LYP functional applied in conjunction with two basis sets (3-21G and 6-31G) to obtain the equilibrium geometries, vibrational frequencies, and IR spectra for the ligands. The highest occupied molecular orbital (HOMO) – lowest occupied molecular orbital (LUMO) energy gap values for all compounds are greater than 4 eV suggesting that the ligands are chemically stable. The ligands exhibit hydrogen bonding which can account for the significant chemical stability. The ligands possess significant dipole moments with values greater than 8 Debye, consistent with their chemical polar character. Our computed vibrational frequencies were found to be in excellent agreement with the experimental values, suggesting our proposed models are good representations of the actual molecular structures.

SAT-13

STRUCTURAL ANALYSIS OF BACTERIOPHYTOCHROMES ON GRAPHITE AND MICA USING SCANNING PROBE MICROSCOPYJustin Thomas, Blaire Sorenson, Daniel Westcott, Brian Lampert, Alexandra Sakols, Emina A. Stojkovic, Stefan Tsonchev, Kenneth Nicholson.*Northeastern Illinois University, Chicago, IL.*

Bacteriophytochromes (BphPs) are red-light photoreceptor proteins found in photosynthetic and nonphotosynthetic bacteria. Classical BphPs undergo reversible photoconversion between distinct red-light (Pr) and far red-light (Pfr) absorbing states. Our research group is studying RpBhpP3 (P3) from *Rhodopseudomonas palustris* that has unique photoconversion between Pr and near-red light (Pnr)-absorbing states. To investigate the structure of intact P3, we are using atomic force microscopy (AFM) and scanning tunneling microscopy (STM), two powerful surface analytic methods that can be used to take images of the macromolecule with individual domain resolution. Proteins self assemble when deposited onto a surface due to protein-protein and protein-surface interactions. We are using AFM and STM to image proteins on a hydrophobic graphite surface and a hydrophilic mica surface. We have obtained images of the P3 dimers on the surface with nanoscale resolution for AFM and STM. The STM data has shown P3 assembling into periodic fibrous structures, while individual molecules as well as aggregates of multiple dimers have been observed via AFM on mica. Our goals are to gain insight into how the nature of the surface drives protein self assembly and how the surface impacts protein structure. We will compare our results with published cryogenic-electron microscopy data on related BphP from *Deinococcus radiodurans* and determine quaternary organization of P3 dimers in the Pnr state. In the future, we plan to study adsorption and arrangement of P3 on N-hydroxysuccinimide-terminated self-assembled monolayers, which have been proposed in the literature as selectively binding individual proteins to the surface in a single orientation.

SAT-3

PH AND PHYSICAL PROPERTIES OF AMINO ACID-BASED SURFACTANTSMariela Vazquez, Fereshteh Billiot.*Texas A & M-Corpus Christi, Corpus Christi, TX.*

The purpose of this research was to examine the effects of pH on the critical micelle concentration (CMC) and aggregation number of 2 amino acid (alanine and leucine) based surfactants. The amino acid-based surfactants were synthesized by reacting the respective amino acids with the N-hydroxysuccinimide ester of undecylenic acid in tetrahydrofuran and water to form undecyl alanine and undecyl leucine. The purity of the surfactants was confirmed by NMR and HPLC. Fluorescence spectroscopy with pyrene as the probe was used to measure the CMC and calculate the aggregation numbers for each of the surfactants from pH 6 to 12. A slight decrease in aggregation number from 70 to 65 was observed for undecyl leucine compared to undecyl alanine. It was further observed that the CMC of both

surfactants increased as pH increased from pH 6 to 8 and plateaued after reaching a pH of 8. It is also worth noting that no significant differences in CMC were observed for the surfactants at each of the respective pHs.

SAT-5

SYNTHESIS OF GUANIDYLATED AMPHIPHILES AND BOLAAMPHIPHILES FOR siRNA ENCAPSULATION IN GENE-SILENCING THERAPY

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Since its discovery by Fire and Mello, RNA interference (RNAi) has been established as a potential route for gene-silencing therapy and has been anticipated as a possible remedy for various diseases such as cancer, viral diseases, diabetes, and gene disorders. However, the development of RNAi therapies has been significantly impeded due to difficulties in the delivery of the nucleic acid into the cells. Recently, lipoplexes and stable nucleic acid lipid particles (SNALPs) have been shown to be effective at encapsulating siRNA for gene-silencing therapy. In particular, the presence of tertiary amines and unsaturated hydrocarbon chains in the lipid portion appear to assist in siRNA interaction and delivery. Our lab envisioned the use of guanidylated amphiphiles and bolaamphiphiles (long hydrophobic chains with polar heads at each end) in the formation of lipoplexes with RNA for delivery applications. The use of guanidine in place of amines should increase the amount of H-bonding interactions to provide more stable complexes. Here, we report the progress towards the synthesis and characterization of a guanidylated amphiphile synthesized from oleyl alcohol and a guanidylated bolaamphiphile synthesized from 10-undecenoic acid using a Grubbs' catalyst for olefin metathesis. These lipids will be combined with RNA to form nanoparticles, which will be investigated as siRNA delivery modalities. (This work was partially supported by NIGMS MARC U*STAR GM007717, NIGMS MBRS-RISE GM60655, and the Department of Chemistry at the University of Texas at San Antonio.)

SAT-1

ON-CHIP SAMPLE PRECONCENTRATION OF THIOLS FOR SENSITIVE *IN SITU* EXTRATERRESTRIAL ANALYSIS

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The search for signs of life on extraterrestrial planetary bodies is among NASA's top priorities in solar system exploration. Because all life on Earth is based on common biochemical roots and genetic history, one essential astrobiological question is whether there is life elsewhere in the universe, and if so, whether it has a similar biochemical nature. Due to the anticipated complexity of extraterrestrial samples, identification and quantification of individual species is extremely challenging or impossible without a method to separate them prior to detection. Microchip capillary electrophoresis (μ CE) is a powerful separation technique that has progressed greatly in the last 2 decades and offers short analysis times, small sample and solvent consumption, and low waste generation. This technique has been successfully employed for analyses of a wide range of compounds in relatively simple samples (e.g., water) to highly complex ones (biological fluids), demonstrating its powerful analytical capabilities. We have designed a new microfluidic architecture that incorporates a preconcentration chamber into existing automated microfluidic technology. This preconcentration chamber encapsulates functionalized silica beads (40 μ m) for the trapping of target molecules (thiols), which ultimately allows for ultralow levels of detection. While preconcentration methods have been demonstrated for a range of molecules, they have never been integrated into fully automated μ CE devices. We have created a microfluidic device capable of completely automated end-to-end analysis of thiols following an initial preconcentration step. This device would allow detection of traces of sulfur-containing molecules in an automated, miniaturized fashion, which is crucial for planetary studies.

FRI-16

SIZE CONTROL IN MICROWAVE SYNTHESIS OF GERMANIUM NANOCRYSTALS

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Germanium (Ge) is a narrow band gap semiconductor and is considered a potential material in the nanoscale for solar energy conversion. Colloidal synthetic methods assist in the formation of size- and shape-controlled nanocrystals. Our group developed a microwave assisted method to prepare colloidal Ge nanocrystals in oleylamine using Ge-iodides as precursors. The nanoparticle size was controlled by adjusting the precursor ratio ($\text{GeI}_2:\text{GeI}_4$). Our current efforts are focused on exploring the effect of additives such as SiI_4 and I_2 in the microwave reaction and determining

the mechanism of formation. Preliminary experiments demonstrate the correlation between nanocrystal size with increasing additive quantity. The Ge nanocrystals were characterized by routine spectroscopic methods, powder X-ray diffraction for phase-purity and crystallinity, and electron microscopy for size and morphology. The results of the experiment along with characterization will be presented and the mechanism of formation proposed.

FRI-8

THE SYNTHESIS OF MIXED-BRIDGE DIQUINOXALINE CAPSULES

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Resorcin[4]arenes have been used as a primary scaffold in supramolecular chemistry to create a family of container molecules that adopt a bowl-shaped geometry, known as cavitands. The environmentally dependent and conformationally changeable structures of cavitands make them attractive compounds for capturing and releasing guest molecules. The main purpose of this research is to synthesize a fully enclosed capsule that is composed of a dimethylene bridged resorcin[4]arene and a diquinoxaline cavitand connected by 2 tetraazaanthracene linkers. The cavitands were generated using well-established organic synthetic methodology. Also, the structure and binding studies of the cavitand capsules were determined using nuclear magnetic resonance analysis. So far, the dimethylene bridged resorcin [4] arene cap and the diquinoxaline cavitand base were synthesized in relatively high yields. Modifications to the reaction conditions are being developed to incorporate tetraazaanthracene in the construction of our product: the molecular capsule. These molecular capsules have potential applications for toxin remediation and drug delivery. In toxic remediation, the cavitand capsules can potentially selectively bind toxins and extract them from the environment. Additionally, capsules could revolutionize how drugs are delivered into the human body and act as a transportation system for foreign molecules.

SAT-11

SYNTHESIS OF ADAMANTANE DERIVATIVES INFLUENCED BY THE STUDY OF SHORT ALKANES

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Molecular gyroscopes are bulky organic molecules designed to induce particular crystalline structures that contain rotating functional units. Their ability to undergo rapid rotation makes them susceptible to changes in transmission of light, which makes them appealing for technological innovations in the area of electrooptic displays such as liquid crystals. To develop a platform for the design of these molecules, our project focuses on the synthesis of new tetragonal rigid compounds related to molecular gyroscopes, which will improve the understanding of crystallization of bulky molecules. Since tetraphenyladamantane moieties have shown distinct crystalline structures and rigidity, they were selected as the core of the molecules. Ethane and propane analogs based on tetraphenyladamantane, with their symmetry and possible rotational abilities, were selected in this project to be the first target molecules. Initially, bromoadamantane was reacted with *t*-butylbromide and aluminum chloride in benzene to yield triphenyladamantane with 71% yield, which made it possible to use it as the next precursor in the pathway. Therefore, through a radical reaction, the synthesis of bromotriphenyl adamantane, with 89% yield, was completed as confirmed by NMR. The synthesis of the final compounds based on tetraphenyladamantane moieties is in progress. Once obtained, their fluorescence and rotational and crystalline properties will be studied to improve our understanding of bulky rigid molecules. These results will later help advance the area of engineering of motion in crystals and electrooptic displays, which are essential for more improvements in the field of liquid crystal technology.

FRI-14

A STUDY OF THE PHYSICOCHEMICAL PROPERTIES OF FIVE GADOLINIUM (III) LIGANDS USING QUANTUM CHEMICAL METHODS

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The aim of our study was to investigate the physicochemical properties of chelated gadolinium (III) complexes commonly used as contrast media in magnetic resonance imaging (MRI) through the use of computational molecular modeling techniques, specifically, Gaussian functions. Contrast media are used in diagnostic radiology to increase the clarity of various abnormal tissues in MRI. Currently, all approved Gadolinium (III)-based contrast agents are formed through nine-coordinate complexes using various ligands, which alter the ion's imaging properties, as well as ensure its safe passage through the body. Our study focused on determining the properties of five such ligands; DTPA,

Cy₂DTPA, MS-264-L, BOPTA, and B-21326/7. The study of these structures and their properties is necessary in order to better understand and predict their behavior in physiological systems. Our calculations were performed using density functional theory (DFT) with 2 basis sets (3-21G and 6-31G) to obtain the equilibrium geometries, vibrational frequencies, and IR spectra for the ligands. The highest occupied molecular orbital (HOMO) to lowest occupied molecular orbital (LUMO) energy gap values for all compounds are greater than 4 eV suggesting that the ligands are chemically stable. The compounds exhibit dipole moments ranging between 4 to 5 Debye indicating they possess polar character. Our computed vibrational frequencies were found to be in agreement with experimental values, indicating that our proposed models are fair representations of the actual molecular structures.

SAT-2

WHY EVERYONE SHOULD EAT MORE FRUITS AND VEGETABLES: RADICAL SCAVENGING AND METAL CHELATING ABILITIES OF PHENOLIC COMPOUNDS

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Scientific studies have increasingly demonstrated that diets rich in fruits, nuts, vegetables, spices, and plant-derived beverages such as red wine reduce the risk of many types of chronic diseases such as cancer, cardiovascular, and neurodegenerative diseases. As we continue to learn more about why diets high in these foods lead to reduced risk of chronic disease, the scientific community has developed an increasing interest in the phytochemicals present in these foods. Amongst these phytochemicals are phenolic compounds, which have been shown to demonstrate significant antioxidant activity and disease-preventive effects. Many chronic diseases have been at least partially attributed to damage caused by reactive oxygen species that can cause deleterious changes to complex cellular molecules such as protein and DNA. By serving as antioxidants, phenolic compounds have the ability to “quench” these reactive oxygen radicals. Additionally, these compounds have an ability to chelate metals, allowing them to mask the pro-oxidant activity of metals such as iron (Fe²⁺). This study uses two assays to determine the radical scavenging and metal-chelating abilities of a variety of phenolic compounds. The data that was generated is then used to develop a quantitative structure activity relationship (QSAR) model that allows us to gain an understanding of how the structures and physicochemical attributes of these phenolic entities affect their metal-chelating and radical scavenging abilities, and eventual cytotoxicities. These results should help us learn more about the abilities of polyphenolics to combat oxidative stress induced by both internal and external factors.

FRI-7

SYNTHESIS AND CHARACTERIZATION OF NOVEL ZINC COMPLEXES AS MODELS FOR HYDROLASES

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In an attempt to develop synthetic models of phosphohydrolase enzymes, noble mono and dinuclear metal complexes using a highly versatile ligand, *N,N'*-Bis[2-carboxybenzomethyl]-*N,N'*-Bis[carboxymethyl]-1,3-diaminopropan-2-ol, and various metal ions (Zn²⁺, Cu²⁺, Ni²⁺) have been synthesized. The complexes have been fully characterized using spectroscopic and crystallographic techniques. The ligand, H₅ccdp, provided a unique synthetic opportunity to either selectively tether an intramolecular H-bonding network or incorporate a second metal ion into its coordination cavity. In this presentation, the synthesis and characterization of these novel complexes will be discussed. (Partially funded by NIGMS MBRS-RISE GM060655.)

EARTH SCIENCES/OTHER PHYSICAL SCIENCES

FRI-176

EXPANDING MINIMUM PROBABILITY FLOW TO SECOND CLOSEST NEIGHBOR: A STUDY OF TRANSITION MATRICES

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The DeWeese group has developed a powerful algorithm called minimum probability flow learning for fitting probabilistic models to data. This approach uses a transition matrix that is extremely sparse. The current algorithm uses a transition matrix that maps 2 states differing by 1 bit flip. We hope to expand the algorithm to incorporate states

that differ by 2 spin flips. Expanding the code is the precursor step to optimizing the transition matrix and ultimately creating a faster and more efficient way for fitting probabilistic models to data.

SAT-176

SEASONAL AND DIURNAL COMPONENTS OF WIND POWER AT CRYSTAL COVE PARK

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Wind power is an incredible source of energy that can meet some of California's high energy demand. With the recent closing of its last nuclear plant, California is more dependent on fossil fuels, making our results even more important. Estimates of coastal wind power have shown that wind power potential in Orange County is weak to moderate, but these estimates do not include the contribution of the diurnal sea breeze to this wind power. This is because data collection of wind power measurements has only occurred twice throughout the day, as opposed to our measurements of wind power, speed, and direction, which have been collected every half hour at Crystal Cove by the meteorology station operated by the University of California, Irvine. The contribution of the sea breeze to wind power is likely significant due to the cubic relationship between wind speed and wind power. Specifically, we will analyze and present data from 2008 to present to characterize both the diurnal and seasonal components of wind power at Crystal Cove Park.

FRI-174

ORIGIN OF METHANE AND OTHER HYDROCARBONS IN MAGMATIC SYSTEMS

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Tectonic systems such as divergent, convergent, and transform plate boundaries provide geochemists a wide array of volcanic and geothermal edifices to probe the Earth's interior in order to further understand our planet. The study of carbon isotopes within volatile gases, such as methane, can help pinpoint the origin of these gases and provide evidence of any crustal interaction that takes place during passage from the magmatic source to the surface. In order to study the $^{13}\text{C}/^{12}\text{C}$ ratio in methane, a network of glass lines under vacuum pressure are needed to separate, combust, and capture the carbon from geothermal samples prior to analysis using mass spectrometry. We aim to investigate and characterize the carbon isotopic composition of methane at different plate boundaries utilizing geothermal systems as our means to capture deep-seated gases transferred to the Earth's surface. Primarily, we plan to distinguish between biogenic, thermogenic, and abiogenic methane as the controlling source of the gas. Our extraction system has been calibrated with methane standards yielding consistent results of -42 ‰ Vienna Pee Dee Belemnite (VPDB). Samples collected from the Salton Sea Geothermal System in California, which interacts with the San Andreas Fault, have yielded a $^{13}\text{C}/^{12}\text{C}$ ratio of -25 ‰ indicating a strong thermogenic imprint to the methane. Samples from the Tengchong Geothermal Province, located within the Tibetan–Yunan fold system, exhibited enriched abiogenic signatures ranging from -14 ‰ to -23 ‰. Further work is planned on samples collected from the East African Rift in Ethiopia and Costa Rica where methane analysis has not been carried out to date.

SAT-174

NOVEL RARE EARTH NANOPARTICLES FOR THE DETECTION OF HEAVY METALS IN THE ENVIRONMENT

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With heavy industrialization in developing countries and little environmental regulation, heavy metals are increasingly being found in the water supply. Water used for irrigation is becoming a major issue because contaminants within it can cause major issues for humans and the environment. Specifically, crops that require flood irrigation such as rice are particularly susceptible to absorbing these toxic elements (heavy metals) and entering into the food supply, which could be detrimental to those who consume them. With proper surface functionalization and the use of rare earth nanoparticles, the presence of heavy metal ions can interact with these nanoparticles and be quantified by quenching a fluorescent signal, shift absorption and through aggregation of particles. With the development of new detection techniques to identify toxic metals such as lead, mercury, and arsenic, sensing for these metals can be obtained through a three-step process. This process includes synthesis, characterization, and surface functionalization. In developing a novel detection scheme, we hope to lay the groundwork for a simple field test such as a test strip or coated cuvette to allow the detection of small amounts of these elements rather than having to send samples to a laboratory. Ultimately, these newly discovered technological materials will be used for a field-ready detection method

for detecting these elements, consequently improving the quality of life for human beings that consume large amounts of these crops and the environments in which these crops are produced.

FRI-175

A FOCUSED STUDY OF METHANE LEAKAGE FROM COMPRESSED NATURAL GAS STATIONS IN THE LOS ANGELES BASIN

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In recent years, natural gas has taken on a larger role in the national energy policy discourse. Natural gas is seen as a fuel that can reduce American dependence on foreign energy and reduce greenhouse gas emissions. However, in terms of net benefits and costs, the implications of increased natural gas consumption are not fully understood; for example, better measurements of methane leakages in natural gas infrastructure are needed to accurately assess the impact of increased natural gas usage on local and regional climates. The goal of our research is to provide a focused analysis of potential methane leakages from compressed natural gas (CNG) stations in the Los Angeles Basin. To improve our understanding of methane leakages, we used a mobile laboratory that is outfitted with cavity-ring down spectrometers measuring concentrations of CH₄, CO₂, and CO. In addition, we take mobile measurements of C₂H₆ and O₃. A handheld methane analyzer was used as a comparison and accuracy tool in measuring CH₄. Data analysis will be conducted with the use of ArcGIS and Matlab. We predict that daytime CH₄ emissions at CNG stations will be higher relative to nighttime. Additionally, our team speculates higher methane leakages from CNG storage tanks compared to CNG pumps. By finding sources of methane leakages in specified CNG stations and by gaining a better understanding of the spatial and temporal patterns of CH₄ emissions, our research can provide valuable information to reduce the climate footprint of the natural gas industry.

SAT-175

ANALYSIS OF LEAF AREA INDEX USING REFLECTANCE DATA ACROSS AN ELEVATION TRANSECT AS A BASIS FOR ECOLOGICAL MODELS

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Leaf area index (LAI), the unit area of leaves per unit area of ground, is an important parameter in many ecological models but is one that is difficult to calculate. Better estimates of LAI would provide scientists the data required to better understand vegetation-atmosphere interactions and other ecological processes. We modeled LAI along a gradient in the Sierra Nevada mountains, beginning at the San Joaquin Experimental Range (SJER) field site in an oak woodland savanna and terminating at the Upper Teakettle (UT) field site in a coniferous forest. We expect that LAI will decrease as we move higher along the elevation transect, and seek to quantify this change using data from NASA's DC-8 aircraft. Shuttle radar topography mission data will be used as an elevation dataset, and LAI will be analyzed by calculating spectral vegetation indices from reflectance measurements. Using data collected in the field at the SJER and UT field sites, we validated our remote sensing estimates of LAI. There is a known correlation between increasing LAI and higher levels of net primary productivity. We anticipate that knowing the spatial distribution of LAI across the transect will be valuable for scientists to understand ecosystem level interactions and the distribution of primary productivity in the Sierra Nevada mountains.

SAT-177

CAUSES OF INCREASED FLOODING ALONG THE NORTH BRANCH OF THE CHICAGO RIVER

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This research studies the causes of flooding along the North Branch of the Chicago River. The North Branch watershed encompasses rural, suburban, and urban land use areas bordering and within the City of Chicago. In the past 5 years, 2 100-year floods in this area displaced residents and caused millions of dollars of property damage. Peak flow and mean discharge data from the 62-year stream-flow record will be analyzed to investigate possible causes of the observed flow increase from the 100-square mile watershed. Population will be used as a proxy for degree of urbanization and will be measured by consulting US Census records for the past 6 decades. An increase in population may correlate with an increase in impervious cover such as buildings, roads, and pavement, as well as an increase in sewerage. These changes create more surface runoff and increased river discharge. Possible correlations between population increase and stream-flow will be investigated. It is also possible that the intensity and depth

of precipitation has changed over the same time period. Changes in average temperature may lead to changes in evapotranspiration, which also could affect stream flow. These variables will be investigated through collection and analysis of precipitation and temperature data from National Weather Service records. The expected results are that there will be a relationship between population and annual peak flow of the North Branch of the Chicago River.

GEOLOGY

SAT-179

CALCULATION OF SO₂ FLUXES FROM ACTIVE VOLCANOES IN EL SALVADOR AND NICARAGUA USING OZONE MONITORING INSTRUMENT IMAGES

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Satellite images from the Ozone Monitoring Instrument (OMI) were downloaded and processed in order to measure the SO₂ mass in plumes and then calculate the flux of SO₂ produced by the most active volcanoes in El Salvador (Santa Ana and San Miguel) and Nicaragua (San Cristóbal, Masaya, Concepción, and Telica) in the period of 2005 to 2012. We discuss here the degassing activity of each volcano studied based on the OMI results and on ground-based data, which were compared with the volcanic activity in the period. Trajectory models from the Hybrid Single Particle Lagrangian Integrated Trajectory Model (HYSPPLIT) were used to determine the altitudes of the volcanic plumes. Sounding data were used to determine the wind speed at the respective plume heights. Based on the 25 OMI images processed and analyzed using the smoke estimation technique developed by Ichoku and Kaufman in 2005, the average SO₂ flux for El Salvador was 530 t/d, and for Nicaragua it was 610 t/d for the period 2007 to 2012. Santa Ana had the highest degassing event, with an SO₂ flux of ~19 kilotons per day on October 2005 during its most recent eruption. The highest emitter for Nicaragua was Masaya volcano, with an average SO₂ flux of 650 t/d during the 2007 to 2012 period. The annual contribution of the studied volcanoes in El Salvador and Nicaragua during the 2007 to 2012 period of time to the global sulfur budget is ~0.50 teragrams per year, which represents ~2 to 5% of the global volcanic sulfur budget.

FRI-179

DETECTION AND ANALYSIS OF GAS AND ASH CLOUDS FROM PACAYA, FUEGO, AND SANTIAGUITO VOLCANOES, GUATEMALA, USING SATELLITE IMAGES FROM THE OZONE MONITORING INSTRUMENT

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Monitoring volcanic emissions is crucial to understanding volcanic behavior and the different influences these materials exert over the atmosphere, land, and on human health. Studying SO₂ emissions through satellite remote sensing techniques with sensors such as the Ozone Monitoring Instrument (OMI) is economically beneficial and work-wise efficient since it can be done for extended periods of time with the analyst in a safe place, away from risk. The SO₂ emission trends in this study showed that there was an increase in SO₂ flux before significant eruptive events and a decrease after. The average SO₂ fluxes for Pacaya, Fuego, and Santiaguito volcanoes were 750 tonnes per day (t/d), 259 t/d, and 660 t/d, respectively. The highest flux was measured at Pacaya volcano, with 23 kilotons/day emitted on May 29, 2010, during its most recent paroxysmal eruption. Although Pacaya showed the highest flux during the study period based on the data and comparing with previous fluxes, Fuego is the most consistent SO₂ emitter of the Guatemalan volcanoes, since it is constantly degassing detectable fluxes of SO₂ which was not observed for either Pacaya or Santiaguito volcanoes. Ash is also a very important volcanic material that needs to be detected due to the risk it poses for crops (by damaging them and consequently affecting livestock) as well as air traffic because it can be interrupted by ash clouds. OMI's aerosol index images (AI) were used to detect ash content in plumes, but in general, most AIs did not show good results.

FRI-178

CARBON ISOTOPE CHEMOSTRATIGRAPHY OF LOWER CEDAR MOUNTAIN FORMATION, UTAH

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The Cedar Mountain Formation in Utah is important to improve our understanding of the Early Cretaceous continental climate. Recent discoveries also make this formation important to understanding the evolution of dinosaurs in the Early Cretaceous. The age of these rocks is still unclear and more studies need to be done to establish a more accurate chronostratigraphy. Vertebrate paleontologists argue that this section is no older than Barremian (130 to 125 Ma) while ostracode and pollen biostratigraphers suggest dates as old as Berriasian (145 to 140). By using organic carbon isotope chemostratigraphy we expect to improve stratigraphic context. In 2007, 57 samples were collected, and this summer they were prepared by crushing them into a fine powder and decarbonated using 3M hydrochloric acid (HCl). The samples were then weighed and analyzed on a Delta + XP IRMS connected to a Costech element analyzer and reported relative to Vienna Pee Dee Belemnite (VPDB). The $\delta^{13}\text{C}_{\text{org}}$ values average 26.5 ‰ and range from -28.8 ‰ to -24.3 ‰. Previous data (U-Pb dates from a carbonate sample of 119 Ma and preliminary paleomagnetic signatures) suggested we could expect to see the global C3 negative isotope excursion followed by a positive excursion. While the curve does vary by about 2 ‰, no significant excursions are recognized, and we therefore conclude the age to be Barremian which, in other carbon isotope curves, show smaller variations. Additional magnetostratigraphic data may clarify this conclusion as will continued stratigraphic research in near localities.

FRI-180

CARBONATE IDENTIFICATION USING X-RAY DIFFRACTION AND ORGANIC CARBON CHEMOSTRATIGRAPHY OF THE RUBY RANCH MEMBER WITHIN THE CEDAR MOUNTAIN FORMATION NEAR MOAB, UTAH

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The Cedar Mountain Formation (CMF) represents the earliest deposition of terrestrial Cretaceous strata in the United States and records significant changes in biota and climate. The goal of this project is to interpret paleoclimate from one of the few well-exposed lacustrine sequences in the CMF through lithologic, mineralogic, and stable isotope geochemical analysis. The Lake Carpenter lacustrine sequence in the Ruby Ranch Member of the CMF is located near Moab, Utah, and was sampled from 4 trenches at 25 cm increments for lithologic description, carbon isotope chemostratigraphy, and carbonate stable isotope analysis. Mineralogy was determined through powdered X-ray diffractometry using a Scintag XDS 2000 XRD. Silicate mineralogy consists of clays and quartz. Carbonate mineralogy fluctuates between calcite, high magnesium calcite, and dolomite. High Mg calcite and dolomite likely indicate arid conditions. The $\delta^{13}\text{C}$ composition of sedimentary organic carbon was determined by powdering the sample, decarbonating the sample with 0.5 M HCl at 60 °C, rehomogenizing the sample, and combusting in a Costech elemental analyzer at 1000 °C. Resulting CO_2 is analyzed on a delta+XP continuous flow mass spectrometer. Initial results show a range of values between -27.9 ‰ (VPDB) at the base to -22.5 ‰ (VPDB) at the top of the sections. These results are still too preliminary to correlate with existing C-isotope records; however, we expect the sequence to correlate to carbon isotope excursions Ap7 to Al1.

SAT-180

ISOTOPIC AND CHEMICAL VARIABILITY OF CALCIUM CARBONATE MICROFACIES IN EARLY TO MIDDLE TRIASSIC LIMESTONES

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The chemical composition and isotopic signature of calcium carbonate (CaCO_3) microfacies reflect the fluids from which they precipitated (e.g., seawater, early diagenetic fluids, or deep burial diagenetic fluids). Consequently, the chemistry of each microfacies provides a fingerprint of the fluids from which it formed. However, the influence of these different microfacies on the bulk composition of CaCO_3 is not well understood. In this study, we will sample carbonate muds, fossil grains, and void filling cements from 2 limestone rock samples that contain a variety of common depositional microenvironments. One sample is a *Tubiphytes* reef boundstone of Middle Triassic age (~247 Mya) containing multiple generations of CaCO_3 cement. The other sample is a thrombolitic microbialite of Early Triassic age (~252 Mya) containing micritic sediment, microbial framework, aragonite crystal fans, and sparry calcite cement. We will analyze CaCO_3 powders from each microfacies in each sample for major and minor elements, including

redox-sensitive trace metals, as well as $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ ratios, using an inductively-coupled plasma optical emission spectrometer (ICP-OES), an inductively-coupled plasma mass spectrometer (ICP-MS), and an isotope ratio mass spectrometer (IRMS), respectively. An improved understanding of the geochemical differences among microfacies and their source fluids will aid the interpretation of bulk rock geochemical records for samples in which analysis of individual carbonate phases is not feasible.

FRI-177

AQUEOUS ALTERATION OF AMORPHOUS FE:SI SYNTHETIC SMOKES WITH MG-RICH SOLUTION TO SIMULATE HYDRATION RELATED TO CM METEORITES

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Goddard Space Flight Center has created amorphous silicate smokes through vapor deposition that have infrared reflectance spectra similar to materials observed in circumstellar disks and in cometary tails. Detailed examinations of primitive meteorites reveal significant volumes of amorphous nonstoichiometric silicate materials, similar to smokes. Consequently, these smokes are the best analogs available for experimental studies to better understand asteroidal aqueous alteration. The vital goal for this current research is to reconstruct the textures/grains present in chondritic meteorites in a laboratory and to try understanding the basic structures in the field of planetary science. In past hydration experiments with deionized H_2O , Fe-smokes resulted in very acidic pHs while Mg-smokes became very alkaline. Therefore, this study is an attempt to understand the interrelationship between Fe and Mg during aqueous alteration. A series of hydration reactions were conducted using Fe-silicate smokes with 3 different Fe:Si ratios. All 3 Fe:Si smokes were reacted with an aqueous solution of $\text{Mg}(\text{OH})_2$ over a period of 30 minutes and pH and T were measured with an OakTron Testr30 every 10 seconds. Hydration of the FeSiOx smokes with $\text{Mg}(\text{OH})_{2(aq)}$ became alkaline immediately and converged on pH of ~ 10.2 in < 30 s. Higher Fe:Si resulted in less alkaline solutions. In conclusion, the reaction's pHs decreased as the ratio increased. These results are consistent with the types of secondary minerals observed in primitive meteorites.

OCEANOGRAPHY

FRI-181

MEASURING OPEN WATER FRACTION AND FLOE SIZE DISTRIBUTION IN THE ARCTIC OCEAN ICE PACK USING HIGH RESOLUTION SATELLITE IMAGES

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Interplay between upper ocean heat content, sea ice cover, and incoming solar radiation determines the perennial ice cover in the Arctic Ocean. Because of this balance, the local open water fraction strongly influences upper ocean heat flux. Determining floe size distribution is important for modeling the incoming solar radiation, since solar radiation readily heats the ocean in the absence of ice cover. Very high-resolution visible and synthetic aperture radar images are now available that show ice floes in great detail. We hypothesize that this imagery can be used to measure open water fraction in the ice pack at scales of 1 to 5000 m. We are developing algorithms in MATLAB to extract open water fraction data and floe size distribution from images taken near oceanographic buoys of interest. The algorithms combine image-processing techniques and manual input to accurately identify boundaries of ice floes within an image. Choices of thresholds to distinguish open water, melt ponds, and ice floes are described. The satellite images allow us to determine relationships between ocean heat fluxes and open water. With these algorithms we will be able to apply quantitative measures of open water fraction to assess the solar heat flux entering the ocean.

SAT-181

SHELLS AND SWIMMING BEHAVIOR: ANALYSIS OF OLYMPIA OYSTER LARVAE EXPOSED TO OCEAN ACIDIFICATION

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Drastic declines in native Olympia oyster populations along the West Coast of the United States have led to recent intensive restoration efforts. In addition to the inherent challenges of restoration, regional and global ocean acidification poses a threat to the reestablishment of native shellfish. Studies have shown that ocean acidification can decrease shell lengths of Olympia oyster larvae. The larval shell is a significant contributor to the larval swimming behavior of Olympia oysters and changes in the larval shell may cause changes in these behaviors. Cultures of 2-day-old larvae were cultured under high (1,000 ppm), moderate (750 ppm), and control (350 ppm) concentrations of CO₂. After 4 days of exposure, larval swimming patterns were video recorded for later analysis of swimming behaviors. Larval samples were also collected from each treatment every 2 days to measure shell growth. There was a significant effect of treatment on length and number of swimmers ($p < 0.05$), with significantly fewer in the high than in the moderate treatment. We could not detect a significant effect of treatment on swimming directional changes ($p = 0.47$). Preliminary results suggest that exposure to ocean acidification during the larval life of Olympia oysters may affect shell size and behavioral activity. Determining Olympia oyster larvae swimming behavior in response to future and regional climate changes will contribute to determining where these larvae move through the water column in order to identify where restoration efforts should be focused.

PHYSICS (EXCEPT BIOPHYSICS)

SAT-208

SPACETIME GEOMETRY AROUND AN ACCRETING, SPINNING BLACK HOLE

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Spinning black holes and their accretion disks are objects of intense study by astrophysicists. The curved spacetime around a black hole, as well as the effects of its gravitation, are described by a mathematical object called the metric. While the metric of an isolated, spinning black hole has been known for decades, a metric that includes the gravitational effects of the accretion disk has yet to be found. Using the Kerr metric in Doran coordinates, we will solve for the motion of a spinning dust cloud near an uncharged, spinning black hole. We will then apply these equations of motion and the gravitational field equations to determine the effects of the gas cloud on the spacetime metric. Our goal is to find an approximate metric describing the accretion of a spinning gas cloud around a spinning black hole. This metric will enable astrophysicists to more accurately predict the gravitational effects of an accreting, spinning black hole, and thus, more reliably identify accreting, compact objects.

SAT-207

EVALUATING THE FIELD EMISSION CHARACTERISTICS OF AL AND CU ELECTRODES FOR DC HIGH VOLTAGE PHOTO-ELECTRON GUNS

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High-current photoguns require high power laser light, but only a small portion of the laser light illuminating the photocathode produces an electron beam. Most of the laser light (~65%) simply serves to heat the photocathode, which leads to evaporation of the chemicals required to create the negative electron affinity condition necessary for photoemission. Photocathode cooling techniques have been employed to address this problem, but active cooling of the photocathode is complicated because the cooling apparatus must float at high voltage. In this work, we evaluate the field emission characteristics of cathode electrodes manufactured from materials with high thermal conductivity: aluminum and copper. These electrodes could serve as effective heat sinks to passively cool the photocathode that resides within such a structure. However, literature suggests "soft" materials like aluminum and copper are ill suited for photogun applications because of excessive field emission when biased at high voltage. Our work provides an

evaluation of aluminum and copper electrodes inside a high voltage field emission test stand before and after coating with titanium nitride, a coating that is very effective at enhancing surface hardness.

FRI-207

CHARACTERIZATION OF ULTRASHORT LASER PULSES USING OPTICAL AUTOCORRELATION ON A FREE-ELECTRON LASER

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Many everyday processes, from chemical reactions and molecular interactions such as photosynthesis to more specialized processes such as X-ray generation, occur on nearly imperceptible timescales. However, investigation into these short events requires even shorter events to measure them, presenting great challenges when studying phenomena on the order of trillionths of seconds. Some of the shortest man-made events are laser pulses, and using laser pulses to produce X-rays, in particular, poses interesting and troublesome problems due to the high power and optical resolution needed to produce these X-rays. Solutions to these problems can lead to new innovations in both basic and applied research, such as in the field of nonlinear optics, surface and photochemistry, interactions between radiation and biological systems, and new imaging capabilities for medical applications. In this study, we conducted an experiment using a broadly-tunable, free-electron laser (FEL) capable of producing a high-repetition-rate train of picosecond optical pulses. The temporal duration of these pulses was inferred from their spatial dimensions by generating autocorrelation functions after splitting the laser beam in an optical autocorrelator and examining the resulting signal after recombination. Introducing a series of time delays by altering the autocorrelator's path length difference enabled us to produce a function that indicated the duration of the optical pulses, which we estimate on a theoretical basis to be less than 5 picoseconds. We present the results of these measurements and describe their application to X-ray generation at the University of Hawaii at Manoa.

FRI-205

STRANGENESS PRODUCTION IN JETS WITH ALICE AT THE LHC

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The study of strangeness production is integral to understanding high energy relativistic heavy ion collisions. The measurement of production yields and particle ratios, dominated by the low energy region of the spectra, helps to understand the properties of the QCD medium created during the collisions. The baryon over meson ratio at intermediate p_T allows the study of hadronization taking place as the medium evolves. Furthermore, the study of strange particles in collisions provides information on parton fragmentation, a fundamental QCD process. To establish a baseline, measurements are first performed in proton-proton (pp) data. However, the role of high-momentum observables is equally important to understanding QCD matter. Low- and mid- p_T strangeness measurements are already in progress at RHIC (Relativistic Heavy Ion Collider) and the LHC (Large Hadron Collider), and it is imperative to extend these observables to higher p_T . We propose to extract flavor characteristics, specifically strangeness, of jets, the high- p_T early probes of heavy ion collisions. Starting with pp , we will measure the strangeness yields in jets to understand the particle fragmentation process, setting the basis for a study in the heavy ion data. In this poster, we will introduce the ALICE experiment (A Large Ion Collider Experiment). We will describe the methodology used for the data analysis and the current status of the data analysis will be presented.

SAT-206

CHARACTERIZING PLASMA GLOBE FILAMENTS

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Plasma, the fourth state of matter, is defined as an ionized gas. Commonplace plasmas can be found in nature, such as lightning and auroras, and industry, such as fluorescent and neon lights. Filamentary structures have been

observed as an interesting phenomenon in plasmas; yet, various aspects of filament formation physics remain unclear. An example of plasma filamentation can be found in toy plasma globes. Commonly available commercial globes are 95% neon and 5% xenon at a pressure near 740 Torr. Plasma globes are typically supplied with a 5kV, 60 kHz electric signal. However, the reason why these conditions are favorable for filamentary structures is unknown. This research will investigate if the ratio of xenon to neon gas affects plasma filament characteristics. In particular, the work will test whether filament morphology (i.e., thickness and branching as a function of radius) alters gradually as xenon percentage increases, or alternately requires a threshold percentage of Xenon for a significant observable change. A sensitive CCD camera will be used to analyze filament number and morphology. These filament characteristics will be measured at various xenon-neon ratios inside a 1.8 liter custom plasma globe. Thus, the study expects to find characteristics such as average filament diameter, branching radius, and filament number changing as a physical function proportional to the xenon-neon gas ratio. Our characterization of the filaments will be ultimately used to understand plasma filamentation phenomena in both nature (e.g., atmospheric sprites) and industry (e.g., dielectric barrier discharges).

FRI-209

KA PIKO O O'AHU, KŪKANILOKO: THE CENTER OF O'AHU, KŪKANILOKO

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In the Kanaka Maoli (Hawaiian) culture, Kūkaniloko is one of Hawai'i's most sacred places. This location is designated as the birthplace for all ali'i, or chiefs, dating back to the 12th century, and, as such, represents the Piko, or source of life, of the island of O'ahu. Kūkaniloko contains many different stones, some of which were calendrical markers noting the dates of conception and predicted birthdates of chiefs. The connection between Kanaka Maoli and the 'āina, or land, is familial and, because of this, Kūkaniloko is particularly sacred in the Hawaiian culture as it signifies the center from which life springs forth. The purpose of this research is to confirm the location of Kūkaniloko as the center of mass of the island of O'ahu using the scientific method. Grid references, global positioning system (GPS), and calculation of center of mass were applied to validate that Hawaiians have an understanding of the scientific concept of mass and applied this knowledge in designating Kūkaniloko as the Piko of O'ahu, both literally and culturally. Assuming the Earth's density to be an invariant quantity, elevations were measured at the center of each grid square using Google earth and applied as weighted position coordinates. Results show that the center of mass of O'ahu, computed using scientific tools, converges towards Kūkaniloko's location as the precision of the grid is increased. Preliminary outcomes suggest ancient Hawaiian knowledge of scientific methods for choosing Kūkaniloko as the Piko of O'ahu.

FRI-206

ENHANCING THERMOELECTRIC EFFICIENCY WITH GATED SILICON NANOWIRES

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Thermoelectric efficiency is proportional to the power factor (defined as the Seebeck coefficient squared times the electrical conductivity) divided by the thermal conductivity of the material. In most materials, the thermoelectric parameters are coupled in such a way that it is difficult to increase the efficiency. However, in recent research, silicon nanowires have proven capable of decoupling thermal conductivity from the power factor. They exhibit a reduced thermal conductivity while maintaining a relatively high power factor compared to bulk silicon. This causes silicon nanowires to have a roughly 100-fold increased thermoelectric efficiency. Our goal is to further increase this efficiency by enhancing the power factor of silicon nanowires. We fabricated an electrical gate around the nanowires, which allowed us to induce and control the carrier concentration in the nanowires. Then, we measured power factor as a function of gate voltage to find the maximum power factor. We also expected our method to work differently in nanowires of different cross sectional area, and, therefore, we evaluated our technique in nanowires of: 35 nm x 41 nm, 35 nm x 35 nm, and 35 nm x 27 nm cross sectional areas. We obtained a maximum power factor in the larger cross sectional area nanowires, yielding a power factor of 2 to 2.25 mW/m-K². Using our technique, we achieved a power factor comparable to bulk silicon, which has not been accomplished before. This enhancement in efficiency can help make thermoelectrics more commercially viable.

FRI-208

SUPERFLUID HELIUM-4 TRANSITION ON MULTI-WALLED CARBON NANOTUBESVito Iaia, Emin Menachekanian, Gary Williams.*University of California, Los Angeles, Los Angeles, CA.*

By understanding the mechanisms of the two-dimensional (2D) Kosterlitz – Thouless (KT) onset of superfluidity in liquid helium-4 and how vortices play a part in this transition, a link to similar breakdowns in other super-materials, such as superconductivity in metals, could be better understood. In a cylindrical geometry such as a thin film coating a carbon nanotube, it is expected that the phase transition should change from 2D to a 1D regime when the vortex core size becomes equal to the nanotube radius. Vortices, which dictate the KT transition, are predicted to completely destroy the superflow in such a 1D regime. Initial measurements of superfluidity in thin films ranging from 3.5 to 6 atomic layers coating the surfaces of the nanotubes over temperatures varying from 150 mK to 1 K have been carried out. The amount of superfluid can be measured by creating oscillating temperature and thickness waves, via mechanical shaker, called thirdsound waves in the helium film. Resonance peaks of the third sound wave are analyzed via fast Fourier transforms (FFT), from which the third sound wave speed can be determined. From analysis, it is seen that the wave speed shows modulation at integer atomic layers. Furthermore, the results are fully consistent with the 2D KT theory. To get to the lower temperatures and thinner films to observe the 1D phase transition, a different suspension system for the experimental cell is currently being engineered, to try to reduce the heating effect of the mechanical shaker on the dilution refrigerator.

SAT-204

RESISTIVE SWITCHING CHARACTERISTICS OF WATER DEGRADED YBCO THIN FILMEdgar Segovia, Stephen Tsui.*California State University, San Marcos, San Marcos, CA.*

In response to consumer demand for electronic storage capacity, there is a global undertaking to investigate memory phenomena in materials. Bipolar resistive switching, whereby the electrical resistance of a material is reversibly modified via application of a voltage of alternating polarity, has been extensively studied in oxide semiconductors. The goal of this research is to explore resistive switching in a $\text{YBa}_2\text{Cu}_3\text{O}_7$ (YBCO) superconductor and how the switching responds to degradation of the YBCO using water. Several 500-nanometer-thick YBCO films were water degraded and then received deposited silver electrodes. The samples were subjected to voltage pulses of 1 microsecond width with varying amplitudes. Preliminary results indicate that the films which received longer water exposure demonstrated a higher frequency of switching over a broad applied voltage range of 200 V to 600 V. Resistive switching is often attributed to the motion of crystalline defects within a thin surface layer of the material under test, so the enhancement of available defects due to the water degradation may play a factor in our samples' behaviors.

SAT-209

DESIGNING EDUCATIONAL INTERACTIVE PROGRAMS FOR AN INTRODUCTORY PHYSICS COURSEBryan Loeding, Max Hansen, Paulo Acioli.*Northeastern Illinois University, Chicago, IL.*

The objective of our research is to design laboratory experiments and computational activities that accompany the first-year, calculus-based physics sequence. Rather than following the traditional sequence, the course uses a more contemporary approach by engaging the students in analyzing fundamental principles rather than secondary formulas. It makes macro-micro connections, introducing the atomic nature of matter early. It introduces students to concepts of modeling by making idealizations, simplifying assumptions, and estimates. The course contains simple laboratory experiments and computational models to predict time evolution of system behavior. The same models can be used in other math-related coursework. The activities were developed in Python and were designed to engage in the process of learning physics through inquiry. The topics covered in these activities were motion, force and momentum, gravitational force, planetary motion, spring stiffness, and Young's modulus. We started with suggested activities and modified them to consider the diversity of Northeastern Illinois University's student population as well as their work-life balance needs as commuting students. Our considerations of the students' needs will lead to the student engagement that is necessary for long-term retention of the concepts and materials. The effectiveness of these activities will be assessed in terms of concept retention and the attitude of the students toward physics.

PROFESSIONAL CAREERS

COMMUNICATIONS

SAT-146

THE REAL HOUSEWIVES OF ATLANTA: DEFINING OR CHALLENGING THE STEREOTYPES OF AFRICAN-AMERICAN WOMEN IN REALITY TELEVISION

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Despite the numerous spans of channels offered to the American audience, television shows with predominantly African-American casts have remained few in number. Scripted sitcoms such as *Good Times* or *The Cosby Show*, which are family-oriented and positive, have been replaced with the less expensive and more entertaining reality television shows of high profile professionals and entertainers. This entertaining realm tends to focus on the women in those worlds and often displays the ever-present stereotypes and image portrayals of the argumentative, angry, and unmarried Black woman. Through the analysis and coding of season 5 of *The Real Housewives of Atlanta*, our research analyzes whether Black women perpetuate or challenge their own negative stereotypes. The number of times the women's actions or dialogue resembles a stereotype, such as in an argumentative or sexual manner, is recorded in an effort to reveal how frequently the stereotypes are displayed in a single episode and throughout the season. The working hypothesis is that African-American women uphold their own negative image portrayals in a media-driven and sexually-entertained society, even when these women are given the power to redirect certain beliefs.

OTHER PROFESSIONAL FIELDS

FRI-146

DIFFERENTIAL HOUSE PRICE CHANGES BY NEIGHBORHOOD IN THE SAN ANTONIO METROPOLITAN AREA

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This study examines the house price change based on neighborhood diversity in the San Antonio metropolitan area over the 2003 to 2013 period. The study of house price appreciation is well researched and there has been some research on how wealth is established among different racial groups. Flippen emphasizes the challenge in determining whether differential appreciation is due to race alone or socioeconomic factors which are correlated to race. MacPherson and Sirmans discovered that percent change of ethnicity was a greater indicator of fluctuation in price appreciation than the population fraction of a particular minority in an area. Our study is more micro in its focus (a single metropolitan area) and includes a period of increasing prices, decreasing prices and recovery of prices. Our data are MLS transactions from 2003 to 2013 in the San Antonio metropolitan area and US Census Bureau data for the same areas. We study the effects of different demographic characteristics and trends such as household status, income level, education, and race/ethnicity as they relate to house price changes. A hedonic regression model allows us to both assess the changing house prices for a constant quality house, and to assess the impact of the demographic variables. Our preliminary findings show that homes in the highest valued and lowest valued neighborhoods declined more sharply in the current downturn and are struggling to recover. Median neighborhoods fully participated in the upswing, and were more quick to recover after the decline.

PSYCHOLOGY & SOCIAL SCIENCES

ANTHROPOLOGY/ARCHEOLOGY

SAT-147

CETACEAN HUNTING AT THE PAR-TEE SITE (35CLT20): ETHNOGRAPHIC, ARTIFACT, AND BLOOD RESIDUE ANALYSIS

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Anthropologists have long believed that Native Americans on the northern Oregon coast did not actively hunt cetaceans; however, archaeological evidence could suggest otherwise. Our project uses ethnographic data, comparative artifact analysis, radiocarbon dating, and blood residue analysis to investigate whether whales might have been hunted during prehistoric times along the northern Oregon coast. A humpback whale (*Megaptera novaeangliae*) phalange with a bone harpoon point embedded in it from the Par-Tee site (35CLT20) may provide evidence of whale hunting. The dimensions of the embedded harpoon point were determined using computed tomography (CT) scanning in order to complete comparative analysis. Based on comparative analysis, 3 harpoon typologies were selected for blood residue analysis. This project has the potential to identify a previously unknown or unrecognized hunting technology within Oregon and may provide the basis for a reassessment of current archaeological collections if cetacean blood residues are identified. In addition, this project may provide a time marker for active or opportunistic whale hunting within Oregon.

CLINICAL PSYCHOLOGY

SAT-151

THE INFLUENCE OF ANTICIPATORY PROCESSING AND SOCIAL ANXIETY ON PHYSIOLOGICAL RESPONDING

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This study examined anticipatory processing with participants high (HSA) and low (LSA) in social anxiety. We expected that HSAs and participants who anticipated would have the lowest heart rate variability (HRV), which measures physiological flexibility. A repeated-measures ANOVA examined HRV change between relaxation and attention tasks. In the anticipation condition, HSAs had no HRV change, as it was low throughout both tasks, but LSAs experienced a drop ($p < .001$). In the distraction condition, LSAs had no HRV change, but HSAs experienced a drop ($p < .01$). These results suggest anticipatory processing resulted in an anxiety increase for LSAs.

FRI-148

THE RELATIONSHIP BETWEEN TRAUMA AND HOARDING SYMPTOMS

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Hoarding disorder (HD) is characterized by chronic saving of one's possessions and often excessive acquisition of items, resulting in clutter. HD can impose health and safety risks on individuals and is a major cost to the community. Previous research has implicated trauma in the development of HD. The current study investigated the association of trauma with both self-reported and behavioral indices of hoarding symptoms. We hypothesized that frequency of traumatic life events (TLEs) would be associated with higher self-reported hoarding symptoms and greater hoarding behaviors. Undergraduate students ($n = 80$) completed self-reported measures of hoarding symptoms and TLEs, and behavioral measures of acquiring and saving tendencies. As part of a larger investigation, participants were randomized to either a psychosocial stress task or a nonstressful control task. Thus, the stress-task condition was controlled for in analyses of the behavioral measures. As expected, more frequent TLEs were associated with greater acquiring tendencies, including more items purchased ($r = .24$, $p < .05$) and more money spent ($r = .35$, $p < .01$) during the task, controlling for the stress-task condition. However, frequency of TLEs was not significantly associated

with saving behavior or self-reported hoarding symptoms. Results suggest that TLEs may be more important in acquiring tendencies than saving behavior, but future research should replicate this finding and use longitudinal designs to confirm the directionality of the findings. Clinicians may benefit from considering a patient's history of TLEs when treating hoarding symptoms, especially for patients experiencing excessive acquisition.

FRI-149

ASSESSING THE NEEDS OF HOMELESS MEN AND WOMEN IN DOWNTOWN LOS ANGELES

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In recent years, the number of homeless women in the United States has increased dramatically. Up until recently, the large majority of homeless were men, with single men being overrepresented. As women become a larger percentage of the homeless population, a better understanding of their needs is required in order to formulate solutions for this specific group. This project will assess the needs of homeless women in downtown Los Angeles and examine the differences between the needs of homeless men. It is hypothesized that the needs of homeless women will be significantly different from the needs of homeless men. Furthermore, it is estimated that homeless women will use the LAC+USC Medical Center more frequently than their male counterparts. Participants included homeless men ($n = 45$) and homeless women ($n = 25$) who were surveyed in areas surrounding the Medical Center. Women reported a greater need for health care services, basic resource services, housing services, and childcare services. Men reported a greater need for employment services, legal services, and substance prevention services. These findings suggest that the 2 groups are unique and may benefit from tailored prevention and treatment approaches. Thus, treating the distinctive needs of different populations may aid in the continuous process to end chronic homelessness.

SAT-148

AN EXAMINATION OF THE CHALLENGES, STRESSORS, AND COPING MECHANISMS IN MEXICAN-AMERICAN WOMEN

Annalia Valdivia, Joanna Sarinana, Amanda Patron, April San Roman, Fiorella Carlos, Patricia Gonzalez, Linda C. Gallo.

San Diego State University, San Diego, CA.

Compared to the rest of the US population, Mexican-American women have an increased risk of developing health problems (e.g., obesity, heart disease). Research suggests that stress plays a significant role in health outcomes. The current qualitative study seeks to provide an in-depth understanding of the challenges, stressors, and coping mechanisms that Mexican-American women experience to inform future studies aimed at improving Latina health. An exploratory, descriptive study consisting of 8 key informant interviews facilitated by qualitatively trained and bilingual project staff members were conducted. Participants were Latina, 18 years and older, and working or residing in the South Bay area. The interviews were tape-recorded, transcribed, and, if necessary, translated for content analysis of common themes and patterns through qualitative methodology to address the aims of the study. In terms of personal stressors, participants most often mentioned experiencing multiple role conflict, unfair treatment, and stress adjusting to the American lifestyle. The coping mechanisms most cited by participants included having a positive outlook on life, social support, social activities, and faith. Findings reveal that there is a unique set of stressors that Mexican-American women experience including multiple role conflicts, unfair treatment, and adjustment to the American lifestyle. In response to these particular stressors, participants reported several coping mechanisms which consisted of having a positive outlook on life, social support, social activities, and faith. It is important for healthcare providers to be aware of the unique stressors that Mexican-American women face as these stressors may have a negative impact on their health.

SAT-150

RELATION BETWEEN CHILDREN'S INTERNALIZING PROBLEMS AND PARENTS' PERCEIVED LEVEL OF STRESS: RACE AS A MODERATOR

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A strong link has been found between stress and psychopathology in both children and adults. The current study examined whether the relation between parents' level of life stress and children's internalizing problems varied by race. Participants were parents ($n = 1,379$) of children (mean age = 11.34, range: 4 to 18) receiving services for mental health problems. At intake, parents reported how stressful their life was currently, using a 5-point Likert scale

(1 = not stressful; 5 = extremely stressful). Multiple regression analysis indicated that the interaction between parents' race (minority vs. nonminority) and child internalizing problems (yes or no) significantly predicted parents' reported levels of stress. For minority parents ($n = 279$), levels of stress were significantly higher for parents of children with, as compared to without, internalizing problems ($t = -3.936$, $p < .001$); similarly for nonminority parents ($n = 1,100$), the relation between child internalizing problems and parental stress level was significant ($t = -2.697$, $p = .007$). Among parents of children with internalizing problems, minority parents reported significantly higher levels of stress than nonminority parents ($t = -2.052$, $p = .041$), whereas, among parents of children without internalizing problems, there was a nonsignificant trend for nonminority parents to report higher levels of stress than minority parents ($t = 1.956$, $p = .051$). Overall, child internalizing problems and parents' perceived levels of stress were significantly related, and this was especially true for minority families. We also found that minority parents reported less favorable attitudes toward seeking professional help than nonminority parents ($t = 3.050$, $p < .05$). Thus, it may take higher levels of perceived stress for minority parents to seek help for their children with internalizing problems.

FRI-147

EXPLORING ETHNIC MATCH, ACCULTURATION MATCH, AND PARENTAL ACCULTURATION AS CORRELATES OF PARENTAL AGREEMENT WITH THERAPISTS ON THE CAUSES OF CHILD PROBLEMS

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Due to the low participation of ethnic minority clients in psychotherapy treatment, cognitive match, agreement, or shared understanding between therapists and clients have been proposed as important in providing culturally competent mental health services. This preliminary study examined different factors (i.e., parent-therapist ethnic match, degree of parent-therapist match on acculturation to mainstream American culture, and parent acculturation to mainstream American culture) that may be associated with parental agreement with therapists on biopsychosocial beliefs and total parental agreement with therapists on the causes of child problems. Data were collected from a diverse sample of parents of youths receiving outpatient mental health services (approximate $n = 277$) and associated therapists (approximate $n = 48$). Parental agreement was assessed using separate parent and therapist reports on the Beliefs about the Causes of Child Problems Questionnaire (BAC). Acculturation was measured using the PAN acculturation scale. For both total parental agreement with therapists and parental agreement with therapists on biopsychosocial beliefs, results indicated parent-therapist ethnic match was unrelated ($p > .05$), degree of parent-therapist acculturation match on mainstream American culture demonstrated a borderline relationship ($p = .05$), and parent acculturation to mainstream American culture was significantly correlated with parental agreement with therapists ($p < .05$). This preliminary study highlights the potential importance of parent acculturation levels in relationship to cognitive match in psychotherapy treatment. Hopefully with greater cognitive match or agreement, parents and therapists will cooperate effectively to improve children's conditions.

SAT-149

ENCULTURATION: A POTENTIAL PROTECTIVE FACTOR AGAINST SUICIDAL IDEATION IN AMERICAN INDIAN/ALASKA NATIVE YOUNG ADULTS, A PROPOSED STUDY

Adam Nordwall, Victoria O'Keefe, LaRicka Wingate.

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Suicide rates among American Indian/Alaska Native (AI/AN) communities continue to exceed most other ethnic groups. Research has begun to identify risk and protective factors to better understand AI/AN suicide. Empirical studies have investigated acculturation (the degree of assimilation to the majority or dominate culture) into the dominant society as a potential risk factor for suicidal ideation. However, few studies have examined enculturation (the degree of maintaining and practicing your own culture) as a combatant against suicidal ideation, specifically in AI/AN young adults. The current proposed study will examine whether enculturation and participation in cultural activities are negatively associated with suicidal ideation in a sample of AI/AN college students. Information gained about the role of enculturation on suicidal ideation may lead to program development that can focus on instilling culture as a potential protective factor against suicidal ideation among AI/AN young adults. Implementing enculturation strategies may not only reduce the risk of suicide, but it may increase cultural identity and pride for AI/AN young adults.

COUNSELING PSYCHOLOGY

FRI-151

SYSTEMS JUSTIFICATION

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There is proclivity in the societal system that, even among disadvantage groups, there is a need to defend authority and justice. This can be explained by the systems justification theory. According to this theory, people have a motivational need to defend the status quo to preserve order in their life. If society is fair, there is no reason to be frustrated about one's position in it. We propose that system justification emerges from a broad cognitive bias to interpret status differences and other patterns in the world in terms of their inherent features. Thinking inherently about socio political patterns might direct people to interpret status differences as fair and legitimate, taking into consideration the inherent characteristics. We present evidence showing that systems justification arises even when there is arguably no motivation to certain social patterns. In one study, adult participants defended the social status quo, even when it occurred in a context far removed from their own inherent explanations of status differences. In the second study, 5 to 8 year old children, who are too young to experience anxiety in society, also showed a preference for inherent explanations of status differences.

EDUCATIONAL PSYCHOLOGY

SAT-152

ETHNIC AND GENDER DIFFERENCES IN HEAD START CHILDREN'S SCIENCE LEARNING

Haley Edwards, Daryl Greenfield.

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In recent years, science and science education have been at the forefront of policy debates, receiving state and national attention. Amid the policy debates and growing concerns over science education is the recognized underrepresentation of women and minorities in the sciences. There is evidence that children as young as preschool age have a substantial knowledge base about the natural world and thus the ability to begin learning science. Using an ethnically and linguistically diverse sample of Head Start children, the current study seeks to examine the gender and ethnic differences in preschool children's science learning in order to better understand the relationship between early science education and later trends that disfavor women and minority participation in the sciences. The study also aims to test the theory that ethnic matches between teachers and students in the preschool years will enhance student performance. The students and teachers in the current study served as participants in an Early Childhood Hands-On Science (ECHOS) curriculum and professional development program. The results from this study are expected to have useful implications for the ECHOS Program as well as similar early science education programs.

EXPERIMENTAL PSYCHOLOGY

SAT-154

INVESTIGATING ORIENTATION DEPENDENCE IN VISUAL OBJECT RECOGNITION

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Understanding the relationship between individual aspects of object recognition and representation is vital to understanding the visual system as a whole. Previous research has supported the idea that the identity and location representation of objects are independently processed in the brain. However, a recent study by Kravitz, Kriegeskorte, and Baker supports the position-dependent hypothesis of visual object representation which states that visually recognizing an object's identity depends on its location in your visual field. The current study uses the behavioral methods outlined in Kravitz et al. to investigate other aspects of visual object recognition, particularly whether recognition is dependent on orientation. The experiment involves participants being exposed to the same image twice, either in the same orientation or in differing orientations each time. For the objects viewed in the same orientation twice, the ability to recognize the objects should be higher for the second viewing (i.e., indicating a priming effect). If

visual object recognition is invariant to orientation, this increased recognition rate should also be observed when the objects appear at different orientations the second time. However, if this priming effect depends on an orientation-specific object representation, the priming effect will be dampened for objects that appear at a different orientation the second time. The current study will provide insight into how visual object recognition is affected by the relationship between object identity and orientation.

SAT-153

DO ANABOLIC STEROIDS IMPACT COGNITION? AN EVALUATION OF ANDROSTENEDIONE'S IMPACT ON COGNITION IN YOUNG MALE RODENTS

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Following natural menopause, androstenedione becomes the main hormone secreted by the follicle-depleted ovaries. We have previously evaluated high physiological doses of androstenedione in the female rodent and found relations between higher androstenedione levels and spatial memory impairment; this relationship was shown when androstenedione levels were of endogenous, or exogenous, origin. This androstenedione-induced memory impairment in females led us to question whether this androgen also impairs memory in males; no study has yet evaluated androstenedione's impact on cognition in the male rodent model. This is a clinically relevant question since androstenedione is a steroid of abuse. In the current study, 4-month-old male rats were given either a daily injection of androstenedione or vehicle (polyethylene glycol). Subjects are currently undergoing a battery of cognitive tasks evaluating spatial working and reference memory including the water radial arm maze (WRAM), Morris water maze (MM), and delayed match-to-sample. Results will be presented.

FRI-152

EFFECTS OF CHRONIC ETHANOL EXPOSURE AND WITHDRAWAL ON SPINE DENSITY IN THE NUCLEUS ACCUMBENS

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The nucleus accumbens (NAc) is critical for reward learning and reinforcement. NAc is a major terminus of the mesolimbic dopaminergic pathway and its examination provides information to help understand the role of this pathway in addiction and drug-seeking behaviors. The present study sought to examine the effects of short- (24 hour) and long- (7 day) term withdrawal from chronic ethanol exposure on spine density in the NAc. Adult male Sprague Dawley rats were placed in airtight plexiglas chambers and received 10 consecutive days of ethanol vapor. Controls received only room air during exposure. Golgi-Cox stained MSNs from the NAc core and shell were analyzed at 1200X magnification. Unobstructed terminal segments of dendrites were sampled and spines analyzed along a length of 40 microns or greater. Spines were counted and characterized by maturation state. Preliminary examination of the data suggests that total spine density follows similar trends found in previous studies of dendritic morphology in these test subjects. There is a trend of overall reduction in the core and shell of the NAc during 24-hour withdrawal. After 7 days of withdrawal, there was an increase in spine density in the core but not the shell compared to the 24-hour and control groups. This increase in the core at 7 days was also found in our analysis of dendritic branching and length. These increases were manifest only after prolonged withdrawal suggesting they reflect a long-term, plastic process initiated by chronic ethanol exposure.

FRI-153

ENVIRONMENTAL ENRICHMENT ATTENUATES THE DELETERIOUS EFFECTS OF HALOPERIDOL AFTER EXPERIMENTAL TRAUMATIC BRAIN INJURY

Elizabeth Ogunsanya¹, Megan Laporte¹, Christina Monaco², Kaitlin Folweiler¹, Anna Greene², Jeffrey Cheng², Anthony Kline².

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Antipsychotic drugs (APDs) are provided to alleviate clinical, traumatic brain injury (TBI)-induced agitation. Because chronic administration of APDs will likely only occur during rehabilitation, we sought to investigate the effects of HAL and environmental enrichment (EE) on behavior after TBI. Fifty-three anesthetized male rats received a cortical impact or sham injury and then were randomly assigned to 4 TBI and 4 sham groups receiving either EE or standard (STD) housing. HAL (0.5 mg/kg) and saline vehicle (VEH, 1.0 mL/kg i.p.) were provided beginning 24

hours after surgery and every day for 3 weeks. Motor and cognitive function was assessed on days 1 - 5 and 14 - 19, respectively. No differences were observed between the TBI STD-housed HAL and VEH groups in either beam walk ($p = 0.68$) or water maze ($p = 0.67$). The TBI+EE+VEH group was significantly better in both motor and cognitive function relative to the TBI+STD+VEH group ($p = 0.0024$ and $p = 0.0003$, respectively). Moreover, the TBI+EE+VEH group was better than the TBI+STD+HAL group on both motor and cognition (p 's < 0.05). However, the TBI+EE+VEH group did not differ from the TBI+EE+HAL group on the beam or in the maze ($p = 0.179$ and $p = 0.45$, respectively; $p = 0.005$ required by the Bonferonni post-hoc test). These data show that EE is beneficial after TBI and also show that HAL produces substantial motor and cognitive deficits. Lastly, the findings indicate that EE can attenuate the detrimental effects of HAL, but HAL, in turn, limits the efficacy of EE. Several ongoing studies are investigating this complex phenomenon regarding APDs and rehabilitation after TBI.

LINGUISTICS

FRI-154

DO WE PREDICT AS WE AGE? AN EVENT-RELATED POTENTIAL STUDY OF SENTENCE PROCESSING IN SPANISH-SPEAKING OLDER ADULTS

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Previous studies have shown that young adults, both Spanish and English speaking, anticipate nouns and articles in sentences. Recent studies show that English-speaking, older adults do not predict upcoming nouns. The current study looks at how normally aging Spanish-speaking older adults differ in their prediction of words, specifically gender-marked nouns, compared to young adults. The older adult participants ($n = 24$) will be matched to a control group of young adults ($n = 24$) on the basis of socioeconomic status and language proficiency. Participants will read sentences that build an expectation for a specific noun while their brain waves are recorded using an electroencephalograph (EEG). The key manipulation will be at the article, which matches or mismatches in grammatical gender with the expected target noun. EEG trials will be time-locked to target words in the sentences and averaged across trials to produce event related potentials (ERPs). Compared to English, determiners in Spanish provide richer information about an upcoming noun because of the grammatical gender agreement between an article and noun (*el mariposa/ la mariposa*). Based on this, we predict that Spanish speakers, unlike English speakers, will be more sensitive to the article and, in turn, the ERP components will reflect an expectancy effect when participants get an article that is opposite in gender to the noun expected from sentence context. This study will allow us to determine if all older adults fail to make predictions based on context, or whether an enriched linguistic context can facilitate predictions, even in a biologically stressed brain.

OTHER PSYCHOLOGY

SAT-156

EFFECTOR DEPENDENT LEVELS OF MOTOR INHIBITION IN RESPONSE SELECTION

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Action selection implies a choice between several potential effectors in competition. Previous studies have shown 2 inhibitory mechanisms that help perform an action efficiently. Impulse control (IC) is manifest in the selected effector and hypothesized to reflect an inhibitory mechanism that helps shape the timing of the response. Competition resolution (CR) is manifest in the nonselected effector and hypothesized to reflect an inhibitory mechanism that helps sharpen the selection process. The role of inhibition in response selection has previously been examined in a series of hand selection studies. A recent study has shown that, in contralateral limb competition, CR inhibition is present only when the response alternatives involved movements of the upper limbs and absent when response alternatives were between an upper limb and a lower limb. To identify constraints on the operation of these two inhibitory mechanisms, we manipulated the effectors used for the response alternatives, measuring changes in corticospinal excitability with motor-evoked potentials elicited by transcranial magnetic stimulation. In a choice reaction-time, task participants had to choose between moving contralateral homologous/non-homologous and ipsilateral limbs. Results show different

levels of inhibition depending on the pair involved in the competition. In particular, there was a stronger inhibition when the two effectors in competition are in the same hand, suggesting that more inhibition is needed for competing effectors close in anatomical representation.

FRI-156

MISCONCEPTIONS ABOUT SMOKING-CESSATION STRATEGIES

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Smokers may have some mistaken beliefs about a cessation treatment that may make them less receptive to it. Previous research has shown there may be some reluctance to adopt or persist with a nicotine replacement therapy (NRT) or drug treatments (Chantix or Zyban) and that smokers have misconceptions about these smoking-cessation strategies. Examples of misconceptions about NRT are that NRT can be addictive and that NRT is harmful. The hypothesis of this experiment is that naïve conceptions that people have about the nature of nicotine and the nature of cessation treatment problems may act to reduce the attractiveness of those treatments. Participants will be from the University of Texas at San Antonio psychology-student pool. The participants will first provide information about their smoking habits. They will then rate their agreement with 30 claims about NRT/Chantix: half the claims will be valid and half will be invalid. Finally, they will be provided with detailed descriptions of the logic and procedure for each smoking-cessation treatment and asked to judge the attractiveness of each treatment on a number of psychosocial dimensions. The significance of the data is that it can be used to better educate individuals about NRT and drug regimens to clear up any counterproductive misconceptions. The importance of this research is to focus on modifying any misconceptions a smoker may have that could be impediments to adopting a given program for smoking cessation. (This work was partially supported by UTSA MARC-U*STAR GM007717.)

SAT-155

IS NEGATIVE PARENTAL AFFECT ASSOCIATED WITH CHILD TEMPERAMENT? A FAMILY STUDY APPROACH

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The TEXAS Family Study investigates child and parent behavior in families with two siblings between the ages of 2.5 and 5.5 years. In the present study, we examined parent affect and its relationship to other parent variables and child temperament. Based on previous research showing associations between negative parent attributes and child temperament, we hypothesized that parents with negative affect will have more negative qualities and will rate their children as more difficult. The sample included 189 children (50.3% female) with a mean age of 3.72 years. Self-reported online questionnaires were completed by parents through Survey Monkey. Parent variables were assessed with the positive- and negative-affect schedule (PANAS), the big five personality inventory (BFI), the Center for Epidemiologic Studies depression scale (CES-D), and a family conflict scale. Child temperament was measured with the toddler behavior assessment questionnaire (TBAQ). Parents with higher positive affect had higher extraversion, agreeableness, and conscientiousness, and lower depression, family conflict, and neuroticism. Those with higher negative affect reported elevated levels of depression, family conflict, and neuroticism, and lower agreeableness and conscientiousness. In addition, parents higher in negative affect rated their children as higher in activity level, perceptual sensitivity, sadness, and object fear. Parent positive affect was not associated with difficult child temperament. These findings suggest that negative parental self-perceptions influence negative perceptions of child temperament. Future analyses with the TEXAS Family Study sample will investigate if this is a parent-rating effect by comparing these parent attributes to objective laboratory ratings of child behavior.

FRI-155

INFLUENCES OF PARENTAL SPEECH ON LANGUAGE ABILITIES IN TODDLERS WITH AUTISM

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Autism spectrum disorder (ASD) is a condition characterized by communication deficits that often persist throughout the lifespan. In typically developing children, parent speech styles influence the child's verbal abilities. This study examined the language trajectories of toddlers with ASD in relation to their caregivers' speech. Children with ASD whose caregivers' speech featured more initiations and narrative dialogue were predicted to have greater linguistic proficiency. Participants were 3-year-olds with ASD (n = 80), with language delays (n = 80), or typical controls (n = 80). Currently, a total of 39 toddlers have participated. In a longitudinal study, they were assessed in standardized

and experimental paradigms. Information about the children's language was gathered from videos of play interactions between the child and caregiver. The speech of both was transcribed and coded. For children, utterances were coded for degree of successful articulation, initiation or responsiveness, and echolalia. Parental speech was coded as an initiation, response, narration, praise, or discipline. Preliminary analyses demonstrate that parents of children with ASD employed more narrative and initiation speech compared to parents of typical children. A greater amount of parent initiations and narrations may reflect the adaptation of parent speech to ASD children's social and communicative deficits. Further analyses will examine interactions between caregiver speech and the linguistic abilities of their children as measured by standardized assessments. Examining which components of child-directed speech are related to language outcomes is key to understanding the influence of caregiver speech on linguistic functioning.

SAT-157

MUSICAL EXPOSURE AND CREATIVITY IN THE BRAIN

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The importance of music to human cognition remains elusive, but slowly, research is providing pieces of the puzzle by identifying critical links between exposure to music and changes in brain structure and function. Creativity is operationally defined as the production of novel and useful ideas and is measured by the creative achievement questionnaire (CAQ), a reliable and valid instrument. We were interested in identifying the relationship between music, specifically music exposure, to creativity as measured by creative achievement. We hypothesized that music exposure (i.e., the number of years playing a musical instrument) would predict both creative achievement, and changes in brain structure relevant to creative achievement. Thirty-two neurologically and psychiatrically normal students studying science, technology, engineering, and math (STEM) were recruited. Behavioral testing included the musical creativity questionnaire and creative achievement questionnaire (CAQ). Magnetic resonance imaging (MRI) was used to obtain brain volumetric measurements, later analyzed using voxel-based morphometry (VBM). Music exposure was associated with decreased brain volumes in several regions, most particularly, the left DLPFC. CAQ was associated with decreased brain volumes in several regions including the left DLPFC, overlapping that observed with music exposure. We interpret these results to suggest that music exposure and creative achievement are systematically linked. The mechanism by which music exposure might lead to higher creative achievement through increased frontal pruning remains unclear but is consistent with other research. Future studies designed to track subjects across time might further clarify the causal mechanisms associated with music exposure and creative achievement.

PSYCHOLOGY (GENERAL)

FRI-160

COMPARING THE LEVELS OF HOPE AND ITS RELATIONSHIP WITH SUICIDAL IDEATION AMONG SEXUAL ORIENTATION STATUS

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There is an increased risk for suicidal ideation among individuals who identify as lesbian, gay, bisexual, or questioning. Hope has been demonstrated as a protective factor for suicide among several ethnic minority groups. Thus, hope may serve as a protective factor for suicide among sexual orientation minority populations. The aim of this study was to compare the levels of hope and its components (goals, pathways, and agency) among a sample of sexual orientation minority participants. This sample included those who self-identified as gay or lesbian, bisexual, other, and don't know. It was hypothesized that hope and its components would be negatively related to suicidal ideation. Additionally, it was hypothesized that gay and lesbian participants would have higher levels of hope compared to bisexuals and those who identified as other and don't know. Correlational analyses and an ANOVA were conducted to test these hypotheses. Results indicated the agency component of hope was significantly negatively correlated with suicidal ideation ($r = -.271$, $p = .039$). Additionally, gays and lesbians exhibited higher levels of hope compared to bisexuals and participants who self-identified as other and don't know [$F(3, 54) = 2.811$, $p = .048$]. However, post hoc analyses revealed no significant differences between the groups in levels of hope or its

components. Results implicate having the determination of reaching goals (agency) may serve as a protective factor against suicidal thinking for sexual orientation minority individuals.

FRI-157

THE UNEXPECTED CLASSROOM: USING ONLINE CHAT TO ENHANCE SUBSEQUENT FACE-TO-FACE COMMUNICATIONS

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Although many researchers speculate socializing online limits face-to-face conversations crippling the learning and practicing of social skills, there is no research that directly examines this hypothesis. The purpose of this study was to identify whether social skills obtained through computer-mediated-communication transfer between online and offline modalities. Participants completed a questionnaire assessing state anxiety, digital media usage, social phobia, and shyness. Participants were then randomly assigned to 1 of 3 conditions. In 2 conditions, participants were taught 10 social skills either online or offline. In the third condition, participants were not taught any social skills and instead given a neutral task. Once exposed to condition specific stimuli, participants conversed with a confederate either online or offline, with the task of getting to know that person. Conversations were recorded and coded by blind observers to determine whether social skills learned in one setting were demonstrated in the other. Lastly, participants completed a second questionnaire that measured state anxiety, perceived rapport, and effectiveness. The first hypothesis predicted that social skills taught and learned in one context would transfer to the other setting. The second hypothesis predicted that social skills taught and learned online and offline will facilitate rapport between online and offline communications. Support was found for both hypotheses. Regardless of the learning condition, social skills were demonstrated either online or offline when participants conversed with their conversation partner and participants that conversed offline with a conversation partner reported experiencing significantly greater rapport than those who conversed online with a conversation partner.

FRI-158

A FACE DATABASE FOR GENUINE EMOTIONAL EXPRESSION

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In both clinical and research applications there exists a need for databases of faces with emotional expressions. In the past, researchers and clinicians have relied primarily on databases of faces that have posed emotional expression rather than faces that are expressing genuine emotions. This has been partly due to the difficulty inherent in collecting images in which people are expressing genuine emotion. In addition, posed emotions may have been preferred due to the exaggerated and highly salient features inherent in posed emotions. However, posed emotions lack the nuance that genuinely expressed emotions have. Past research has suggested that there exist no important differences between posed and genuine emotional expression. However, recent studies have found evidence that this may not be the case. The current study takes on the task of collecting both posed and genuinely expressed emotions from a single group of participants. Images of genuinely expressed emotions will be collected by video taping participants while they watch video clips. Each video clip has been selected based on its ability to evoke the desired emotion. Posed emotions will be collected by simply asking participants to look happy, sad, disgusted, etc. Once the images have been collected we will perform a direct comparison between the posed images and the genuinely expressed images. After the database has been compiled and tested for validity and reliability, the database will be published online and made available for use by researchers that study face recognition and recognition of emotion.

SAT-159

CAN PERCEPTIONS OF HYPOCRISY BE PREDICTED?

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In 2002, Fiske proposed a model of 5 core social motives (belongingness, understanding, control, enhancement, and trust) that enable people to live harmoniously within groups. Rubin and Hewstone found that, when threatened, individuals will increase in-group favoritism and derogation of out-groups. We propose that threats to Fiske's core social motives will influence whether or not an individual will perceive another person's behavior as hypocritical as a means of bolstering or reaffirming their self-esteem. N = 106 participants were randomly assigned to either a control or a threat condition. Participants then looked at a series of photos with a variety of target ingroups and outgroups and

subsequently rated the pictures on a scale of 1 (not hypocritical) to 7 (very hypocritical). It was found that participants in the threat conditions rated the photo of the “Jewish man eating bacon” as more hypocritical than participants in the control condition on all 3 hypocrisy dependent variables (Pillai’s trace (12,228) = 2.258, $p = .010$). None of the other photos produced significant differences. We suspect that accusing him of hypocrisy mitigated the feelings of threat produced by the manipulation, which would account for the nonsignificant findings for the subsequent photos. A follow-up study could examine whether placing other pictures earlier in the lineup would produce similar results. (Partially funded by NIGMS MBRS-RISE GM060655.)

SAT-161

MEDIA IDEALS, BODY EVALUATION, AND ATTRACTIVENESS PERCEPTIONS AMONG MEXICAN-AMERICAN, COLLEGE-AGED WOMEN AND MEN

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Research suggests there is an existing relationship between media internalization, body evaluation, and perceptions of attractiveness although no known studies have examined this association among the Mexican-American population. Mexican-Americans are challenged, through the process of acculturation, to alleviate the disparities between American mainstream and Hispanic traditional culture ideals. Acculturation seems to be a critical variable that marks important differences in media internalization, body evaluation, and attractiveness perceptions in this group. The present study aims to examine whether acculturation influences the associations between these variables. Mexican-American, college-aged participants will be asked to fill out questionnaires that contain items measuring acculturation levels, body satisfaction, perceived attractiveness, and media internalization. Our hypotheses are, participants who report positive body satisfaction will perceive themselves as more physically attractive than those who report negative body satisfaction; media internalization and body satisfaction will be negatively correlated; and less-acculturated Mexican-Americans will internalize media ideals at lower levels, report higher levels of perceived attractiveness, and will be more satisfied with their bodies compared to highly acculturated participants. It is expected that the relationships among acculturation, media internalization, body satisfaction, and attractiveness will not differ between men and women. Since Mexican-Americans are a part of a rapidly growing Hispanic population, investigating the associations between these variables becomes important. Varying acculturation levels should be considered in future studies that examine media literacy, body evaluation, body esteem, and perceptions of attractiveness. (This study is partially supported by the UTSA MARC-U*STAR GM007717.)

FRI-160

KINESIC CUES: INVESTIGATING HOW TO EFFECTIVELY SIMULATE BODY LANGUAGE IN A VIRTUAL ENVIRONMENT

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Understanding a person’s body language is a critical skill for first responders like law enforcement, National Guard, military, etc. Learning to decode body language, for example, nervous or aggressive body language, facilitates the detection of human threats. The research presented focuses solely on kinesics, that is, the interpretation of nonverbal cues such as body language, gestures, postures, and facial expressions displayed by individuals. By synthesizing an exhaustive literature review, 4 key categories: manipulation, illustrators, regulators, and emblems, of kinesic cues were identified. The cues in each category have been displayed on virtual agents for simulation-based training (SBT) research. The purpose of this research is to provide guidelines to develop state-of-the-art SBT that can train first responders to detect nervous or aggressive behaviors on the scene by decoding body language. We hypothesize that virtual agents exhibiting kinesic cues will be a strong research tool for effective SBT. This poster will deliver the theoretical foundation for new research about the 4 kinesic cue categories and provide relevant examples of each associated cue. The information presented will be used as a start to further investigate kinesic cues in greater depth using an empirically based research design.

SAT-158

CREATIVITY ASSESSMENT IN IDENTICAL AND FRATERNAL TWINS REARED APART: PILOT ANALYSIS

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The present study will use a drawing task to assess individual differences in creativity. The main study will examine the environmental and genetic contributions for creativity using data gathered from identical (MZA) (n = 81 pairs) and fraternal twins reared apart (DZA) (n = 56 pairs) from the *Minnesota Study of Twins Reared Apart* (MISTRA). However, the first step in this project was a pilot study to evaluate methods and procedures prior to conducting the main study. In the pilot study, members of the Segal lab at California State University, Fullerton each created 5 house and person drawings. Drawings were evaluated using Amabile's consensual assessment technique that involves having judges evaluate creativity within their domain of expertise. This approach predicts high reliability for assessing creativity among experts. Raters scored the level of creativity using Bouchard & Segal's artistic quality rating scale (AQRS) form, which measures aesthetic features of creativity. A total of 40 mock drawings of a house (20) and person (20) were rated by 3 artists and 1 nonartist to evaluate the reliability of the AQRS scoring sheet. Results showed high interrater agreement with intraclass correlations ranging from .875 to .931. The main study hypothesizes that creativity will be more similar in MZA twins than DZA twins, due to the MZA twin's genetic identity, and artist raters' judgments will have higher agreement than those of nonartist raters. Findings from the pilot study support our chosen method for our main study.

FRI-159

HOW HAWAII'S SCHOOLS ARE IMPLEMENTING THE COMPREHENSIVE STUDENT SUPPORT SYSTEM TO ASSURE STUDENTS ARE GETTING THE SUPPORT THEY NEED

Annalise Ferreira, Dale Fryxell.

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Every school wants the best for its students. In Hawaii, the Department of Education (DOE) is doing this by implementing the comprehensive student support system (CSSS). This system ensures each student receives all the support they need based on 3 values: high-quality instructional leadership; comprehensive student support; and curriculum, instruction, and assessment. From these values, the DOE created an innovation configuration map (IC), which helps to evaluate each school's progress in implementing the CSSS. The IC map is composed of 5 different components: school climate and culture, continuum of proactive supports for early intervention and prevention, CSSS critical learning supports, response intervention, and school-wide positive behavioral interventions and support. Each component can be evaluated at 4 different status levels: establishing, applying, integrating, and systematizing, with the systematizing level being the highest, most desirable level. For this study, each public school in the state of Hawaii has been analyzed and compared to one another regarding their implementation status. The results show that schools across the state of Hawaii and within the different school complexes are at different levels in their progress towards fully implementing the CSSS. The results of this study will be useful for the Hawaii DOE in allocating their resources for future training and support.

SOCIAL PSYCHOLOGY

SAT-134

DATING VIOLENCE, SUICIDAILITY, AND DEPRESSION: RESULTS FROM A NATIONALLY REPRESENTATIVE DATA SET

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Dating violence, commonly known as physical, sexual, or psychological abuse in a dating relationship, has been associated with negative physical and psychological outcomes. Perhaps one of the most detrimental effects of being in a violent dating relationship is suicidality. Adolescents in a violent dating relationship tend to think more about suicide compared to adolescents who have not been victims of dating violence. The current study explores the mediating role of depression in the relationship between dating violence and suicide. Data from the *National Longitudinal Study of Adolescent Health* (ADD Health) was used to determine if depression increases the likelihood of suicidal ideation among participants who have been victims of dating violence. Adolescent study participants (n =

7,470) completed self-reported measures of dating violence, depression, and suicidality (suicidal ideation/attempt). Mediation analyses revealed a significant relationship between dating violence and suicidality ($\beta = .12$, $p < .001$), as well as a significant relationship between dating violence and depression ($\beta = .20$, $p < .001$). The third regression testing the path between depression and suicidality, controlling for dating violence, was also significant ($\beta = .31$, $p < .001$), as was the fourth regression testing dating violence and suicidality, controlling for depression, ($\beta = .06$, $p < .001$). The findings indicate that depressed, victimized adolescents are at higher risk for planning and attempting suicide compared to nonvictimized adolescents using a nationally representative data set.

FRI-134

IMPACT OF NEIGHBORHOOD EFFECTS ON YOUTH ACADEMIC PERFORMANCE AND BEHAVIOR

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Previous studies have investigated the link between neighborhood socioeconomic status and academic achievement and found that students have less academic progress when growing up in disadvantaged neighborhoods. In order to further understand the association between individual and contextual characteristics and their role in children's achievement, this study examined how educational outcomes vary according to neighborhood characteristics. Using multistate data from the NICHD (Eunice Kennedy Shriver National Institute of Child Health and Human Development) Study of Early Child Care and Youth Development and the *Uniform Crime Report*, children's performance on cognitive and achievement tests in fifth grade were regressed based on their individual characteristics (e.g., attitudes toward school and relationships with parents) and neighborhood characteristics (e.g., crime and safety ratings). Additionally, we tested whether the influence of child characteristics on cognitive development depended on environmental context using moderation models. These analyses were replicated in a younger sample (Early Childhood Longitudinal Study–Birth Cohort).

SAT-135

DIGIT RATIOS AND VISUAL PREFERENCES FOR GENDER-LINKED STIMULI IN MEN AND WOMEN

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Sex differences in preferences for social stimuli are well-established. In childhood, boys and girls prefer different toys (e.g., dolls vs. vehicles), play-styles (e.g., rough/active vs. calm play), and prefer playmates of the same sex. In adulthood, sex differences exist in preferences for opposite sex faces and characteristics associated with reproductive success (e.g., waist-to-hip ratio, status). Converging evidence from studies of typical development and studies of individuals with endocrine disorders has suggested that stronger male-typical preferences are influenced by higher levels of androgens during prenatal life. However, previous research based on self-reports of gender-linked behavior has not established whether strong preferences for childhood, gender-linked stimuli (e.g., toys, play styles) are associated with strong preferences for adult, gender-linked stimuli (e.g., attractive opposite sex faces). The goal of the present study is to examine the within-subject stability of gender-linked preferences across multiple domains using eye-tracking technology. Visual interest in gender-linked stimuli will be measured in 180 undergraduate students (90 males) using a remote eye-tracker (ASL). In addition, participants will complete self-report measures of gender-linked personality traits and childhood gender dysphoria. The lengths of the index and ring fingers (2D:4D ratio), a proxy measure of prenatal androgens, will also be measured. We hypothesize significant associations among domains of gender-linked visual preferences in males, but not in females and that more male-typical digit ratios will be associated with stronger male-typical visual preferences in both men and women. The findings from this research will have implications for theories of gender development and sexual orientation.

FRI-135

PREVALENCE OF DATING VIOLENCE AMONG YOUTHS, WITH AND WITHOUT DISABILITY, IN PUERTO RICO'S PUBLIC SCHOOLS

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Violence in Puerto Rico has become a problem of epidemic proportions. Our responsibility is to build alternatives that promote nonviolent relationships among people, specifically among youth. The FILIUS Institute and the Institute of Interdisciplinary Research have combined efforts to develop this study. Although there is scarce research in Puerto Rico regarding the topic, the research that does exist has shown the pertinence of studying dating violence (DV)

among youth as a way to comprehend the intensification and continuity of these incidents during youth and adulthood. Therefore, the main goal of this research is to understand the prevalence of DV among youths, with and without disability, in Puerto Rico's public schools. Specific objectives are to establish the prevalence of DV among youths, with and without disability, and determine the risk and protective factors associated with DV. Because of the stigma attached to disabilities and because of the social marginalization that this population faces, we hypothesized that the prevalence of DV will be higher in relationships where one of the members has a disability. In coordination with school administration, participants were informed and submitted consent and assent forms. A total of 100 students of both sexes from a Cayey public high school participated in self-administered questionnaires. Some of the most relevant results are: a higher tendency toward DV in relationships where one of the members has a disability, but more intense incidents in relationships where one of the members does not have a disability. Most of the participants reported having friends engaged in high risk behavior.

SAT-133

EXPLORING THE RELATIONSHIP BETWEEN AUTONOMY AND DEPRESSION AMONG US-BORN AND NON-US-BORN LATINA ADOLESCENTS

Maria Renteria, M. Teresa Granillo.

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Latina adolescents report higher levels of depression when compared to their non-Latina White and Latino counterparts. Researchers have examined the relationships of familism, parent-adolescent conflict, and the degree of acculturation among Latina adolescents. While the role of autonomy has been considered as an important factor related to depression among Latina adolescents, it has only been discussed theoretically. There is a lack of empirical research connecting autonomy and depression specifically among Latina adolescents. The purpose of the current study is to fill this gap in the literature and conduct the first empirical study examining the relationships between autonomy and depression among Latina adolescents, and to look at the differential relationships between these factors among US-born and foreign-born Latina adolescents. It is expected that US born Latinas will have higher levels of depression than non-US-born Latinas, but that limited or constraint autonomy will be associated with depression among both groups of adolescent Latinas. Data from this study will come from the Add Health dataset, the largest and most comprehensive longitudinal survey of adolescents. Add Health employs in-school questionnaires administered to 2,126 adolescents in grades 7 to 12, 279 of which were administered to Latina adolescents. The goal of the current study is to allow clinical practitioners to enhance individual and family psychotherapeutic depression intervention programs that target reducing conflict in the parent-adolescent dyad.

FRI-133

OSTRACISM AND INTEREST IN GANG MEMBERSHIP

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Ostracism, being ignored and excluded, threatens 4 basic human needs: belonging, self-esteem, control, and meaningful existence. In this study, attitudes toward joining extreme groups such as gangs will be evaluated after an episode of ostracism using a simple toss game online called Cyberball. With Cyberball, participants are asked to mentally visualize the game, as if with two other people, getting the ball a third of the time if in the included condition. Those that are randomly assigned to the ostracism condition are thrown the ball once or twice and then never again. We hypothesize that, after being ostracized, people will be more willing to join extreme groups like gangs to restore their basic needs. A sample of people on the Purdue University campus will be randomly assigned to one of two conditions, inclusion or exclusion, using Cyberball on a portable iPad to determine their willingness to join gangs.

SOCIOLOGY

FRI-132

IT'S THE LITTLE THINGS THAT SHAPE OUR EDUCATION: RACIAL MICROAGGRESSIONS IN THE CLASSROOMS OF A PREDOMINANTLY WHITE UNIVERSITY

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The racial climate of universities and students' experiences with racial microaggressions influence their decisions to populate or avoid certain campus areas. This study will use qualitative and quantitative methods to analyze experiences with racial microaggressions in classrooms among students of color at a predominantly White university. Analyzing locations of a campus community allows the students, faculty, and staff to have a better understanding of campus climate and how to create initiatives to combat the decreased sense of belonging that is often experienced by students of color. Some subsidiary concepts that will guide our research include how color-blind ideology affects racial groups on the campus, the history of spatial terrains of racial microaggressions, and the analysis of students' narratives and their lived experiences. This research contributes to the research in the field of racial microaggression by examining how identity within racial groups interacts with sense of belonging in various spatial locations on campus. This mixed-methods investigation will provide better understanding of the racial climate at predominantly White institutions.

SAT-131

MOBILIZING AROUND NANOTECHNOLOGY: THE ROLE OF NON-GOVERNMENTAL ORGANIZATIONS

Kelli Pribble, Cassandra Engeman.

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Nanotechnology has emerged as an issue of concern for organized public interest groups or nongovernmental organizations (NGOs). NGOs are uniquely positioned to dedicate time and resources to nanotechnology-related issues and, therefore, can directly affect public perceptions by conveying their understanding of nanotechnology and its potential implications for society and the environment. What are the main nanotechnology-related issues for NGOs and to what audience do NGOs appeal for action? In order to observe how NGOs mobilize around nanotechnology-related issues, a database was compiled consisting of 173 organizations that articulated interest in nanotechnology. These groups were then divided into nanoengaged and allies according to the level of involvement portrayed by each NGO. Focusing on the 85 identified nanoengaged organizations, this research compiles the written statements, publications, and press releases for each organization. These documents are being coded for issue domain such as potential environmental risks of nanotechnology, consumer and worker safety, or potential promises of nanotechnology for innovation; and audience, for example, government agencies, policymakers, scientists, companies, or publics. Preliminary research suggests that most NGOs are concerned with the potential risks of nanotechnology use and application for consumers and environmental safety, and call for regulation and increased investment in nanotechnology environmental health and safety research. Rather than rallying the public to achieve these aims, a majority of NGOs appeal directly to governments in order to effect change. Future research will encompass a more systematic assessment of how nongovernmental organizations understand and communicate nanotechnology-related issues.

SAT-132

THE IMPORTANCE OF SEXUAL HEALTH DISCUSSIONS: DIFFERENCES IN HETEROSEXUAL MEN'S AND WOMEN'S SEXUAL HEALTH COMMUNICATION WITH CLOSE FRIENDS

Donna James, Matthew Mutchler Luis Juarez.

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Although it is evident that discussing sexual health issues may lead to safer sex behaviors, there is limited insight about the differences between how heterosexual men and women discuss sexual health issues with friends. Our study was based on quantitative data collected through questionnaire surveys of college students regarding their level of sexual communication with their closest friend. We used a convenience sample made up of 250 participants, 60% of which were female and 40% were male. The race/ethnicity of the participant sample was 45.2% Hispanic, 36.4% African American, 11.6% White, 6% Asian-Pacific Islander, 2.8% Native American, and 1.6% other. The age range of participants was 18-21 = 30.8%, 22-25 = 32.8%, 26-30 = 18.4%, 31-40 = 7.6%, 41-50 = 6.8%, 51-60 = 3.2%, and 61 or older = 0.4%. Our analyses of the data demonstrated that women were more likely to discuss several aspects of

sexual health topics that were included in our survey, such as relationship issues ($P < .05$), and women were more inclined to discuss HIV with a close friend than men ($P < .05$). Also, women were more comfortable discussing some sexual health topics than men ($P < .05$). Our results lead us to further research questions: If heterosexual women are more likely to discuss sexual issues, why are they more likely to contract HIV? Greater knowledge about sexual health communication may help foster increasingly successful health communication that reduces HIV risk.

GRADUATE POSTER ABSTRACTS

BIO/AGR/ENV LIFE SCIENCES

BIOCHEMISTRY/BIOPHYSICS

Ballroom C - 122

BIOCOMPATIBILITY STUDIES OF PRECIOUS METAL NANOPARTICLES EVALUATED BY *IN VITRO* CYTOTOXICITY ASSAYS USING LIVER AND BREAST CANCER CELL LINES

M. Esther Salinas, Jason Parsons.

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Silver, gold, and palladium nanoparticles (NPs) are nanotechnological products studied for the treatment of cancer and targeted drug delivery. In the present study, gold, palladium, and silver NPs were synthesized by chemically reducing potassium tetrachloroaurate (III) hydrate, potassium tetrabromaurate (III) dihydrate, potassium tetrachloropalladate (II), and silver nitrate. The synthesis of the NPs was performed using either trisodium citrate or sodium borohydride. The sodium borohydride-synthesized nanomaterials were stabilized using cetyltrimethylammonium bromide (CTAB). NPs were tested *in vitro* for toxicity assessment in cellular environments. Hepa-1c1c7 from mouse hepatoma, HepG2 from human hepatocellular carcinoma, and MCF7 from human adenocarcinoma were treated with stabilized NPs and nonstabilized NPs over a range of doses (10 to 160 μ M). The toxicity of the NPs was evaluated by measuring changes in cellular morphology via TEM imaging and metabolic activity via MTT cytotoxicity assay. Our data suggests that the cytotoxicity of NPs changes with nanoparticles' synthesis methods with the 2 stabilizing agents and cell type. Results of these studies will be presented.

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MF₃:ND₃⁺ (M=LA,GD,Y) NANOPARTICLES FOR OPTICAL AND MAGNETIC IMAGING

L. Chris Mimun¹, G. Ajithkumar¹, Brian Yust¹, Madhab Pokhrel¹, Zakary Elliott¹, Francisco Pedraza III¹, Ashish Dhanale¹, Ai-Ling Lin², Liang Tang¹, Dhiraj Sardar¹.

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Near infrared light (NIR)-based detection and therapy is well known in the biomedical industry. In this project, we are proposing the development of infrared-based magnetic nanoparticles (NP) for various biophotonics applications such as optical imaging that uses the low attenuation of biological tissues within the NIR window of interest and magnetic resonance imaging (MRI), that uses the magnetic properties of Gd. Halides such as MF₃ (M=La, Gd, and Y) were doped with an infrared-active rare earth ion, Nd³⁺. Synthesis conditions have been optimized for obtaining the brightest phosphor with a size of < 50 nm. Characterizations of the NPs were done to explore the excitation and emission properties, crystal structure, TEM images, and magnetization properties. Toxicity studies of the synthesized NPs were also carried out to determine the viability and cytotoxicity at different concentrations. Since bioimaging is one of the key features of using these infrared-based magnetic nanoparticles, confocal images of cells have been obtained where the NPs were incubated with cells for 24 hrs. Our future goal is to use the properly optimized phosphors for real-time imaging using an IR camera as well as MRI T1 studies in the future. [This research was partially funded by NIGMS MBRS-RISE GM060655 and by the National Science Foundation Partnerships for Research and Education in Materials (NSF-PREM) grant N0-DMR-0934218.]

Ballroom C – 22

SYNTHESIS AND CHARACTERIZATION OF A THIOL-BASED HDAC INHIBITOR

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Histone deacetylase (HDAC) is an enzyme involved in histone modification resulting in changes in gene expression. All NAD⁺-independent HDACs deacetylate lysine residues on histones and contain a catalytic zinc ion in their active sites. HDAC inhibitors are appealing anticancer agents because they hinder the formation of tumors, prevent cell proliferation, and induce terminal differentiation of tumor cells. However, they have been problematic for their off-target effects as well as poor bioavailability. Thiol-based HDAC inhibitors are potent, metabolically stable, small molecules

that may be able to combat some of these issues. The thiol moiety of these inhibitors functions by coordinating zinc ions, preventing it from initiating catalysis. In this work, 7-mercapto-*N*-(4-phenyl-2-thiazolyl)hexanamide was synthesized, purified, and characterized. Its binding energetics with zinc were analyzed by isothermal titration calorimetry (ITC). Preliminary ITC data indicate complications due to sulfhydryl group oxidation in solution, which is mitigated by zinc chelation. Namely, we see much more oxidation occurring in control runs where the HDAC inhibitor is titrated into a buffer without zinc. Efforts are under way to select solution conditions that minimize oxidation, thus increasing the accuracy of resulting binding parameters. In summary, a novel HDAC inhibitor has been synthesized. Through investigating binding energetics with zinc, information is obtained regarding the significance of metal chelation on HDAC inhibition, furthering the development of antitumor agents.

Ballroom C - 152

ENGINEERING HIGH-AFFINITY HUMAN SINGLE-CHAIN T-CELL RECEPTORS AGAINST CANCER ANTIGENS

Sheena Smith¹, Daniel Sommermeyer², Thomas Schmitt³, Dolores Schendel⁴, Helga Bernhard⁵, Kurt Piepenbrink⁶, Brian Baker⁶, Thomas Blankenstein², Wolfgang Uckert², Philip Greenberg³, David Kranz¹.

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Single-chain T-cell receptors consisting of 2 linked variable regions (V α and V β , referred to as scTv) provide a useful alternative engineering format to single-chain antibody fragments (scFv). Previously, we described the engineering of 2 high affinity human T-cell receptors (TCRs) in which the usage of the highly stable V α 2 region, when properly paired with different V β regions, allowed the TCR to be expressed on the surface of yeast as an scTv and correlated with the ability to express soluble scTv fragments in *E. coli*. In this study, a wild-type HLA-A2-restricted TCR specific for melanoma antigen MART1/Melan-A, called INRI-T1, and a wild-type TCR specific for Wilm's tumor antigen, called WT1 P22, which naturally use the highly stable V α 2 region, were engineered for high affinity against their respective peptide antigens via yeast display and fluorescence-activated cell sorting. Alanine mutations of various CDR residues demonstrated the key role of particular residues in contacting the alpha helices of HLA-A2. In addition, we have generated a single TCR platform for yeast display-based engineering of designer TCRs with specificities for diverse peptide antigens. This approach would avoid the need to isolate T-cell clones against each peptide antigen and the subsequent characterization of the TCR genes and products.

Ballroom C - 147

RARE-EARTH-DOPED, UPCONVERTING PARTICLES FOR BIO IMAGING APPLICATION

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Trivalent, rare-earth ions, especially erbium (Er³⁺) and ytterbium (Yb³⁺), codoped in Y₂O₃S nanoparticles, are known for their extraordinary spectroscopic properties. A thorough optical characterization, including the absolute upconversion quantum yield (QY) decay time measurement, is of critical importance in evaluating their potential for bioimaging. In this paper, we will be presenting measured absolute upconversion QYs for Yb³⁺ and Er³⁺ doped in Y₂O₃S at 980 nm excitation at various power densities. Comparison of absolute QYs for different concentrations of Yb³⁺ and Er³⁺ doped in Y₂O₃S will be made for all the upconversion emissions with respect to the reported most efficient upconverting phosphor, NaYF₄, doped with 20% Yb³⁺ and 2% Er³⁺. Furthermore, applications of these nanophosphors in bioimaging will be explored, depending on the measured absolute upconversion quantum yields and decay time. In addition, preliminary results on *in vitro* imaging using upconverting nanoparticles as a contrast agent will be reported.

Ballroom C - 132

HYBRID INVERSE PROBLEMS AND MEDICAL IMAGING

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Couple-physics inverse problems or hybrid inverse problems are research areas that are interested in developing the mathematical framework for medical imaging modalities that combine the best imaging properties of different types of waves (e.g., optical waves, electrical waves, pressure waves, magnetic waves, and shear waves, etc). In some applications of non-invasive medical imaging modalities (e.g., cancer detection), there is a need for high contrast and high resolution images; high-contrast contrast discriminates between healthy and non-healthy tissue whereas high resolution is important to detect anomalies at early stages. Some current methodologies (e.g, electrical

impedance tomography, optical tomography, ultrasound, and magnetic resonance) focus only on a particular type of wave that can either recover high resolution or high contrast, but not both with the required accuracy. The aim of hybrid inverse problems is to couple the physics of each wave to benefit from the imaging advantages of each one. Three examples of this physical coupling are 1) ultrasound modulated electrical impedance tomography (UMEIT), 2) magnetic resonance electrical impedance tomography (MREIT), and 3) ultrasound modulated optical tomography (UMOT). In this work, we develop a general approach to prove stability in recovering the conductivity for the non-linear second step of this hybrid inverse problem. Our data are internal functionals that are reconstructed from boundary measurements in a first step of the process. We prove Holder conditional stability for the non-linear problem of recovering the internal conductivity from these internal measurements.

Ballroom C - 128

CHARACTERIZATION OF OXYLIPIN SIGNATURE IN LIPID TRANSFER PROTEIN MUTANTS OF *ARABIDOPSIS THALIANA*

Charmaine Fay Soco, Robert Luis Vellanoweth.

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Lipid transfer proteins (LTPs) exist in many animal tissues as well as in some fungi and plants. *In vitro*, LTPs are known for extracellular transport of lipids such as phospholipids, cholesterol, and gangliosides. LTPs constitute a large gene family and are ubiquitous in higher plants which indicate diverse physiological functions. In plants, LTPs are subdivided into two families, both of which have the common characteristic of a hydrophobic cavity for binding lipids. LTPs are important in cellular signaling, antimicrobial activity, and survival in plants. Studies on *Arabidopsis thaliana* have shown expression of LTPs in siliques, possibly to mediate transfer of lipids and other metabolites from seeds to other plant organs. In our lab, an LTP gene knockdown mutant of *Arabidopsis thaliana* showed a prolonged reproductive stage compared to the wild type. This led us to hypothesize that LTPs shuttle signaling molecules from seeds to meristems, without an apparent perennial phenotype being observed in the mutant. Interestingly, oxygenated fatty acids, collectively known as oxylipins, are known to regulate plant cell death. Oxylipins are present in seeds of *Arabidopsis thaliana*. Our aim is to characterize oxylipin differences in wild-type and LTP mutant seeds of *Arabidopsis thaliana* through analytical methods. Liquid chromatography-mass spectrometry (LC/MS) will identify similarities and deviations in oxylipin signatures between the seed types. The result of this study will demonstrate any association between oxylipins as regulators of plant cell death and lipid transfer proteins as the mode of transport for those signaling molecules.

Ballroom C - 78

INVESTIGATING THE ROLES OF EIF4F AND EIF4F IN *ARABIDOPSIS THALIANA*

Nicola Cole, Karen Browning.

University of Texas at Austin, Austin, TX.

In one of the early steps in the initiation of translation, the cap-binding complex eIF4F binds to the 7-methyl-guanosine of the mRNA in preparation for translation. The eIF4F complex is composed of eIF4G, the scaffolding protein, and eIF4E, the cap-binding protein, and is conserved in mammals, fungi, and plants. Unique to plants is an alternative complex, eIFiso4F, made up of eIFiso4G and eIFiso4E. Having a comparable molecular weight and an amino acid sequence similarity of ~41%, eIFiso4E is very similar to eIF4E. The functional domains found in eIF4G are the same in eIFiso4G; however, eIFiso4G is lacking a significant portion of the N-terminus. Our hypothesis is that these differences indicate differing roles that the 2 complexes may have. To investigate these roles, we have carried out RNA-immunoprecipitation on wild type *Arabidopsis thaliana* using antibodies specific to either of the 2 complexes, followed by deep sequencing of the messages isolated from either of the two complexes. Messages found to be favored by one isoform over the other will be confirmed by *in vitro* translation assays.

Ballroom C - 49

PREDICTING TETRACYCLINE RESISTANCE THROUGH MATHEMATICAL MODELING

Anisha Perez, Colin Bacorn, Erica Stoddard, Kimberly DeBruler, Yousif Shamoo.

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The US Department of Health & Human Services reports that healthcare-associated infections (HAIs) are one of the top 10 leading causes of death in the United States. Due to the widespread use of antibiotics, bacterial resistance has emerged as a growing threat to public health. We have demonstrated that under simple conditions, antibiotic resistance and its evolution can be accurately modeled *in vitro*. We use experimental evolution and biochemical

assays to link cellular fitness (e.g., resistance) to the physicochemical properties of proteins, specifically to the enzyme TetX2. TetX2 is an enzyme that inactivates the tetracycline class of antibiotics including minocycline (MCN) and the first-line antibiotic tigecycline. Our mathematical model correlates the effect of increasing internal MCN concentrations on bacterial growth rates taking into account MCN inactivation by TetX2, and diffusion of the antibiotic across the membrane and periplasm. Most importantly, this relationship is reversible allowing us to predict kinetic protein properties from growth rates. Our goal now is to extend the model to include drug effluxer pumps specific to tetracycline resistance, TetA, and those indicated in general antibiotic resistance such as the tripartite pumps AcrAB, TolC, and AdeABC. The model can be used to deduce the physicochemical parameters of these membrane proteins without the difficult and arduous tasks of purification and kinetic assays.

Ballroom C - 95

THE DEVELOPMENT OF *IN VITRO* MICELLES FOR DETERMINING THE K_m OF LECITHIN CHOLESTEROL ACYLTRANSFERASE FOR CHOLESTEROL IN THE PRESENCE OR ABSENCE OF JOJOBA OIL

Jeremiah Heredia, Raymond Garcia.

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Atherosclerosis is the leading cause of death in the United States. It is a progressive disease that causes the hardening of arteries due to excess cholesterol and fat deposits in the inner arterial wall. Elevated high density lipoprotein (HDL) concentrations are anti-atherogenic. Reverse cholesterol transport (RCT) is an important process for transporting cholesterol in HDL from peripheral tissues and macrophages to the liver for degradation. This transport system is regulated through various proteins including lecithin cholesterol acyltransferase (LCAT), which is an enzyme that esterifies free cholesterol to cholesteryl esters in HDL. When New Zealand White (NZW) rabbits were fed a cholesterol plus jojoba oil-rich diet, elevated HDL concentrations and enhanced LCAT activity were obtained. We hypothesize that jojoba oil is regulating the biochemical mechanism action of LCAT by decreasing the K_m of this enzyme for its cholesterol substrate. This hypothesis will be validated by developing *in vitro* micelles with different concentrations of free cholesterol. Two types of micelles, those with free cholesterol and those with free cholesterol plus jojoba oil, will be exposed to LCAT in the serum of NZW rabbits. The rate of esterification of free cholesterol to cholesteryl ester will be determined with an enzymatic cholesterol assay. If our hypothesis is correct, then the K_m of LCAT for cholesterol will be lower with the cholesterol plus jojoba oil micelles than with the cholesterol micelles. (Supported by NIH Grant GM61331.)

BOTANY

Ballroom C - 40

THE ROLE OF A PUTATIVE *ARABIDOPSIS THALIANA* FLAVONOL SYNTHASE IN THE BIOREMEDIATION OF PHENANTHRENE

Juan Hernandez-Vega, Adan Colon-Carmona.

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Polycyclic aromatic hydrocarbon (PAH) pollution is an issue with severe consequences to the environment. PAHs are a group of contaminants with 2 or more benzene rings fused together; they are very stable and resistant to degradation in soil and water environments. Current bioremediation strategies include the use of soil bacteria such as *Pseudomonas* to degrade these contaminants. These bacteria contain dioxygenases (DOXs) that modify PAHs by oxidizing their structure and increasing their reactivity. The objective of this research is to determine if plant DOXs have similar ability. In our laboratory, we use phenanthrene as a model PAH. Previous data confirmed the overexpression of 6 DOX genes in response to PAH exposure. The cDNA of one of these enzymes, flavonol synthase (*AT5G05600*), was cloned and expressed in *Escherichia coli* cells. These proteins were successfully purified from the cells' extracts. Current experiments include *in vitro* enzymatic assays to determine possible chemical modifications of PAHs. Preliminary fluorescent emission results suggest that modifications of phenanthrene took place. Phenotypic analysis of knock-out mutant lines, compared with wild-type plants, showed that mutants were hyposensitive to phenanthrene, suggesting a possible role of this gene in PAH degradation *in vivo*. Moreover, preliminary results of transgenic lines over-expressing flavonol synthase showed a hypersensitive effect of these lines under phenanthrene treatment. Taken together, these results support the idea of the involvement of flavonol synthase in the catabolism of PAHs and the accumulation of toxic intermediates during its biotransformation in plants.

Ballroom C - 121

INVESTIGATION OF NATURAL POPULATIONS OF *CARICA PAPAYA*'S MORPHOLOGICAL AND GENETIC STRUCTURE THROUGHOUT MESOAMERICASandra Mardonovich¹, Richard Moore¹, Oscar Rocha².¹Miami University, Oxford, OH, ²Kent State University, Kent, OH.

Gene flow is an important process when looking at the population structure of a species and its evolutionary history. This project aims to characterize the morphological and genetic diversity of natural *Carica papaya* populations throughout Mesoamerica to determine whether these populations are wild (populations derived from uncultivated stock) or feral (populations derived from individuals escaped from cultivation). A previous study on natural Costa Rican papaya populations illustrated a wide range of morphological diversity in reproductive structures and showed a high level of allelic diversity among these populations. This previous study, however, was limited in geographic scope because only populations from Costa Rica were sampled, while the range of natural papaya populations extends from Costa Rica north to Southern Mexico. An expansion of this project to include populations from Panama, Nicaragua, Honduras, Guatemala, and Southern Mexico combined with the data from Costa Rica will give a thorough analyses of gene flow among and within papaya populations. With 20 nuclear microsatellites, the structure and levels of genetic diversity will be measured to distinguish genetic relationships among populations and to untangle any shared genetic ancestry with cultivars. If results are similar to Costa Rican populations, we can infer there is some level of introgression from cultivated papaya into natural papaya populations. This could also provide more insight to the domestication history of this important tropical fruit crop.

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SMALL-SCALE GENOTYPIC DIVERSITY AND BREEDING DYNAMICS IN THE DESERT MOSS *SYNTRICHIA CANINERVIS*Jennifer Rodriguez, Kristen Fisher.

California State University, Los Angeles, Los Angeles, CA.

Syntrichia caninervis is a dominant moss in the Mojave Desert, where it plays an important role in the composition of biotic soil crusts. While individual patches of this moss species are typically assumed to represent multiple branches of the same clone (individual genotype), preliminary genotyping efforts on *S. caninervis* have indicated that small patches may, in fact, comprise multiple genetically unique individuals. Furthermore, sexual reproduction is relatively uncommon in *S. caninervis*, since male and female gametangia are produced by separate individuals, and fertilization distances are presumably very short. We have located a population of *S. caninervis* in the eastern San Gabriel Mountains that supports an unusually high frequency of sexual reproduction, as indicated by the presence of multiple sporophytes. Here, we characterize the fine-scale demographics of *S. caninervis* by densely sampled and genotype branches from the same patch as, or patches proximate to, sporophytes in order to answer these questions: How many individuals (unique genotypes) are present in a small patch of *S. caninervis*? Are individual branches within a small patch closely related (e.g. siblings)? What is the fertilization distance from male to female gametophyte? Are multiple sporophytes on a female gametophyte fathered by the same male?

CELL/MOLECULAR BIOLOGY

Ballroom C - 10

EXERCISE DURING PREGNANCY CONVEYS PROTECTIVENESS AGAINST MAMMARY TUMORIGENESIS IN RAT OFFSPRINGLeon Clah, Ignacio Camarillo.

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Breast cancer is the most frequently diagnosed cancer among women. Lifestyle factors such as physical activity and diet play a role in attenuating the incidence of breast cancer. Current research shows that exercise during pregnancy can convey long-term health benefits to offspring. The goal of this project was to determine if maternal exercise during pregnancy could lead to reduced mammary tumor development in female offspring. Female rats were divided into 2 groups, sedentary and exercise, with the exercise group given access to a running wheel only during pregnancy. Female pups were weaned at 21 days of age, were fed a high fat (HF) diet, and did not have access to an exercise wheel. At 6 weeks of age, pups were given a single injection of N-Methyl-N-nitrosourea (MNU) intraperitoneally

at 50 mg/kg. The study was conducted for 15 weeks, and the developing tumors were palpated and measured with calipers. Endpoint analyses revealed that pups from exercised dams (Exercise) had a lower tumor incidence (42.86%), as compared to pups from sedentary dams (Sedentary), having 100% tumor incidence. Exercise pups had a higher frequency of tumors at 1.67 tumors/rat than Sedentary at 1.17 tumors/rat. In addition to tumor monitoring, the intraperitoneal (IP) fat was collected and weighed against the weight of the animal at time of euthanasia. Exercise pups had an increase in IP fat (2.67%) over the Sedentary pups (1.60%). Collectively, these are the first data to demonstrate that short-term exercise during pregnancy can lead to reduced tumor development in offspring.

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VISUAL CONFIRMATION OF DE NOVO GENE TRANSCRIPTION OF X-LINKED MIRNA GENES THAT ESCAPE MEIOTIC SEX CHROMOSOME INACTIVATION

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MicroRNAs (miRNAs) are small, non-coding RNAs known to regulate gene expression at the post-transcriptional level, and potentially at the transcriptional level as well. Studies with gene knockouts have demonstrated that miRNAs are critically required for normal spermatogenesis and male fertility in mammals. We have previously shown that ~20% of testicular miRNAs map to the X-chromosome and that ~40% of these display testis-specific or testis-preferential expression. Surprisingly, real-time qPCR further revealed an increase in the expression of a majority of the X-linked miRNA transcripts in spermatocytes at a time when all 364 X-linked messenger RNA-encoding genes studied to date decline in expression due to meiotic sex chromosome inactivation (MSCI). Many of these genes also remain repressed by post meiotic sex chromatin (PMSC) in spermatids. We hypothesized that elevated levels of X-linked miRNA transcripts in primary spermatocytes are due to ongoing, active transcription, indicating escape of these genes from the repressive effects of MSCI. To test this hypothesis, we used immunofluorescence staining, DNA-fluorescence *in situ* hybridization (FISH), and RNA-FISH on spermatogenic cells from testes of adult mice. Our data confirm that type I, II, and III X-linked miRNAs suppressed by MSCI, escaping MSCI, or escaping MSCI and PMSC, respectively. Three-dimensional analyses obtained by reconstructing confocal images of spermatocyte nuclei indicate type II and III X-linked miRNA genes that escape MSCI undergo *de novo* transcription only at the periphery of the heterochromatic XY body. Further studies are under way to characterize the molecular mechanisms involved in escape of X-linked miRNA genes from MSCI or PMSC.

Ballroom C - 70

CYTOKINE STIMULATION OF MUC16 EXPRESSION IN HUMAN ENDOMETRIAL AND OVARIAN EPITHELIAL CELL LINES

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MUC16/CA125 is a high molecular weight, heavily glycosylated transmembrane mucin primarily found at the apical surface of normal epithelia. Mucins protect and lubricate against pathogenic infections. Membrane mucins are aberrantly over-expressed in many cancers including those of the uterus, ovary, and pancreas. Expression of MUC1, a well characterized mucin, is highly stimulated by the proinflammatory cytokines, tumor necrosis factor α (TNF α), and interferon γ (IFN γ), as well as by progesterone in various cellular contexts. High levels of all 3 factors are detected in uterine tissues at the same time that MUC1 is highly expressed. Also, we previously demonstrated that rosiglitazone inhibits MUC1 expression in a variety of contexts. We hypothesized that these same factors also might stimulate MUC16 expression. In this study, we describe that MUC16 mRNA and protein expression is stimulated 2 to 3-fold by TNF α (2.5 ng/ml) alone and 3 to 4-fold by IFN γ (20 IU/ml) alone in IHEEC cells, a telomerase immortalized human endometrial epithelial cell line. Interestingly, combined treatment with both cytokines resulted in a large (20 to 60-fold), synergistic stimulation of MUC16 mRNA and protein expression. Cytokine stimulation of MUC16 expression also was observed in several other cell lines indicating that this may be a general response. We currently are examining rosiglitazone responses and how the cytokine response is mediated at the level of the MUC16 promoter. Collectively, these studies demonstrate that MUC16 is a target of proinflammatory cytokine actions and may contribute to mucosal defense responses and progression of MUC16-expressing tumors. (Supported by NIH grant HD29963 awarded to DDC.)

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DEVELOPMENT OF AVIAN INNER EAR HAIR CELL CHIMERASGiovanni Diaz¹, Kazuo Oshima², Stefan Heller².¹*San Francisco State University, San Francisco, CA*, ²*Stanford University School of Medicine, Palo Alto, CA*.

One in five Americans have hearing loss. Hearing loss results from loss of inner ear sensory hair cells due to loud noises, aging, toxic chemicals, or genetic predisposition. In mammals, lost hair cells cannot be regenerated naturally. The Heller Laboratory has recently developed *in vitro* guidance methods for pluripotent mouse and human stem cells to generate otic progenitor cells. The differentiation of these progenitors into mature sensory hair cells has been promoted by coculture with non-sensory cells isolated from the developing chicken inner ear. Our goal is to increase the efficacy of otic cell differentiation and maturation by developing *in ovo* transplantation and *in vitro* cell suspension assays of mouse and human progenitor cells into the chicken embryo otocyst. We hypothesize that the developing chicken inner ear provides a superior niche for differentiation into sensory hair cells. We are working in parallel on both an efficient *in ovo* and *in vitro* avian-mammalian chimera model that would utilize the developing chicken inner ear as a micro niche for differentiation into hair cells and potential identification of factors involved in regeneration. Our objective is to optimize conditions for both Chimera *in ovo* transplantation and *in vitro* cell suspension model systems. Our studies will identify optimal conditions for differentiation of both models including the number of cells per suspension, medium, dissociation enzymes, culture duration, and ratio of mouse/human to chicken cells. The proposed study will provide an efficient platform for investigating the potential use of stem cell transplantation therapy to restore hearing.

Ballroom C - 2

ELUCIDATING THE ROLE OF WNT SIGNALING IN XENOPUS NEURAL CREST INDUCTIONStefanie Monica, Richard Harland.*University of California, Berkeley, Berkeley, CA*.

The neural crest (NC) is a vertebrate-specific population of multipotent cells, often referred to as the fourth germ layer because of their unique ability to migrate all over the body and form many different types of tissue. Precise control of BMP and Wnt signaling in both space and time is necessary for proper NC induction. While the distinct roles of Wnt and BMP signaling are well studied, the precise dose-response relationship between Wnt signaling and NC induction has not been elucidated. In this work, we aim to better understand the role of canonical Wnt signaling in NC formation. We used a small molecule activator of Wnt signaling (6-bromoindirubin-3'-oxime) and a small molecule inhibitor of BMP signaling (LDN193189) to systematically alter signaling in *Xenopus laevis* embryos. Using neuralized animal cap explants of *Xenopus laevis* embryos, we tested how different levels of Wnt signaling affect NC induction. *In situ* hybridization and RT-PCR were employed to quantify the level of gene expression of NC markers including *snail2*, *foxd3*, *Ap-2*, and *SoxE* family members *Sox8*, *Sox9*, and *Sox10*. Preliminary results confirm that the LDN drug induces neural tissue in animal caps, as evidenced by an increase in neural markers *Otx2* and *Sox2*. Additionally, treatment with both LDN and BIO induces NC tissue as demonstrated by an increase in NC markers *snail2* and *foxd3*. With this work, by regulating the degree of Wnt activation, we aim to describe the molecular mechanisms underlying the reiterative role of Wnt signaling in neural crest induction and maturation.

Ballroom C - 81

DISCOVERY OF A MACROPHAGE-BIGH3-APOPTOTIC AXIS IN DIABETIC NEPHROPATHYRobert Moritz, Richard LeBaron.*University of Texas, San Antonio, San Antonio, TX*.

Diabetic nephropathy (DN) is the most prevalent cause of end-stage renal disease. DN is manifested, in part, by extracellular matrix (ECM) accumulation in the kidney and renal cell injury. To further clarify the nature of ECM in diabetic renal damage, we are investigating the TGF β -induced proapoptotic ECM protein transforming growth factor beta-induced gene human clone 3 (BIGH3). Our study has uncovered a mechanistic link between macrophages, the synthesis and secretion of BIGH3, and the induction of apoptosis in kidney cells. Our histological examinations of diabetic mouse kidney cortex revealed an increase in infiltrating macrophages and BIGH3 protein in the interstitial matrix and basal lamina when compared to control cortex. Macrophages cultured under diabetic conditions enriched their medium with TGF β 1. This "diabetic" macrophage-conditioned medium (dMCM) promoted BIGH3 expression and apoptosis in renal proximal tubule cells (RPTEC). Exposing these cells to recombinant BIGH3 also induced apoptosis. Importantly, an inhibitor of TGF β 1 receptor signaling decreased dMCM-induced RPTEC apoptosis, as did anti-BIGH3 antibody. These results provide evidence for a macrophage-BIGH3-apoptotic axis in progression of DN. Our previous

studies have implicated integrins in BIGH3-induced apoptosis. Uncovering the integrin type involved in our proposed mechanistic axis is the next objective of our research on understanding BIGH3 actions in DN. Collectively our findings are expected to lead to novel agents and targets for clinical intervention in diabetic nephropathy.

Ballroom C - 58

ROLE OF INTERPHOTORECEPTOR RETINOID-BINDING PROTEIN ON THE TRANSFER OF ATROL AND 11CROL IN THE CONE VISUAL CYCLE

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There is a growing body of experimental evidence implicating interphotoreceptor retinoid-binding protein (IRBP) as a key protein involved in transferring all-trans retinol (atROL) and 11-cis-retinol (11cROL) in the novel cone-specific visual cycle. It is well known that in the classical visual cycle, retinoids are transferred between the retinal pigment epithelium (RPE) and the photoreceptor cells; however, in the cone cycle, retinoids are transferred between Müller glial cells and cone photoreceptors. Recently we have shown that IRBP binds to and protects atROL and 11cROL in a light-dependent manner *in situ*. We now hypothesize that IRBP not only functions to protect retinoids from degradation, but also is responsible for the transfer of retinoids between Müller cells and cone photoreceptors. To test this, primary Müller cells will be explanted from freshly isolated chicken retinas and grown to confluence (approx. 14 days). Cells will then be treated with 2 µM of either 11cROL or atROL along with 0, 1.0, 10, or 100 µM IRBP and incubated for 24 hrs at 37 C + 5% CO₂ under photopic conditions. Following the 24 hr incubation, cells will be harvested and homogenates prepared. Retinoids will be extracted and then identified and quantified by HPLC. Results from these experiments will provide evidence supporting IRBP's role in vitamin A regeneration in the cone visual cycle, a molecular mechanism that remains largely unknown.

Ballroom C - 133

KINETOCHORE COMPONENT LOCALIZATION AND FUNCTION DURING SPERMATOGENESIS MAY DEPEND ON SPERM-SPECIFIC PP1 PHOSPHATASES

Joseph Beyene, Diana Chu.

San Francisco State University, San Francisco, CA.

Male infertility affects millions of couples within the US. Male fertility and sperm function depend upon proper chromosome segregation during meiosis. However, little is known about the molecular components required for chromosome segregation during sperm meiosis. Our lab examines the role that PP1 phosphatases, GSP-3/4, have in *C. elegans* sperm meiosis. GSP-3/4 are sperm-associated protein phosphatases that are 98% identical. While *gsp-3/4* mutants are infertile and *gsp-3/4* mutant sperm chromosomes fail to segregate properly during meiosis, the specific roles GSP-3/4 have in chromosome segregation remains unknown. During meiosis, microtubules attach to kinetochores to pull chromosomes apart. We have found that GSP-3/4 colocalize with kinetochore components. Thus, we hypothesize that GSP-3/4 are required for the correct localization and function of kinetochore components during spermatogenesis. Consistent with this, we have found that a kinetochore component called HCP-2 mislocalizes in *gsp-3/4* male mutants, suggesting a dependency upon GSP-3/4 for kinetochore localization. We are using cytology to visualize if GSP-3/4 regulate additional kinetochore components. These results will elucidate the extent to which GSP-3/4 regulate kinetochore localization during spermatogenesis. Furthermore, we aim to visualize kinetochore and microtubule interactions in *gsp-3/4* male mutants. This will allow us to observe how changes in kinetochore components influence microtubule attachment to sperm chromosomes. In *gsp-3/4* mutants, we anticipate that there will be aberrant kinetochore localization along with abnormal attachment of microtubules to chromosomes. Our work will demonstrate sperm-specific aspects of kinetochore components and their dependency on GSP-3/4 for proper localization.

Ballroom C - 118

A GENOMICS AND PROTEOMICS APPROACH TO STUDY PLANT DEFENSE RESPONSE AGAINST INSECT HERBIVORE

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Plants receiving green leafy volatiles (GLV) prime their defenses resulting in a stronger and faster response when under actual attack. This has been tested to date on a variety of plant species. In a metabolic analysis of different plant species, we found that free fatty acids accumulate rapidly upon treatment with GLV, and that this increase in free

fatty acids enhanced the response to subsequent insect elicitor (IE) treatment. Microarray analysis of transcriptional networks activated in corn in response to GLV or IE in corn (*Zea mays*) identified specific transcriptional networks. However, in both studies, the temporal information was limited and did not allow for a more transcriptional analysis. Therefore, we plan to expand these first studies by analyzing a longer time frame. Since no such study has ever been performed with dicot plant, we plan to perform a similar analysis with *Arabidopsis*. The goal of this activity is to identify the transcriptional networks activated by GLV in different plant species. We will identify similarities and differences in response to these volatile signals. We will characterize the consequences of this signaling by monitoring changes in the proteome. Additionally, we will analyze transcriptional networks in response to IE in 2 plant species and compare those with the respective proteome. The outcome of this study will help to establish GLV as volatile signaling compounds and their acceptance as a major plant hormone. (Partially funded by NSF LSAMP-BD 1249284.)

Ballroom C - 137

WHOLE GENOME TRANSCRIPT PROFILING ANALYSIS OF TDRD7 NULL MOUSE MUTANT LENS

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The lens is a transparent tissue of the eye that serves to focus light on the retina for optimal visual acuity. Loss of lens transparency results in a disease termed "cataract" which affects ~77 million individuals and accounts for ~50% cases of blindness worldwide. Specialized lens cells termed "fiber cells" function to render the lens transparent by undergoing a terminal differentiation program that involves dramatic regulation of gene expression accompanied by cellular elongation and organelle degradation. We have identified an RNA binding protein and RNA granule component TDRD7, mutations in which are associated with posterior polar cataract in pediatric patients. We hypothesize that TDRD7 mediates post-transcriptional control of gene expression in fiber cells. *Tdrd7* null mouse mutants closely phenocopy the human cataract and thus present an excellent resource for investigating TDRD7 function in the lens. We intend to perform RNA sequencing to identify differentially regulated transcripts and potential splice variants in *Tdrd7* null mouse mutant lens. Furthermore, we intend to test if *Tdrd7* nullizygosity affects the expression of small RNAs (e.g., miRNAs, piRNAs, and snoRNAs) in the lens. Additionally, to test if different RNAs are preferentially localized in different regions of the elongated fiber cells, we are using laser capture microdissection to isolate apical and basal regions of mouse fiber cells for gene expression profiling by microarrays. These approaches will identify the molecular targets/components of the *Tdrd7* pathway, which in turn will provide novel insights into the etiology of congenital posterior polar cataract in humans.

Ballroom C - 15

SCREEN FOR NUCLEAR-ENCODED SPLICING FACTORS FOR YEAST MITOCHONDRIAL GROUP II INTRONS

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Hypothesized to be ancestors of eukaryotic spliceosomal introns, extant group II introns have been found in bacteria Archaea and in the mitochondria and chloroplast genomes of some eukaryotes. Sometimes referred to as molecular fossils, some of these catalytic RNAs may encode an intron-encoded protein (IEP) that has reverse-transcriptase, RNA splicing, DNA binding, and DNA endonuclease activities. Not all group II introns, however, encode an IEP, eliciting the question as to how these introns are spliced out. Two such model introns are the mitochondrial (mt) introns *al5y* and *bl1* in *Saccharomyces cerevisiae*. Previous *in vitro* studies on the self-splicing activity of these introns have revealed requirements of nonphysiologically high salt concentration and temperature for catalytic activity, suggesting dependence upon proteins *in vivo*. With most mitochondrial proteins known to be encoded by the nucleus, it seems highly likely that some exist to assist, either directly or indirectly, in the correct splicing of these mt introns. Previous searches for such mutants relied on a combination of 2 screens: looking for a glycerol (Gly) phenotype in the presence of a given intron and Gly⁺ phenotype in the intron's absence. In contrast, this study employs a rapid method that uses northern hybridization to identify splicing defects in null mutants, allowing for recognition of proteins that would not have been detectable by other methods. Preliminary results suggest involvement of multiple proteins and a possible splicing complex situated at the surface of the mt inner membrane in close association with mt ribosomes.

Ballroom C - 25

RNA-FLOURESCENCE *IN SITU* HYBRIDIZATION PROBE DESIGNLuis Flores, Enrique Sosa, John R. McCarrey.*University of Texas at San Antonio, San Antonio, TX.*

RNA fluorescence *in situ* hybridization (RNA-FISH) is a powerful technique used to detect sites of *de novo* transcription in cells. RNA-FISH can be used in combination with immunofluorescence staining to detect gene expression in specific cell types. We have optimized the RNA-FISH protocol for use in spermatogenic cells. We have designed RNA-FISH probes to be used to determine the transcriptional timing of X-linked microRNA (miRNA) genes that escape the process of meiotic sex chromosome inactivation (MSCI) during prophase I of spermatogenesis. Thus far, we have successfully produced RNA-FISH probes for the control genes *Ataxia telangiectasia* and *Rad3 related* (*Atr*) and α -crystalline (*Cryaa*). *Atr* is a constitutively expressed autosomal gene and therefore serves as a positive control, while *Cryaa* is a gene that is terminally repressed in spermatogenic cells and serves as a negative control. We have also produced probes specific to X-linked miRNAs that escape MSCI. This approach will allow us to assess the extent to which X-linked miRNA genes escape MSCI during spermatogenesis and allow us to determine the precise timing of X-linked miRNA transcriptional activity in relation to normal X-linked mRNA gene inactivation due to MSCI.

Ballroom C - 24

RNA INHIBITION OF LATE MITOTIC TARGETS THAT REDUCE MITOTIC SLIPPAGE IN *DROSOPHILA* S2 CELLSLuis Soto, Blake Riggs.*San Francisco State University, San Francisco, CA.*

Chemotherapy is one of the most widely used cancer treatments; however, it is not effective against all types of cancer. It has been shown that some cancer cells escape the mitotic arrest caused by chemotherapeutic drugs and exit mitosis without completing chromosome segregation. This phenomenon is known as mitotic slippage and it can confer resistance to chemotherapy by allowing cancer cells to exit mitosis before the onset of apoptosis caused by a prolonged mitotic arrest. Recently, a study showed that blocking the regulatory machinery that drives mitotic exit eliminates mitotic slippage. However, this study relied on depleting a regulatory protein to levels below 5%, which may not be a practical therapeutic strategy. Therefore, our research aims to identify better targets for blocking mitotic slippage. I hypothesize that knockdown of late mitotic targets via RNA interference (RNAi) will block mitotic slippage and induce apoptosis in *Drosophila* S2 cells. To determine the efficiency of each knockdown, we will use time-lapse microscopy to visualize the number of cells that undergo apoptosis in the presence of a chemotherapeutic drug and compare these results to the number of cells that undergo mitotic slippage under the same conditions. Mitotic slippage will be determined by measuring DNA content of surviving cells via FACS. Cells that undergo mitotic slippage should be tetraploid because they exit mitosis prior to chromosome segregation. To conclude, the identification of better targets for blocking mitotic slippage could provide a way to improve current chemotherapeutic treatments and advance the field of cancer research.

Ballroom C - 27

NINE POSTTRANSLATIONAL MODIFICATIONS DURING THE BIOSYNTHESIS OF CINNAMYCIN AND THE TAILORING ENZYMESAyse Okesli¹, Wilfred van der Donk².¹*University of Illinois at Urbana-Champaign, Urbana, IL,* ²*Howard Hughes Medical Institute, University of Illinois at Urbana-Champaign, Urbana, IL.*

Lantibiotics are ribosomally synthesized and post-translationally modified antimicrobial peptides that are characterized by the thioether cross-linked amino acids lanthionine (Lan) and methylanthionine (MeLan). Cinnamycin is a 19-amino-acid lantibiotic that contains one Lan and two MeLan. Cinnamycin also contains an unusual lysinoalanine (Lal) bridge formed from the ϵ -amino group of lysine 19 and a serine residue at position 6, and an erythro-3-hydroxy-L-aspartic acid resulting from the hydroxylation of L-aspartate at position 15. These modifications are critical in mediating the interactions of cinnamycin with its target, phosphatidylethanolamine. Recently, the cinnamycin biosynthetic gene cluster (*cin*) from *Streptomyces cinnamoneus* DSM 40005 was reported. Herein, we investigated the biosynthetic machinery using both *in vitro* studies and heterologous expression in *Escherichia coli*. CinX is an R-ketoglutarate/iron(II)-dependent hydroxylase that carries out the hydroxylation of aspartate 15 of the precursor peptide CinA. In addition, CinM catalyzes dehydration of 4 Ser and Thr residues and subsequent cyclization of Cys residues to form the three MeLan bridges. The order of the post-translational modifications catalyzed by CinM and CinX is interchangeable *in vitro*. CinX did not require the leader sequence at the N-terminus of CinA for activity,

but the leader peptide was necessary for CinM function. Although CinM dehydrated serine 6, it did not catalyze the formation of Lal. A small protein encoded by cinorf7 is critical for the formation of the cross-link between Lys19 and dehydroalanine 6 as shown by coexpression studies of CinA, CinM, CinX, and Cinorf7 in *E. coli*.

Ballroom C - 55

DETERMINATION OF THE MEMBRANE TOPOLOGY OF PORCUPINE

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Wnt signaling is critical for proper embryonic development and adult tissue homeostasis. The palmitoylation of Wnt proteins by Porcn, a multitransmembrane spanning protein, is required for Wnt signaling. Porcn is localized to the endoplasmic reticulum (ER), Golgi, and cell surface. Mutations in Porcn cause dramatic defects in mice and humans. Though the developmental roles of Porcn are known, its topology is poorly understood. Although numerous bioinformatic algorithms that predict membrane topology are available, no clear prediction for Porcn has emerged. Thus, we initiated experiments to experimentally determine the topology of Porcn. Our preliminary data orient the N and C terminus towards the luminal and cytosolic sides of the ER, respectively. Moreover, introducing N-linked glycosylation sites into Porcn showed that an A174N point mutation results in glycosylation, indicating ER lumen localization. Cumulatively, our bioinformatic and experimental data led us to hypothesize that Porcn has 11 TM domains and that Cys 17 is the only cysteine residue oriented toward the ER lumen/cell surface. Immunostaining with a polyclonal antibody targeted against Porcn residues 281-301 localizes this region to the cytosol and is consistent with our hypothesis. Labeling of Porcn-expressing cells with biotin-maleimide further shows that at least one cysteine residue is present on the cell surface. We are now testing whether substitution of Cys 17 will remove all maleimide reactive sites in the Porcn protein that are localized to the cell surface. These data will provide strong evidence for the proposed model. Additional experiments will be carried out to further validate this model.

Ballroom C - 14

CHEMICALLY DIVERSE MICROTUBULE STABILIZERS CAUSE DISTINCT DYSREGULATION OF KEY MITOTIC PROTEINS

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Microtubule stabilizers are some of the most useful and successful drugs used to treat adult solid tumors. However, the molecular events responsible for their antimitotic actions are not yet fully understood. In this study, we evaluated the mitotic defects and signaling events initiated by three structurally different microtubule stabilizers: taccalonolide AJ, laulimalide/fijianolide B, and paclitaxel. These agents cause the formation of aberrant, but morphologically distinct, mitotic spindles leading to the hypothesis that they initiate distinct mitotic signaling events. Each microtubule stabilizer caused different patterns of expression of key mitotic signaling proteins. Taccalonolide AJ caused centrosome separation failure to a much greater extent than paclitaxel or laulimalide. Taccalonolide AJ is also unique in that it was the only stabilizer to cause centrosome disjunction failure. These observations were consistent with the different defects in expression and activation of *Plk1* and *Eg5* caused by each stabilizer. Localization studies revealed that TPX2 and Aurora A are associated with each spindle aster formed by each stabilizer, which suggests a common mechanism of aster formation. However, taccalonolide AJ was the only one that caused pericentrin accumulation on every spindle aster. Pericentrin's localization to every spindle aster could facilitate the stability of the highly focused asters formed by taccalonolide AJ. Laulimalide and paclitaxel caused completely different patterns of expression and activation of these proteins, as well as phenotypically different spindle phenotypes. Determining how chemically distinct microtubule stabilizers disturb mitotic signaling could identify key proteins involved in controlling sensitivity and resistance to the antimitotic actions of these agents.

ECOLOGY

Ballroom C - 23

ASSOCIATIONS BETWEEN DEMERSAL FISHES AND STRUCTURE-FORMING INVERTEBRATES IN TEMPERATE WATERS ON THE CONTINENTAL SHELF OF THE PACIFIC NORTHWEST

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Plans are underway to deploy wave-energy capture devices off the coast of the Pacific Northwest as a solution to the region's ever-growing demand for energy. Implementation of wave energy fields could have far-reaching effects on structure-forming invertebrates, which are slow growing, fragile, and sensitive to siltation. Impacts on these invertebrates could in turn have adverse effects on associated fish species by reducing available or preferred habitat. We aim to evaluate the extent to which fishes associate with the structure-forming invertebrate community at sites that may be impacted by wave energy generation. Video footage was collected for this study by the remotely operated vehicle (ROV) Hammerhead from Gray's Bank, Washington, and Siltcoos Reef, Oregon, in late summer 2011. We characterized the proximity of 660 individual fishes with 907 structure-forming invertebrates in the study area. More than 75% of individual fishes were within 1 body length of an adjacent invertebrate. Chi-squared tests suggest a difference in associating groups of fishes between soft-sediment and hard-bottom habitat. Furthermore, regression testing showed significant relationship between structure-forming invertebrates and fish in only the soft-sediment habitat; however, the relationships observed were weak. Ultimately, the hard substrate provided by wave energy structures in a soft-bottom environment may be more important to demersal fishes than structure-forming invertebrates.

Ballroom C - 71

HABITAT-RELATED FOOD PREFERENCES IN BRUSH MICE (*PEROMYSCUS BOYLI*) EVIDENCE FROM FEEDING TRIALS AND ISOTOPES

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Habitat generalists are species that use multiple types of habitat; however, individuals within such generalist species may specialize on particular habitat types or resources within habitats. The brush mouse (*Peromyscus boylii*) is found in multiple habitat types in western North America. Within this species, individuals exhibit strong preferences for the type of habitat they were born and reared in, and habitat preferences may be partially driven by experience with or preferences for foods associated with that natal habitat type. We used cafeteria trials to investigate food preferences of mice from oak woodland and chamise chaparral habitats. Mice were simultaneously offered 8 food types. There were no significant differences in the amount of each food type that was consumed between mice originating in woodland versus chaparral habitats. However, brush mice from both habitat types preferred acorns to other types of food. In feeding trials, acorns were offered without the outer shell, decreasing handling time. Mice may have favored acorns due to the higher energetic content of acorns as compared to the other food types offered. In addition, a pilot isotope study has been initiated to determine if differences in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ isotopes in mouse fur samples are linked to habitat of origin.

Ballroom C - 86

PATTERNS OF COSPECIATION AND HOST SWITCHING IN AVIAN MALARIA PARASITES OF AFRICAN SUNBIRDS (FAMILY NECTARINIIDAE)

Elvin Laron, Ravinder Sehgal.

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The malaria parasite *Plasmodium falciparum* is one of the world's most devastating and widespread parasites, killing more people than any other parasitic infection. Parasites of this genus can also exploit multiple vertebrate hosts including reptiles, mammals, and birds. Furthermore, malaria parasites of birds are found on all continents of the world except Antarctica. The potential for these widely spread avian plasmodium parasites to leap into new hosts has conservation implications, as was seen in the endemic bird populations of Hawaii. The host-specificity, pathogenenicity, and geographical distribution of avian plasmodium are influenced by the life history of the host-parasite relationships. However, understanding these processes requires an extensive sampling of parasite distributions across hosts. We thus sought to understand the history of avian plasmodium and the widespread

bird family, Nectariniidae. These birds spread from Asia to Africa. After arriving in Africa, they rapidly diversified. To determine whether Nectariniidae speciation led to congruent parasite speciation in Africa, we generated a three-genome phylogeny of avian plasmodium found in Nectariniidae and performed a cophylogenetic analysis using an existing Nectariniidae phylogeny. Our co-phylogenetic analysis indicates the extent of avian plasmodium parasite cospeciation, host switching, sorting, and duplication events that occurred in the sunbirds.

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THE INFLUENCE OF HABITAT COMPOSITION AND FOOD AVAILABILITY ON MIGRATORY AND RESIDENT BIRD ABUNDANCE AND DIVERSITY IN A SUBTROPICAL DRY FOREST IN SOUTHEASTERN PUERTO RICO

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Habitat selection on the wintering grounds is crucial for migratory bird survival and for a successful migration. Vegetation features can influence resource availability for birds, an important factor affecting habitat selection. We will identify the use of secondary dry forest by both migratory and resident birds. Using 3 sites with distinct degrees of disturbance and successional stages, we will evaluate the abundance and diversity of avian communities depending on the characteristics of each site, including plant composition and arthropod abundance. For this, fixed-radius point counts and mist netting will be used in order to quantify bird presence and fitness (body condition index, BCI). For site characterization, plant identification, relative density, frequency, and dominance will be assessed using point-centered quarter methods (PCQM). Arthropod sampling will include branch clippings and leaf litter collection for canopy and floor insect communities. Special focus will be placed on sedentary species, those known to roost in their foraging habitat: 1 migrant (Ovenbird, *Seiurus aurocapilla*) and 1 resident (Bananaquit, *Coereba flaveola*), assessing body condition and possible interactions within the habitat. Potential relationships of habitat structure and vegetative composition (or tree dominance) with avian species richness and body condition will be assessed. With this information, habitat use can be evaluated so as to establish better conservation plans for migratory and resident birds, bringing additional information for the restoration and conservation of favorable spaces.

Ballroom C - 31

INFLUENCES OF FOOD WEB STRUCTURE ON VECTOR ABUNDANCE AND CHAGAS DISEASE TRANSMISSION IN CENTRAL PANAMA

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Food webs can provide information on how ecosystem structure influences infectious disease agents; however, understanding how food webs influence pathogen transmission remains unclear, particularly in relation to vector-borne pathogens. Chagas disease (CD), an illness that affects millions of people in the Americas, is caused by a protozoan parasite, *Trypanosoma cruzi*. The main vector for CD in Panama is the reduviid bug, *Rhodnius pallescens*, which primarily inhabits the palm tree *Attalea butyracea*, found in lowland tropical areas throughout Panama. The abundance of *R. pallescens* increases in areas of anthropogenic disturbance, but the actual mechanism of abundance increase is not understood. The objective of this study is to determine whether there is a significant relationship between food web community/structure and vector dynamics by identifying how variations in palm tree species community and trophic relationships influence *R. pallescens* abundance, population structure, and infection with trypanosomes across levels of anthropogenic disturbance in Central Panama. Individual *Attalea butyracea* palms will be cut down and dissected in order to determine palm tree species composition. Floral and faunal species living within the palm crown will be recorded using observation methods. Parasitoids, parasites (including *T. cruzi*), and blood meal composition will be detected within *R. pallescens* using molecular diagnostics PCR and next generation sequencing (NGS). By incorporating disease and food-web ecology within a network modeling framework, this project can increase our understanding of anthropogenic effects on host-parasite interactions and the indirect impacts habitat disturbance has on disease transmission of multihost, vector-borne pathogens.

Ballroom C - 4

EXAMINING BIVALVE COMMUNITY SHIFTS OVER TIME IN SEVERAL BAYS IN SAN DIEGO, CALIFORNIA, AND NORTHERN BAJA CALIFORNIA, MEXICOAnai Novoa¹, Drew Talley¹, Theresa Sinicrope-Talley².¹*University of San Diego, San Diego, CA*, ²*University of California, San Diego, La Jolla, CA*.

Many bivalves have been depleted from their native estuaries through direct and indirect human effects, including overharvesting, habitat loss and alteration, pollution, and introduced species invasions. The loss of native bivalves can result in the loss of the ecosystem functions that they provide such as water filtration, soil aeration, biodeposition, bioturbation, attachment substrate for epibionts, and refuges for free-living fauna. Shifts in bivalve communities may be especially prevalent in developed coastal ecosystems such as southern California and northern Baja California, where human development and impacts are high. Sporadic studies of the bivalve communities within estuaries throughout this region over the past 50 years indicate dramatic local shifts in bivalve communities. If we hope to predict the future change of these communities and the ecosystem services they provide, we need a better understanding of both the local and regional trends and causes of changes in bivalve communities through time and across gradients of natural variability. In this project, we use historical bivalve datasets with additional sampling to address long-term (30 to 50 yr) regional bivalve community shifts in several bays in San Diego, California, and northern Baja California, Mexico. We expect to see decreases in density and diversity of large, edible species associated with overexploitation; increases in introduced invasive species; and decreases in surface-dwelling species, all of which may be an indirect inhibition response to invasive species.

ENVIRONMENTAL SCIENCE/STUDIES

Ballroom C - 7

ANALYZING CHANGES TO CORAL HEALTH AND METABOLIC ACTIVITY IN AN OXYGEN DEPAUPERATE ENVIRONMENTJames Murphy, Robert Richmond, Jon-Paul Bingham.*University of Hawaii at Manoa, Honolulu, HI.*

Scleractinian corals play a critical role in marine ecosystems by providing essential structure for coral reef habitats. However, recent investigations have found an alarming increase in coral death as the result of stressors, which threaten the general health of tropical coastal environments. Of particular interest is the effect of invasive algal overgrowth on the health of Hawaiian corals through the effects of anaerobic respiration. The fast-paced growth of *Gracilaria salicornia* gives this alga the ability to overgrow coral heads, restricting water flow and light, thereby smothering corals. Field data shows hypoxic conditions ($\text{DO}_2 < 2 \text{ mg/L}$) occurring underneath algal mats at night, and the concurrent bleaching and partial tissue loss of shaded corals. This study aimed to simulate hypoxia in a laboratory setting in order to limit the effect of environmental variables on coral health. Analyses of stress in corals due to anoxia were accomplished through the quantification of lactate (LDH), alanopine (ADH), strombine (SDH), and octopine dehydrogenases (ODH). Treatment corals were found to exhibit almost complete tissue loss, severe bleaching, and significantly increased ADH/SDH activity with increasing hypoxia exposure duration. Conversely, control corals were found to exhibit little to no tissue loss, bleaching, or significant increases in enzyme activity throughout the treatment cycle. These findings suggest anoxia as a major source of increased coral stress, which possibly occurs in response to hypoxic conditions, such as invasive algae mat smothering, and provide insight into coral tolerance to controlled, extremely low-oxygen environments.

Ballroom C - 141

BIOACCESSIBILITY, RELEASE KINETICS, AND MOLECULAR SPECIATION OF ARSENIC AND LEAD IN GEO-DUSTS FROM THE IRON KING MINE FEDERAL SUPERFUND SITE IN HUMBOLDT, ARIZONANazune Menka, Jon Chorover, Rob Root, Eduardo Saez, Clark Lantz, Wendell Ela.*University of Arizona, Tucson, AZ.*

Arizona has approximately 60,000 to 100,000 abandoned or inactive mining sites. Mine tailing disposal sites in arid areas such as Arizona are susceptible to wind erosion and become sources of airborne particulate matter or geo-dusts including $<10 \mu\text{m}$ (PM10) and $<2.5 \mu\text{m}$ (PM2.5). These particles are comprised of contaminants such as arsenic and lead that are detrimental to human health. Climate models predict that the southwestern US will

become increasingly drier, increasing the importance of the harmful effects of these airborne metal and metalloid contaminants. This research aims to use surface tailings to 1) identify the particle size fractions of airborne arsenic due to wind erosion, 2) determine the bioaccessibility of arsenic in simulated lung and gastric fluids, and 3) determine the molecular speciation via post-extraction analysis of the remaining tailings using synchrotron-based X-ray absorption spectroscopy (XAFS and XANES) and x-ray diffraction (XRD). Solutions were analyzed for solubilized arsenic and lead using an acid digestion and ICP-MS. Mine tailing crust samples were collected and sieved to obtain size fractions relevant to ingestion (<150 µm) and inhalation (<2.5 µm). These size fractions were then extracted with simulated gastric and lung fluids to determine the bioaccessibility of arsenic and lead of the different size fractions. Kinetic studies included short-to-long residence time steps to determine the reaction rate. We hypothesize that 1) smaller particles with greater surface area have accelerated kinetics of arsenic and lead release, and 2) bioaccessibility is a predictable function of the local contaminant-bonding environment as revealed from spectroscopy.

Ballroom C - 110

IMPACTS OF SEA OTTER RECOLONIZATION ON KELP FOREST COMMUNITIES IN SOUTHEAST ALASKA

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Interdisciplinary research is needed to study the effects of top-level predators on process, function, and resilience in marine ecosystems. The reintroduction of sea otters to southeast Alaska following their extermination in the 19th century fur trade provides an opportunity to study the structure of marine ecosystems along a gradient of occupation of a top-level predator. The expansion of sea otter populations in southeast Alaska has negatively impacted commercial, sport, and subsistence shellfish fisheries, but it is possible that sea otter colonization may benefit other fisheries because otters promote a diverse kelp-dominated ecosystem. Fishery species that rely on kelp for spawning, nursery, or adult habitat might be expected to benefit from sea otters. Ecological theory predicts that systems with top-level predators are more stable than those with top-level predators removed. We will investigate these processes by collecting ecological data using SCUBA survey techniques to study the effects of sea otter recolonization (no otters, recently colonized more than 2 years, established more than 10 years, and established less than 20 years) on kelp, fish and invertebrate communities throughout southeast Alaska. Our interdisciplinary study will include local and traditional knowledge through semi-directed interviews on the abundance, distribution, and impacts of sea otter recolonization. Ultimately, our goal is to use input values drawn from resource users and stakeholders as well as analytical information from statistical analyses and conceptual models to estimate the current location, amount, and value of otter-mediated kelp forest ecosystem services and tradeoffs under different management alternatives.

Ballroom C - 146

CONTAMINANT ACCUMULATION IN NEOTROPICAL MIGRANTS DURING MIGRATION

Alejandra Maldonado, Miguel Mora.

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It has been hypothesized that migratory birds accumulate their contaminant burdens while on their wintering grounds. The purpose of this study was to determine seasonal variation of contaminant accumulation in migratory songbirds during migration. The potential for exposure differs among feeding guilds due to specific ways in which contaminants move through food webs. This project also aimed to evaluate the diet and trophic position of birds. Samples were collected from sites located in Texas, Mexico, and Costa Rica during the fall, winter, and spring migration periods. Birds were analyzed for persistent organic pollutants. In addition, feather, liver, and stomach content samples were analyzed for stable isotopes of carbon and nitrogen to examine diet and trophic relations. Understanding how contaminants impact migratory songbirds is critical for their protection and conservation. Information from this study can be used in conducting risk assessments of avian wildlife and incorporating this knowledge further into conservation efforts.

Ballroom C - 139

EMPOWERING CLIFTON, ARIZONA, RESIDENTS THROUGH EDUCATION TO PROTECT THE SAN FRANCISCO RIVER

Berenise Rivera, Channah Rock.

University of Arizona, Tucson, AZ.

The Arizona Department of Environmental Quality (ADEQ) is a regulatory agency that maintains a 303d list of locations that do not meet clean water regulatory standards. As of 2008, ADEQ listed 17 impaired watersheds

throughout the state of Arizona on the 303d list due to *E. coli* presence higher than the US EPA-set standards. The Gila River is listed on the 303d list, and it is comprised of the Upper Gila River Watershed from Coolidge Dam to the Arizona-New Mexico border and covers about 6,000 square miles. The objective of this study is to evaluate community perception on water quality of the San Francisco River in Clifton, Arizona, composed of about 56% Hispanic population. Preliminary survey results on water quality of the San Francisco River (SFR) consisted of 48% of people surveyed thinking the SFR has poor water quality for swimming. Also, the majority of respondents are concerned with poor water quality and their health. Sixty percent of people get information from the newspaper, factsheets, or brochures, and 52% of people get information from conversations with others. This presentation will describe the use of information, such as fact sheets/brochures on water quality and human health and a one-day workshop on basic microbiology, and the impact in community stewardship leading to behavior change. This data will be used to understand the interaction between research and the public to promote greater understanding of the issues that impact water quality and human health.

GENETICS

Ballroom C - 154

USING *CAENORHABDITIS ELEGANS* AS A MODEL FOR OXYGEN-DEPRIVATION RELATED DISEASE

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Oxygen deprivation is central to a number of human health issues including stroke and myocardial infarction, and there are numerous factors that predispose individuals to an increased risk of death from oxygen-deprivation related disease. These factors include obesity, diabetes, family history (genetic makeup), and age. To better understand the genetic and cellular pathways involved in the pathology of these combinatory stresses, we employed the model system *C. elegans*, a soil nematode. *C. elegans* is particularly well suited for this work given that it is a powerful genetic model system and has the ability to survive severe oxygen deprivation. In *C. elegans*, specific hallmarks of the disease process can be modeled through genetic and environmental manipulation in order to better understand the associations between genotype, diet, age, and oxygen deprivation responses. We are using *C. elegans* to examine how diet and genotype influence oxygen-deprivation response and survival. Wild-type, 1-day old *C. elegans* fed a normal diet are able to survive exposure to short-term (24 hrs) oxygen deprivation (anoxia). However, animals fed a glucose-supplemented diet show a significant reduction in survival in response to the same treatment, suggesting that glucose supplementation negatively impacts anoxia survival, and that a homeostatic balance of carbohydrate stores is important. Additionally, this diet-induced anoxia sensitivity can be modulated genetically and can be suppressed by mutations in genes in highly conserved pathways, including insulin-like signaling. Additional analysis will allow us to further characterize the specific genes and signaling pathways involved in anoxia survival on a high-carbohydrate diet.

Ballroom C - 134

ALLELE-SPECIFIC PROTEIN EXPRESSION AND PHOSPHORYLATION IN A DIPLOID YEAST SPECIES

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Diploid organisms, such as humans, carry 2 copies of DNA: 1 from each parent, or 2 alleles for each gene. These alleles can harbor distinguishing divergent mutations. Diploid strains of the single-celled fungus, *Saccharomyces cerevisiae*, baker's yeast, also carry copies in a similar way. We are interested in understanding how the expression of each parental copy is regulated. In this study, we use 3 yeast strains (*S. cerevisiae*, *S. bayanus*, and their hybrid) as a model. We measure relative protein abundances between the 2 parental strains and their hybrid descendant using mass spectrometry. We ask: what is the protein-allele specific expression in the hybrid? We report the relative abundance of each parental allele in the hybrid for ~1,400 proteins and determine to which functional proteins groups each belongs. We also measure the relative amounts of protein phosphorylation between *S. cerevisiae*, *S. bayanus*, and each allele in the hybrid species. Our work will shed light on how different species and individuals might vary in terms of protein regulation and signaling regulation.

Ballroom C - 145

GENOME INSTABILITY AS A NOVEL MOLECULAR MARKER FOR PHENOTYPIC ROBUSTNESSGrace Mason, Keisha Carlson, Christine Queitsch.*University of Washington, Seattle, WA.*

Phenotypic robustness is the ability of organisms to develop into wild-type adults despite genetic and environmental perturbations. In the genetic model organism *Arabidopsis thaliana*, we have shown that decreasing robustness by inhibiting the protein chaperone HSP90 increases the penetrance and heritability of traits. Based on our data and similar observations in other diverse model organisms, we hypothesize that differences in robustness among humans may account for the variability in penetrance of disease alleles and the missing heritability of complex traits. Currently, we measure robustness by calculating the variance in a quantitative trait among many isogenic siblings. High variance of a trait indicates low robustness. In order to predict the effect and heritability of genetic variants in individuals and nonmodel organisms, our goal is to identify molecular markers that correlate with an individual's robustness. An excellent candidate for a molecular signature of robustness is genome instability. For example, in human cells, reduction of HSP90 increases mutation rates of microsatellites, and in fruit flies it increases transposon mobility. We demonstrate that reduced HSP90 activity, and thereby low robustness, in *A. thaliana* correlates with increased somatic homologous recombination and microsatellite slippage. By measuring robustness using traditional methods, we show that genome instability mutants in *A. thaliana* have lower robustness than wild-type plants. Therefore, genome instability can serve as a molecular marker for an individual's level of robustness and potentially as a predictor for the penetrance of genetic variants in complex traits and disease.

Ballroom C - 26

EXPLORING POPULATION GENETICS AND ESSENTIAL HABITAT OF SNOOK IN SOUTH TEXASAlin Gonzalez, Deborah Overath.*Texas A&M University-Corpus Christi, Corpus Christi, TX.*

Snook (*Centropomus spp.*) were an important commercial fishery in South Texas until the population crashed in the late 1930s. As snook numbers increase again in South Texas, proper management of this growing fishery requires biologically pertinent information. Two important questions are, what is the genetic structure of snook, and are snook breeding in Texas waters? Currently such information does not exist. The overall goal of this project is to provide important baseline genetic data for snook in South Texas. Samples from adult snook and young-of-the-year (YOY) were collected and analyzed for 10 species-specific microsatellite markers using standard population genetic techniques and statistics. A sibship analysis will be performed on YOY to determine if they could have been produced by local adults, indicating a local breeding population. This project will also use geographic information system (GIS) methods to determine areas of high genetic diversity using the landscape genetics GIS toolbox. This approach will also indicate if clusters of siblings exist and if any clusters are genetically different from one another. With the results of this ongoing study, the utility of GIS maps will allow managers to locate areas of high genetic diversity and essential habitats.

Ballroom C - 9

HSP90 AND AGO1 IN THE BUFFERING OF PHENOTYPIC VARIATIONTzitziki Lemus Vergara, Christine Queitsch, Jennifer Lachoweic.*University of Washington, Seattle, WA.*

Robustness to genetic and environmental perturbations is a fundamental property of biological systems. Previous work has demonstrated the importance of the molecular chaperone HSP90 in maintaining organismal robustness. HSP90 inhibition reveals cryptic genetic and epigenetic variation with significant phenotypic consequences in flies, fish, plants, and yeast. The molecular mechanisms underlying the release of HSP90-dependent variation are not well understood. Recent studies found that microRNAs (miRNAs) are also important in maintaining robustness due to their function in modulating gene expression. In humans and flies, HSP90 is required for the formation of the miRNA-silencing complex. Moreover, in tobacco cell lines, HSP90 interacts physically with ARGONAUTE1 (AGO1), a key protein in the plant miRNA pathway, and a component of the miRNA-silencing complex. We hypothesize that HSP90 and miRNAs interact in maintaining organismal robustness in *A. thaliana*. Using established assays for HSP90 function, we demonstrate that *HSP90* and *AGO1* interact genetically in the buffering of phenotypic variation in early seedlings. Moreover, *AGO1* polymorphisms correlate with sensitivity to HSP90 inhibition of divergent *A. thaliana* strains. Using expression analysis we showed that HSP90-AGO1 interaction in the buffering of variation is complex. Currently, we are comparing AGO1's buffering potential and breadth to HSP90 by crossing *ago1* mutants into different

A. thaliana accessions. The *A. thaliana* Argonaute family is comprised of 10 members. Among these, we show that AGO10 and AGO5, the closest AGO1 paralogs, do not interact with HSP90. We are investigating whether other Argonautes interact genetically with HSP90.

Ballroom C - 48

DELINEATION AND VALIDATION OF A TBX1 BINDING SITE ON GENOMIC DNA

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TBX1 encodes a transcription factor that contains an evolutionarily conserved DNA binding domain termed the T-box that is shared with other family members. Haploinsufficiency or mutation of *TBX1* is responsible for the etiology of DiGeorge syndrome but few direct downstream targets have been identified. All T-box proteins bind to similar but not identical consensus DNA sequences, indicating that there are specific binding preferences. Our hypothesis is that *TBX1* has a preferential DNA binding sequence through which regulation of direct downstream targets occurs. To determine the mouse *TBX1* consensus sequence, systematic evolution of ligands by exponential enrichment (SELEX) was performed with GST-*TBX1*, and oligonucleotide alignment generated 2 novel motifs. *TBX1* protein binds strongly to a tandem repeat composed of 2 half-sites, AGGTGTGAAGGTGTGA, as well as a half-site partial site, AGGTGTGATCGCGTCAT. *TBX1* also strongly activates transcription of reporter vectors in cell culture via these binding sites. Using this information, an *in silico*, genome-wide binding site analysis identified *Tbx1* target genes for which a subset (*NeuroD*, *Fgf8*, *Mef2c*) were altered in gene expression in *Tbx1*^{-/-} embryos. We also determined these to be bound by *TBX1* *in vitro* and activated via luciferase assays. Three known *TBX1* mutations (F148Y, H194Q and G310S) were generated and determined to bind to the consensus sequence but could not activate transcription in cell culture reporter assays, providing insight into their function for the first time. This work will provide a strong basis for future chromatin immunoprecipitation studies or biochemical studies to understand *TBX1* protein function.

Ballroom C - 136

THE PHYSIOLOGICAL ROLE AND FUNCTION OF N6-METHYLADENOSINE

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Epigenetics is widely studied in DNA but recently, *FTO*, an obesity risk gene, implicates the methylation of the N⁶ position of adenosine (m⁶A) of posttranscriptional RNA in energy homeostasis. We devised a novel immunoprecipitation (IP) protocol, MeRIP-seq, to isolate mRNA for m⁶A sites, coupled with a novel computational peak-finder, MeRIPPeR, to localize these sites throughout the genome. MeRIP-seq isolates fragmented and RiboMinus-treated mRNA using an antibody specific for m⁶A. The IP fragments are sequenced using next-generation sequencing (NGS). MeRIPPeR uses Fisher's exact test as its primary peak-finding metric to localize m⁶A sites throughout the genome. These sites are then analyzed using known RefSeq gene annotations. Using MeRIP-seq and MeRIPPeR, we identified mRNAs of 7,676 genes which contained m⁶A and discovered that m⁶A sites are especially enriched near stop codons and in the 5' end of the 3' UTR. We confirmed some m⁶A sites using biotinylated DNA probes and streptavidin Dynabeads, which demonstrates that MeRIP-seq successfully isolates mRNAs with m⁶A sites. Our results indicate that m⁶A is a common modification of mRNA and show insight into the role of RNA epigenetics. We are now further examining the physiological role of this modification in transcriptional and translational regulation and in the contexts of diseases, including acute myeloid leukemia, neural tube defect, and obesity.

MICROBIOLOGY

Ballroom C - 65

THE CHARACTERIZATION OF POTENTIAL SIDEROPHORE PRODUCING CAVE BACTERIA ISOLATED FROM LECHUGUILLA AND SPIDER CAVES, CARLSBAD CAVERNS NATIONAL PARK (CCNP)

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Bacteria play large roles in the cycling of iron in surface environments, but below the surface, bacteria may have an essential role. Along with some eukaryotic organisms, bacteria have the ability to survive in a low nutrient and aphotic environment. Determining how bacteria acquire and cycle iron in the subsurface remains an unanswered question

of subterranean ecology. One way that bacteria collect iron is through the secretion of low-molecular-weight proteins called siderophores, which have a high selectivity for ferric iron. In this study, we investigated Lechuguilla and Spider Caves in Carlsbad Caverns National Park (CCNP). These caves contain iron-rich deposits called ferromanganese deposits (FMD), which are found on the cave walls and ceilings. Previous investigations of FMD in these caves identified bacterial communities related to iron and manganese-oxidizers. Based on these findings, we hypothesize that cave bacteria obtain oxidized iron from FMD through the secretion of siderophores. This iron is used for critical cellular processes. We analyzed previous FMD-inoculated cultures from Spider and Lechuguilla Caves and collected 173 isolates of sub-cultured bacteria. These isolates were characterized by catalase and oxidase testing, and Gram staining, and tested for siderophore production. Fifty nine of the 173 isolates tested positive for siderophore production. The identification of isolates that produce siderophores supports our hypothesis that bacteria could be mining the cave FMD for oxidized iron and manganese cellular requirements. The identification of novel cave siderophores may be valuable in designing more effective antibiotics called sideromycins.

Ballroom C - 50

***DESULFOVIBRIO* SPP. AND MERCURY METHYLATION IN THE GASTROINTESTINAL TRACT OF PRAIRIE VOLES**

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Mercury is a heavy metal known to alter the social behavior in the highly social prairie voles. We are trying to correlate the effects of mercury on vole social behavior with changes in the composition of the gut microbiota (gut-brain axis). Adult prairie voles received HgCl_2 in drinking water *ad libitum* for ten weeks while control voles received unadulterated water. The intestinal microbiota were characterized using pyrosequencing and quantitative real-time PCR. Male prairie voles exposed to HgCl_2 displayed reduced interaction with unfamiliar conspecifics while female prairie voles appeared to be unaffected. Compositional analyses of the microbiota of male/female and treated/untreated animals revealed differences in some genera/species including *Desulfovibrio* species which were present in higher numbers in mercury-treated voles. Because of the integration of the intestinal microbiota in the gut-brain axis, the observed effects of toxic metal exposure on vole behavior might also be based on changes in the microbiota. We have identified sex-specific differences that could play a role in the increased susceptibility of male voles to the behavior-altering effects of mercury-ingestion. *Desulfovibrio* spp. might increase the bioavailability of mercury through methylation. Future studies will be directed towards understanding of the molecular mechanisms of mercury toxicity and the role of the gut microbiota in social behavior.

Ballroom C – 18

PRELIMINARY ASSEMBLY OF THE GENOME OF *SPIROPLASMA HYD-1*: AN ENDOSYMBIOTIC BACTERIUM THAT PROTECTS *DROSOPHILA* FLIES AGAINST PARASITIC WASPS

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Intimate associations between insects and maternally transmitted bacteria are pervasive and diverse, and greatly influence the ecology and evolution of the organisms involved. Recent studies have revealed that many such endosymbionts confer protection on their hosts against natural enemies. Similarly, many heritable symbionts manipulate their host's reproduction to enhance their own transmission. The mechanisms by which endosymbionts confer defense or manipulate host reproduction remain largely unknown, partly due to the fastidious nature of most heritable endosymbionts. Our understanding of symbiont-mediated mechanisms, as well as their ecological and evolutionary consequences, can be greatly facilitated by the development of symbiont genomic resources for studies of comparative and functional genomics and molecular evolution. Herein, we present a preliminary assembly of the genome *Spiroplasma* strain *hyd-1* (class Mollicutes), a symbiont that confers protection on its host *Drosophila hydei* against parasitic wasps (*Leptopilina heterotoma*). A paired-end indexed library for Illumina sequencing was generated from fly hemolymph DNA extracts. Approximately 330 million, 100-bp reads were obtained and assembled in Velvet according to parameters selected with VelvetOptimiser. Our results indicate that the *S. hyd-1* genome has a low GC content and small size according to previously reported Mollicute sequences. We also present a preliminary genomic comparison of the assembled *Spiroplasma hyd-1* genome and its close relative, the pathogen of honeybees (*S. melliferum*), and discuss their differences. This study provides the groundwork for comparative and functional genomics of *Drosophila*-associated *Spiroplasma* strains that exert protective and reproductive phenotypes.

Ballroom C - 35

MERKEL CELL POLYOMAVIRUS SMALL T ANTIGEN HYPERACTIVATES THE NF-KB PATHWAYChristian Berrios, James A. DeCaprio.*Dana-Farber Cancer Institute, Boston, MA.*

Merkel cell polyomavirus (MCV) is the etiological agent of Merkel cell carcinoma (MCC). Classical studies using simian virus 40 (SV40), a model polyomavirus, have demonstrated that SV40 small T antigen (ST) plays a critical role in cellular transformation by binding to protein phosphatase 2A (PP2A) and affecting multiple signaling pathways. MCV-ST was recently shown to be capable of transforming rat fibroblasts independent of PP2A binding. A large-scale and systematic proteomic screen of viral proteins in normal human cells revealed a highly enriched and novel interaction between MCV-ST and the nuclear receptor SET domain-containing protein 1 (NSD1). NSD1 is a histone methyltransferase whose amplification has been associated with multiple forms of cancer. Additionally, NSD1 activates NF- κ B through direct methylation of the NF- κ B p65 subunit, providing a potential mechanism for the high levels of NF- κ B activity seen in some MCC. Cocomplex formation between NSD1 and MCV-ST has been confirmed with epitope-tagged NSD1 as well as endogenous NSD1 in multiple cell lines. Using an NF- κ B luciferase reporter assay, MCV-ST-expressing cells were found to have up to a 4-fold increase in NF- κ B activity over both SV40-ST- and GFP-expressing cells. Additionally, analysis of the MCV-positive MCC cell lines MKL-1 and WaGa indicated high levels of activated p65 as well as phosphorylation of I κ B α , compared to the MCV-negative UI50 cell line. These results indicate that MCV-ST expression leads to heightened NF- κ B activity in both MCC and normal cell lines, potentially through its association with NSD1, which may represent a putative drug target for MCC.

Ballroom C - 72

GENETIC STUDIES OF PYRUVATE USE IN *METHANOSARCINA BARKERI* STR FUSAROMadeline Lopez Munoz, William Metcalf.*University of Illinois at Urbana-Champaign, Urbana, IL.*

Methanogenic archaea are the only microorganisms to date capable of producing methane as an end product of their metabolism. Within methanogens, Methanosarcinales are known to use H₂/CO₂, methylamines, methylsulfides, methanol, and acetate as energy sources. Even though Methanosarcinales make use of such a wide substrate range for methanogenesis, complex organic compounds such as sugars and long-chain fatty acids are not substrates for methanogenesis. A *Methanosarcina barkeri* fusaro strain capable of using pyruvate as its sole energy and carbon source was previously isolated; however, the genetic basis of pyruvate use was not determined. Whole genome sequencing of 2 mutant strains revealed 2 mutations of interest. One was localized in the Mbar_A2165 locus, which encodes a potential transcription regulator, and a second one was in the Mbar_A1588, encoding the *bpl* subunit of the *pyc* operon. To assess the involvement of the mutations in the pyruvate using phenotype, they are being recreated in a WT background. Re-creation of the mutation present in the *pyc* operon did not confer the Pyr⁺ phenotype. In addition, a deletion of the *pyc* operon was constructed to evaluate the role of the enzyme in the Pyr⁺ phenotype. RNA sequencing of the strains revealed an overexpression of genes involved in gas vesicle synthesis and pyruvate ferredoxin oxidoreductase, the latter being an enzyme involved in the reductive decarboxylation of pyruvate to acetyl-CoA. To further investigate pyruvate metabolism in *M. barkeri*, a strain containing a deletion of the *por* operon is under construction.

Ballroom C - 92

BACTERIAL DEGRADATION OF ALIPHATIC ALKANES ACROSS ECOSYSTEMS IN PUERTO RICOYomarie Bernier, Sharon A Cantrell, José R Pérez-Jiménez.*Universidad del Turabo, Gurabo, PR.*

Alkanes are organic compounds that reach the environment by different processes. Microbial degradation of alkanes contributes to bioremediation. However, most studies have been conducted on polluted and temperate sites. The objective is to isolate and characterize putative alkane-degrading bacteria (ADB) in response to hexane, 2,2,4-trimethylpentane, and hexadecane. Soil samples were collected at 7 sites having various pollution levels in Puerto Rico. Native microbiota was cultivated, as consortia, on rich media. The community was described using 16S rDNA-TRFLP profiles generated after digestion with *Hae*III. ADB were isolated from samples on mineral media supplemented with a specific alkane as the sole carbon source. Bacterial prospects for aliphatic alkane degradation were subjected to 16S rDNA sequencing and an alkane degradation preference test. A total of 77 ADB have been isolated. Among the putative alkane degraders, we found isolates closely related to *Aeromonas*, *Alcaligenes*, *Arthrobacter*, *Comamonas*, *Cupriavidus*, *Enterobacter*, *Klebsiella*, *Paenibacillus*, and *Ralstonia*. All prospects have

been able to grow in a 1.2% alkane concentration. Twenty-three percent (n = 18) were able to degrade the three alkanes. Hexadecane was preferred as an isolation carbon source (60% of ADB) over isooctane (21%) and hexane (19%). However, alkane preference tests revealed broader capability: hexane (34% of ADB), isooctane (71%), and hexadecane (83%). ADB prevails across neotropical ecosystems despite the pollution level and are physiologically heterogeneous. Vigorous growth was noticeable for polluted sites, which suggests adaptation to persistent exposure to the alkanes. This collection of alkane-degrading bacteria provides novel isolates to deal with pollution and possibilities for further disclosure of biodegraders in nature.

Ballroom C - 32

CARDIAC LESION FORMATION OCCURS DURING SEVERE, INVASIVE PNEUMOCOCCAL DISEASE

Armand Brown¹, Marocs Restrepo¹, Ganesh Halade¹, Eric Mortensen², Merry Lindsey³, Martha Hanes¹, Elaine Tuomanen⁴, Carlos Orihuela¹.

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Streptococcus pneumoniae (the pneumococcus) accounts for approximately 40% of all cases of community-acquired pneumonia and is a leading cause of bacteremia and sepsis. Individuals hospitalized for invasive pneumococcal disease (IPD) are at an increased risk for sudden death as a result of adverse cardiac events, in particular new or worsened congestive heart failure. Herein we describe the novel observation of cardiac lesions formed within the ventricles of septic mice. Lesion formation was positively correlated with bacterial burden in the blood as well as serum levels of troponin, a clinical marker for cardiac damage. Lesion formation was also concomitant with changes in electrophysiology as measured by limb-lead ECG, which indicated a progressive loss of cardiac contractility. Lesions increased in number and size during the infection, becoming first detectable at 24 hours post-intravenous challenge, and had a marked absence of infiltrated immune cells, which stands in stark contrast to abscesses typically seen formed by other Gram-positive bacteria. Pneumococci could be visualized within the lesions, and, using immunohistochemistry, we detected the toxin pneumolysin at sites where apoptosis was occurring. Notably, lesions were confined to the heart and occurred following both intratracheal and intravenous challenge. We conclude that mice with severe invasive pneumococcal disease develop altered cardiac electrophysiology that is associated with the presence of lesions. These lesions may explain the high incidence of adverse cardiac events during severe disease. Studies are ongoing to characterize the mechanism underlying lesion formation, and how this is related to adverse cardiac events in humans with IPD.

Ballroom C - 1

SERRATIA MARCESCENS PNEUMONIA

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Serratia marcescens, a Gram-negative bacteria, is the most common *Serratia* species isolated in human infections. As a ubiquitous, opportunistic bacterium, this organism is an important emerging pathogen possessing multiple antibiotic-resistance mechanisms and ease of transmission in hospitals. Although *S. marcescens*-caused pneumonia and lung abscesses have been documented, little is known about how the pathogen colonizes and causes disease in the respiratory tract and how the host resolves infection. We propose that both bacterial and host factors contribute to the pathogenesis and resolution of *S. marcescens* infection. To test this hypothesis, we developed a mouse model of lung infection following intratracheal inoculation. Bacterial burden experiments revealed that the CFU in the lungs is at high levels at 4 and 12 hours post-infection and starts decreasing significantly after 24 hours. Gross inflammation measured by organ weight after infection was significantly elevated compared to the PBS-treated mice. Bronchoalveolar lavage fluid from 12, 24, 48, and 72 hours showed an increase of polymorphonuclear leukocytes that peak at 24 hours and then diminish at 48 and 72 hours. A deeper analysis of the immune response revealed that inflammatory cytokines and neutrophil chemokine levels rapidly increase after inoculation. Moreover, we found that neutrophil-depleted mice were susceptible to virulent *S. marcescens* infection, succumbing within 12 hours post-inoculation with a nonlethal dose. These results reveal the importance of a fast and efficient innate immune response to contain this pathogen and suggest that colonization of the lungs is key to *Serratia marcescens* mortality.

Ballroom C - 112

PNEUMOCOCCAL SERINE-RICH REPEAT PROTEIN INHIBITS COMPLEMENT DEPOSITION AND OPSONOPHAGOCYTOSIS BY MACROPHAGESRyan Gilley¹, Carlos Sanchez¹, Catherine Hyams², Jeremy Brown², Carlos Orihuela¹.¹The University of Texas Health Science Center at San Antonio, San Antonio, TX, ²University College Medical School, London, GB.

Streptococcus pneumoniae is an important human pathogen and is the leading cause of community-acquired pneumonia throughout the world; this is despite the availability of multiple effective vaccines. Although *S. pneumoniae* is primarily a commensal of the human nasopharynx, it is an opportunistic pathogen and has the capacity to cause invasive pneumococcal disease. Pneumococcal serine-rich repeat protein (PsrP) is a member of the serine-rich repeat protein family found exclusively in Gram-positive bacteria and is a key virulence factor that facilitates *S. pneumoniae* adhesion to lung epithelial cells by binding to keratin 10. Our lab has recently determined that PsrP also protects the bacteria against opsonophagocytosis. Western blot and FACS analysis showed that mutants deficient in PsrP (*Qpsrp*) had greater amounts of detectable C3b on their surface than wild-type bacteria. FACS data also suggest macrophages take up fewer pneumococci when PsrP is present. Ongoing studies are focused on determining which complement pathway is deterred by the presence of PsrP. Planned studies include treating serum with EGTA, which preferentially chelates Ca²⁺, thereby inhibiting the classical cascade but leaving the alternative cascade intact. Additionally, depleting serum of key complement components like C4 or Factor H will selectively inhibit one pathway. Collectively, these experiments will determine which complement pathway is inhibited by the presence of PsrP.

NUTRITIONAL SCIENCES

Ballroom C - 149

DIFFERENCES IN NATURAL HEALTH PRODUCT USE AMONG SAUDI ARABIAN STUDENTS: USA VS. SAUDI ARABIASamiah Alqahtani¹, Ahmad Aboshaiqah², Ali Almajwal², Dina Haque¹, Maria Pontes Ferreira¹.¹Wayne State University, Detroit, MI, ²King Saud University, Riyadh, SA.

We test hypotheses regarding Saudi student use of natural health products (NHP) for health maintenance (HealthM). We hypothesize that there are geoethnic and gender differences in NHP use. We also seek to identify the top 10 NHPs used for HealthM by Saudi students and to determine predictor variables for student use of the top ten NHPs for HealthM. Students from King Saud University ($n = 500$: 250 males and 250 females) and Wayne State University ($n = 500$; 250 males and 250 females) will participate in a cross-sectional online survey of NHP use. χ^2 and Fisher exact tests will analyze group differences and determine the top ten NHPs used for HealthM. Multiple logistic regression analyses will determine predictor variables for the top ten NHPs used for HealthM. Data will be analyzed by SPSS software 20. The critical alpha level will be set at 0.05 *a priori*. We expect Saudi students (Saudi Arabia) use different NHPs for HealthM than US-Saudi students. We also expect to find greater use of NHP for HealthM among female students, regardless of country. We will identify the top ten NHPs used for HealthM. Gender, tobacco status, age, and geoethnicity are expected predictor variables for student use of the top ten NHPs for HealthM. These anticipated novel findings of under-studied groups should clarify medicinal plants commonly used by Saudi Arabian male and female students (US vs. Saudi Arabia). Future directions include the establishment of the evidence-based efficacy of popular NHPs used by Saudi students.

Ballroom C - 148

ASSESSING THE IMPACT OF ELDERS ON STUDENT INTEREST IN STEMSarah Alkholi¹, Priscila Angeles Rojas¹, Tanya Dahms², Maria Pontes Ferreira¹, Fidji Gendron³¹Wayne State University, Detroit, MI, ²University of Regina, Regina, SK, CA, ³First Nations University of Canada, Regina, SK, CA.

Minorities are underrepresented in postsecondary education, have high attrition rates, and are poorly represented in STEM fields. Academic performance improves when cultural relevance and support are provided. The interface of Western science and Indigenous science provides an opportunity for bridging this divide. We hypothesize that the presence of Indigenous science Elder educators alongside Western science educators in an online STEM course is associated with cultural relevance/supportiveness of the course, student learning outcomes, student interest in

STEM, and perceived merit of Indigenous science educators in postsecondary STEM education. We conducted a longitudinal study of an interdisciplinary, multi-institutional, cross-cultural online STEM course in spring 2013 offered at mainstream and Tribal universities. Precourse and postcourse surveys were administered to participating students. Learning outcomes were measured by quizzes. The outcome measures of interest per the hypotheses were assessed. Group differences will be tested by ANOVA, and predictor variables determined by regression (SPSS software). We expect to find differences between the with-Elders group and the without-Elders group of students; specifically, the presence of Elders in an online STEM course will improve course cultural relevance, student learning outcomes, student interest in STEM, and perception of the merit of Elders in postsecondary STEM education. We anticipate that Elders can be involved in novel pedagogical approaches and delivery modalities to reach Aboriginal students, such as live and distance delivery of health-related courses. These findings can influence STEM education policy toward an increased Native retention in STEM while benefiting all students.

OTHER BIOLOGICAL SCIENCES

Ballroom C - 159

IDENTIFYING BIOMARKERS FOR MONITORING DISEASE PROGRESSION IN EXPERIMENTAL AUTOIMMUNE ENCEPHALOMYELITIS BY M² PROTEOMICS

Erica Saenz-Trevino, Niannian Ji, Itay Raphael, William E. Haskins, Thomas Forsthuber.

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Multiple sclerosis (MS) is the most common debilitating, progressive neurological disorder which afflicts over 400,000 Americans. Currently, determining clinical and subclinical progression for MS patients has been an obstacle for MS therapy due to the lack of specific and sensitive laboratory tests. Recently, our lab has developed a technique called microwave & magnetic (M²) proteomics, which is a rapid, quantitative approach ideal for identifying putative protein biomarkers and therapeutic targets of experimental autoimmune encephalomyelitis (EAE), a commonly used animal model for MS research. Notably, we identified a number of putative-biomarkers that correlated with different stages of relapsing-remitting EAE. The objective of our research is to identify protein biomarkers correlated to disease progression using the progressive EAE disease model in nonobese, diabetic (NOD) mice. We hypothesize that during the disease some key central nervous system (CNS) disease specific proteins will be released into blood and/or cerebrospinal fluid (CSF) and the identification of these proteins can be used to determine disease progression. In this study, we will induce progressive EAE disease in NOD mice, monitor clinical symptoms, and analyze the CNS proteome changes at representative time points of the disease using M² proteomics. After identifying putative CNS-specific proteins for disease progression, we will use M² proteomics and other quantitative measurements (e.g., ELISA) to identify candidate protein biomarkers indicative for EAE progression in the blood and/or CSF. This research will provide a proof-of-principle for the development of novel prognostic tests in MS patients. (Partially supported by NSF LSAMP-BD 1249284.)

Ballroom C - 30

RECEPTOR ACTIVATOR OF NUCLEAR FACTOR KAPPA-B AS A THERAPEUTIC TARGET IN TRIPLE-NEGATIVE BREAST CANCER

Monica Reyes, Hiroko Masuda, Dongwei Zhang, James Reuben, Wendy Woodward, Bryant Darnay, Gabriel Hortobagyi, Xiaoping Wang, Naoto Ueno.

The University of Texas MD Anderson Cancer Center, Houston, TX.

Triple-negative breast cancer (TNBC) has a poor prognosis and high metastatic rate. Receptor activator of nuclear factor kappa-B (RANK), a promoter of bone metastasis, may contribute to the enrichment of cancer stem cells (CSCs). CSCs are enriched with the epithelial-to-mesenchymal (EMT) phenotype. It is unknown whether RANK is a clinically relevant target in TNBC. We hypothesized that RANK promotes tumorigenicity and metastasis of TNBC via the regulation of EMT and enrichment of CSCs. We analyzed RANK mRNA expression levels, obtained by Affymetrix gene chip array, in ER⁺/HER2⁻ breast tumors (n = 22) and ER⁻/HER2⁻ primary breast tumors (n = 18) including TNBC tumors and found RANK expression to be higher in the ER⁻/HER2⁻ breast tumors compared with the ER⁺/HER2⁻ breast tumors (P = 0.034). We stably transfected human TNBC cell line MDA-MB-231 with scrambled shRNA, RANK shRNA, clone 1, or clone 2 to examine whether RANK regulates migration and invasion, EMT, and CSC-like phenotype. RANK knockdown in MDA-MB-231 inhibited migration (P = 0.0005) and invasion (P = 0.0006) and reduced mammospheres (P = 0.0188). In 3D matrigel, we observed significant inhibition of EMT-like phenotype in MDA-MB-231 RANK shRNA

($P < 0.05$), and downregulation of EMT markers, vimentin, and snail shown by qRT PCR analysis. We concluded RANK is a regulator of EMT and CSC-like phenotype in TNBC cells. We plan to investigate the effects of RANK inhibition on EMT, CSC enrichment, and metastasis in vivo using TNBC xenograft and metastatic mouse models. The significance of this work is that finding a therapeutic target for TNBC will reduce the mortality of this deadly disease.

PHARMACOLOGY

Ballroom C - 34

DETERGENT STABILITY SCREENING OF VOLTAGE-GATED PROTON CHANNEL

Amruta Agharkar, Eric B. Gonzales.

University of North Texas Health Science Center, Fort Worth, TX.

The human voltage-gated proton channel (Hv1) is a 4 transmembrane domain proton-selective channel which causes efflux of protons. It is gated by membrane depolarization, lacks a traditional pore domain, and is sensitive to pH gradients. This channel plays a role in male fertility, stroke, respiratory burst, and breast cancer cell proliferation and migration. Although similar to voltage sensing domains with solved 3-dimensional structures, the Hv1 proton channel structure remains elusive. Determining the structure of Hv1 channel will serve as a template for designing new therapeutic strategies. Here, we present our progress toward solving the 3-dimensional structure of the Hv1 proton channel. We have generated a carboxy-terminal polyhistidine-tagged Hv1 channel protein which we verified by western blots. Small scale expression experiments for detergent screen and a time course study have been performed to find suitable conditions for stabilizing the Hv1 channel protein outside the cell membrane. We are analyzing the stability of protein during metal affinity chromatography and size exclusion chromatography and have begun with the crystallization trials. Furthermore, whole-cell patch-clamp electrophysiology is used as a guide for solving the structure of a functional channel. Our data demonstrates that Hv1 proton channel forms a dimer at day 2 of culture. We anticipate that purified protein, in milligram quantities, will be isolated and subjected to crystallization trials. Future experiments will focus on generating protein on a larger scale to determine the optimal conditions for crystallization and to determine the Hv1 proton channel's 3-dimensional crystal structure.

Ballroom C - 33

CRYSTALLIZATION SCREENING OF A GAMMA-AMINOBUTYRIC ACID-SENSITIVE ION CHANNEL

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Gamma-aminobutyric acid (GABA) is the major inhibitory neurotransmitter in the vertebrate brain, and targets include membrane proteins. The GABAA-rho receptor, a member of the Cys-loop super family of ion channels, is one of GABA's targets and has been implicated in various retinal disorders, and, specifically, a mutation in GABAA-rho1 has been implicated in increased susceptibility for bipolar schizoaffective disorder. Although the 3-dimensional structure of homologues of this receptor have been solved, the GABAA-rho receptor structure remains elusive. We have identified a GABAA-rho construct that can be used to generate purified and intact protein that leads to the growth of protein crystals, a critical step toward solving the protein's structure. GABAA-rho1 was subcloned into a baculovirus expression vector using blunt-end PCR and transfected into SF9 insect cells. Cells were harvested, and protein was isolated using metal affinity and size exclusion chromatography. A phosphate buffered saline (PBS)-based running buffer was used to stabilize the purified protein. Protein crystallization trials were performed using the lipidic cubic phase technique and observed weekly for crystal formation using a stereomicroscope. GABAA-rho was isolated using metal affinity chromatography. Our size exclusion chromatography studies reveal that using a PBS-based running buffer stabilizes the pentameric arrangement of purified GABAA-rho receptor. Subsequent lipidic cubic phase crystallization trials revealed three conditions yielding birefringent protein crystals. Based on preliminary data, we have identified optimal buffer and detergent conditions to isolate and solubilize the protein and optimal crystal conditions for protein crystal formation.

PLANT SCIENCES

Ballroom C - 54

PLANT SELECTABLE-MARKER GENE DELETION USING BXB1 SITE-SPECIFIC RECOMBINATION SYSTEM

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An important tool for the production of genetically modified (GM) crops is the selectable marker gene (SMG), which allows for the identification of transformed cells. Following selection, transformed plant cells can multiply and generate stably transformed plants. The SMG, usually an antibiotic or herbicide-resistance gene, will remain in the genome of GM crops. Both regulatory agencies and the public have raised food safety and environmental concerns about the presence of SMGs. The most controversial concern involves horizontal transfer of the SMG coding for antibiotic resistance, which could possibly reduce the clinical effectiveness of antibiotic drugs. Mycobacteriophage Bxb1 site-specific recombination system can be used in plant transgenesis to excise the SMG coding for antibiotic resistance. Bxb1 is a uni-directional, site-specific recombination system. This means that once the SMG is excised, it is no longer able to reinsert into the genome. A Bxb1 site-specific, recombinase expressing, autoexcision vector containing the kanamycin resistant gene *nptII* was created in our lab, electroporated into *Agrobacterium* strain LBA4404, and used in tobacco leaf disc transformation. Activation of the seed-specific promoter allowed for autoexcision of the gene cassette containing *nptII* and the recombinase. The cultured tissue was screened on kanamycin selection medium. Molecular analysis including genomic DNA isolation, GUS analysis, PCR, and sequencing has been conducted. Sequencing demonstrated successful autoexcision in first-generation seeds. Further analysis will be completed to test the effectiveness of this Bxb1 system in homozygous deletion of the antibiotic-resistance marker gene *nptII* in second-generation tissues.

COMPUTER/INFORMATION SCIENCES

Ballroom C - 125

AN EFFICIENT FPGA IMPLEMENTATION FOR ELLIPTIC CURVE POINT MULTIPLICATION

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Efficient elliptic curve cryptography (ECC) depends on efficient finite field arithmetic for speed and a sufficiently large finite field for security. The most widely studied ECC systems to date have been those over binary fields (i.e., $GF(2^m)$) and prime fields (i.e., $GF(p)$ where p is prime). Binary fields have the advantage that arithmetic in the ground field $GF(2)$ is very simple, but reduction modulo of an irreducible polynomial can be costly. Prime fields have the advantage that there is no need for reduction modulo an irreducible polynomial; however, arithmetic modulo p using the standard method of division by p can be costly. In this work, we implement elliptic curve point multiplication on an FPGA over a prime field $GF(p)$ where p is a pseudo Mersenne prime having the same number of bits as the NIST-recommended field $GF(2^{233})$. We use an improved method for multiplication modulo p , and we compare performance to recent results for an FPGA implementation of elliptic curve point multiplication over a $GF(2^{233})$.

Ballroom C - 104

OPTIMIZATION TECHNIQUES FOR MULTI-CRITERIA DECISION MAKING

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In multi-criteria decision making, decisions are made based on multiple criteria that can be conflicting and non-homogeneously satisfied. By using fuzzy (non-additive) measures, it is possible to create a model that incorporates the preference relations of all possible subsets of criteria. In practice, identifying fuzzy measures is a difficult task. It is necessary to have an automated process that can extract the fuzzy measures from previous decisions by human experts. A hybrid optimization approach has been proposed, using bees algorithm and an interval constraint solver. In this work, we present 3 versions of this approach, with each version representing variations on the order and number of times both the bees algorithm and the constraint solver are called. We also test each of these versions with both toy examples and a real-world scenario: software quality assessment (SQA). The results showed that this approach

helps predict software quality consistently with over 60% accuracy, which is as accurate as previous approaches to SQA using machine learning.

Ballroom C - 6

MULTIEXPERT, MULTICRITERIA DECISION MAKING

Joel Henderson¹, Martine Ceberio¹, Stefano Bistarelli².

¹*University of Texas at El Paso, El Paso, TX*, ²*University of Perugia, Perugia, IT*.

Expert analysis and decisions are highly valued assets in a wide variety of fields, from social services to grant funding committees. However, the use of experts can be prohibitive due to either lack of availability or cost. As such, it is desirable to be able to replicate such decisions. There are many obstacles that impede an accurate simulation of expert decisions. For example, despite looking at the same information, 2 experts may disagree on the decisions. Moreover, a single expert may make inconsistent decisions across similar scenarios. In this work, we focus on multicriteria decision making in the case of multiple experts. We examine how multicriteria decision making techniques can address the multiexperts dimension of the problem, as well as how argumentation networks can inform us about how to aggregate the multiple experts' decisions. Questions that we consider include how to predict best decisions based on multiexperts' prior decision data and how to use that knowledge to be able to predict and diffuse disagreements in group decision making. We look at experts' decision data in the area of software quality assessment, and we analyze automated decisions that result from using nondiscriminatory techniques, i.e., techniques that take all decisions, even conflicting, into account with the same importance. We reconsider these data, explore the use of argumentation networks, and reflect on the relevance of such an approach. We report the results of our preliminary observations and we propose directions for future work.

Ballroom C - 59

GENETIC ALGORITHM FOR CRYPTANALYSIS ON SUBSTITUTION CIPHERS

Jose Nieves Jr., Aldredo Cruz.

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A genetic algorithm (GA) is a search method based on natural selection and genetic inheritance. Cryptology encompasses cryptography and cryptanalysis. Cryptography is the process of protecting information by encrypting it into an unreadable format. Cryptanalysis is the process of obtaining the original message from an encrypted message without knowledge of the key. Here, the use of genetic algorithms to solve classical problems that arise in cryptology is investigated to determine its benefits. More specifically, how the use of genetic algorithms may lead to efficient cryptanalysis of substitution ciphers, which may be present in modern symmetric cryptographic systems. Frequency analysis is used in the fitness function to measure the performance of each key generated by the genetic algorithm. Different parameters and techniques for the cross-over, mutation, and parent selection are explored. If the GA-based approach proves successful, it could lead to faster, more automated cryptanalysis techniques.

Ballroom C - 116

PRIVACY PRESERVATION CONSTRUCTS FOR JSON IN THE CONTEXT OF HEALTH INFORMATION SYSTEMS

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University of Puerto Rico at Mayagüez, Mayagüez, PR.

JavaScript Object Notation (JSON), a data-interchange language used for transmitting structured data over a network connection between a server and web application, is an alternative to XML, which underlies many Internet applications, including electronic healthcare information systems. JSON suffers from the lack of mechanisms to support user-centered privacy preservation. This paper introduces an enhancement to JSON to support privacy preservation corresponding to discretionary access control in health information systems. A mechanism has been introduced by which one can define privacy policies as JSON tree structure nodes. Obviously, any mechanism to define privacy policies in JSON needs to be supported by the query language. Hence, we have also proposed a simple extension onto Javs Query Language (JaQL). We will implement a prototype of this solution. Our extensive experiments will prove that our privacy preservation approach does not impose a significant overhead with respect to query execution time in JaQL.

Ballroom C - 140

PEDIGREE EVALUATOR

Mario Zuniga, Andres Figueroa.

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Collecting family history to find inherited traits is a fundamental procedure in human genetics. A pedigree is a genealogical graph or table that represents relationships between individuals. Pedigrees can be used in a clinical setting, such as genetic counseling sessions or genetic evaluations, and in genetic research. This includes risk information for future pregnancies or relatives who are currently unaffected but who are at risk for developing a disorder based on family history information. Pedigrees are essential to identify and discover genes that are involved in the development of genetic disorders. Pedigrees are also essential to genetic counseling. Genetic counselors usually draw pedigrees by hand or with the assistance of general drawing software such as Microsoft PowerPoint. This handwriting procedure is usually time-consuming and may lead to a mess when pedigrees are later modified. We are introducing Pedigree Evaluator. Pedigree Evaluator is a user-friendly, Java-based application for pedigree data analysis. Similar commercial products are expensive and do not execute on different platforms. Pedigree Evaluator provides automatic pedigree drawing tools. Pedigree Evaluator is not only a tool to draw pedigrees but also a complete database package for pedigree management, clinical data management, import/export pedigree modules, and user configurable pedigree views. (The authors acknowledge the National Science Foundation (grants CNS-0837556 and CNS-0940575) for its support.)

EDUCATION

OTHER EDUCATION

Ballroom C - 123

META ANALYSIS OF STUDENT IDENTITY AND AGENCY IN CRITICAL MATHEMATICS EDUCATION

Gabriela Vargas, Rochelle Gutierrez.

University of Illinois at Urbana-Champaign, Champaign, IL.

Research in mathematics education has shifted towards a sociopolitical perspective on equity, classified as critical mathematics education. As such, researchers are developing ways of defining and measuring student identity in relation to mathematics. Specifically, methods of defining students' identity are influenced by researchers' experiences within the field, either as past teachers, researchers observing the field, or teacher educators. With research calling for more student learning positioning in the classroom, professional development programs are transforming the resources to better support students. This poster presents a meta-analysis of literature in critical mathematics that explores how student agency and identity can be defined and the role that mathematics plays in that definition. Results from 32 articles/chapters reviewed show that how researchers position themselves within the field influences the methods and definitions of mathematics and student identity they develop. As of now, the majority of research studies talk about students gaining resiliency to confront stereotypes that they face and very little about how math becomes a part of the student through the development of mathematical identities. Researchers who discuss mathematical identities should not just consider how math contributes to students' identities, but should also show how students can contribute to the identity of mathematics. By moving research beyond the notion of students being math doers and seeing mathematics as a way of shaping our world, students can see themselves as contributors in creating a new world and a more humanistic version of mathematics.

TEACHER EDUCATION

Ballroom C - 119

SYSTEMIC FUNCTIONAL LINGUISTICS AS A TOOL FOR EXAMINING NOS/OTR@S EXPERTISE IN A SECONDARY MATHEMATICS PRESERVICE SEMINAR

Juan M. Gerardo, Rochelle Gutierrez.

University of Illinois at Urbana-Champaign, Champaign, IL.

Mathematics education researchers use discourse analysis to analyze small-group and whole-group discussions. Systemic functional linguistics (SFL), more specifically, the system of negotiation, is one methodological approach that researchers are beginning to use to examine authority in interactions. To date, most SFL research focuses on K to 12 classrooms where teachers are older than students. In contrast, we examined the extent to which preservice secondary mathematics teachers (PSMTs) were positioned as experts during two lessons in a teacher education seminar, one mathematical, and the other pedagogical. Our theoretical framework assumes the PSMTs will acknowledge teaching is a political act and strive to develop solidarity and interdependent (nos/otr@s) relationships with marginalized students. That is, they will aim to position their students as experts. We wanted to test if the research team, indeed, was modeling this kind of behavior of positioning students as experts during interactions with the PSMTs. Using SFL, we coded for moves that positioned PSMTs as experts and when they positioned themselves as experts. The analysis shows that PSMTs were not positioned as experts in a mathematics problem led by an accomplished teacher (and member of the research team) as often as when the PSMTs were discussing a pedagogical lesson with the same teacher. By focusing on the kinds of questions that were asked, SFL helped elucidate when authority was located within a single person and when it was distributed among several people. Implications for future research are discussed.

ENGINEERING

AEROSPACE, AERONAUTICAL, ASTRONAUTICAL ENGINEERING

Ballroom C - 101

THE EFFECTS OF VARIOUS COMBUSTION TECHNIQUES IN A SUBSONIC TURBINE-LESS ENGINE THROUGH COMPUTATIONAL INVESTIGATION AND EXPERIMENTAL VALIDATION

Hakob Karaoglanian, Joseph David Wells, Chivey Wu.

California State University, Los Angeles, Los Angeles, CA.

A new high-powered, green, clean, turbine-less engine has been developed at California State University, Los Angeles. While successfully tested and run without a mixing chamber, the present study will investigate computationally and experimentally different mixing and combustion techniques to see which will provide the ultimate amount of thrust through a cylindrical shaped mixing chamber. Due to its chemistry and clean byproducts when burned, hydrogen will be used as the fuel source initially in the present study. Hydrogen is very light and abundant on Earth and will be the stepping stone to segue ourselves away from harmful energy sources into an age of clean, renewable energy.

BIOENGINEERING/BIOMEDICAL ENGINEERING

Ballroom C - 131

ENHANCED DELIVERY AND IMAGING OF NEUROTHERAPEUTICS VIA US, MRI, SPECTMichael Valdez¹, Ted Trouard¹, Pier Ingram¹, Paul Helquist², Robert Erickson¹, Russell Witte¹, Terry Matsunaga¹, Lars Furenlid¹, Zhonglin Liu¹.¹University of Arizona, Tucson, AZ, ²University of Notre Dame, Notre Dame, IN.

Niemann-Pick type C (NPC) disease is an incurable and fatal childhood disease. The disease is characterized by a buildup of cholesterol in the brain resulting in cognitive decline and eventually death. Cyclodextrin (CD) has been shown to bind cholesterol and transport it out of cells, but CD does not cross the blood-brain barrier. This represents a major obstacle for using CD treatment in children. Transient and nondestructive opening of the blood-brain barrier (BBB) has been demonstrated in mice by using ultrasound (US) in conjunction with microbubble contrast agents. We are investigating the use of this technique to treat NPC disease with CD. Mouse models of NPC will be used in conjunction with US and CD treatment. MRI is currently being used to assess the opening of the BBB by coinjecting gadolinium-DTPA (Gd-DTPA) with the microbubbles and carrying out T1-weighted MRI.

Ballroom C - 80

PLATELET STORAGE: A CHILLING STORYKristin Reddoch¹, Prajeeda Nair¹, Robbie Montgomery², Heather Pidcock², Chriselda Fedyk², Anand Ramasubramanian¹, Andre Cap².¹University of Texas at San Antonio, San Antonio, TX, ²United States Army Institute of Surgical Research, San Antonio, TX.

Platelets are transfused to prevent bleeding and induce hemostasis and can be critical in saving lives following trauma. Currently, platelets are stored at room temperature (RT) for up to 5 days. This short shelf life severely compromises platelet inventories owing to a high risk of bacterial contamination. Cold storage (4 °C) of platelets can lower this risk, but the actual practice has been abandoned since cold activates platelets and causes rapid clearance from circulation. In cases of severe trauma, 4 °C platelet storage may help achieve faster control of bleeding and improve patient outcomes. In this work, we evaluated the hemostatic potential of platelets stored at 4 °C and RT under standard blood banking conditions for up to 5 days using clinically relevant assays. Single-donor apheresis platelets were collected from 5 donors and stored at RT or at 4 °C with agitation. Measurements were made on days 1, 3, and 5 to assess platelet quality, metabolism, aggregation, clot strength, adhesion, activation, microparticle release, and soluble factor release. Cold storage of platelets proved superior in terms of function, preservation of platelet metabolism, and minimization of the amount of soluble marker release compared to RT. While there is currently no single assay in the market that accurately predicts *in vivo* performance, the data obtained from this study suggests a need to further explore the use of cold temperatures, particularly for treatment of severe hemorrhage, in times where quick and efficient hemostasis is the determining factor between life and death. (This work was partially funded by NIGMS MBRS-RISE GM060655.)

Ballroom C - 107

MODELIZATION OF PHOTOACOUSTIC SIGNALS FROM MAGNETICALLY ORIENTED GOLD NANORODSGilbert Bustamante, Jing Yong Ye.

University of Texas at San Antonio, San Antonio, TX.

Gold nanorods exhibit a high optical absorption that can be tuned based on the aspect ratio. When the gold nanorods are excited with a nanosecond laser pulse, they can produce ultrasonic waves through thermoelastic effects. Thus, gold nanorods may be used as contrast agents for photoacoustic imaging. The strength of the signal is dependent on several factors, including the angle between the polarization of the excitation light and the rod orientation. Having the ability to control the orientation of the gold nanorod allows one to optimize the photoacoustic signal when the polarization of the laser is parallel to the rod. We propose to build a computational model of a gold nanorod conjugated with an iron nanoparticle on one end of the rod and use an external magnetic field to control the orientation of the nanoparticle conjugates. Two dimensional models will be used to calculate the minimal forces needed to orient the rod and the intensity of the photoacoustic signals from the excited gold nanorod. We plan to implement the experiment in the future using the information from the simulations.

(Partially funded by NIGMS MBRS-RISE GM060655.)

Ballroom C - 83

ORGANIC AMPHIPHILIC NANOSTRUCTURES FOR PHOTOTHERMAL ABLATION OF TUMORSTravis Cantu, Jennifer Irvin, Tania Betancourt.*Texas State University, San Marcos, TX.*

Currently, chemotherapy is the most widely used technique to treat cancer. Although this method is effective at treating certain stages and types of cancer, there is a need for more direct treatment. Recently, one technique that has gained interest due to high selectivity is photothermal therapy (PTT). The PTT approach uses photoabsorbing agents to burn cancer cells by generating heat from externally applied optical energy. The vast majority of research focused on PTT is on the inorganic nanomaterials that absorb light in the near-infrared (NIR) region. We are currently developing an organic-based PTT nanomaterial. The polymer being studied is bis-3,4-ethylenedioxythiophene (EDOT)-benzene (BEDOT-B) and the surface will be modified with polyethylene glycol (PEG). This is an electroactive polymer-based material with an absorbance in the NIR region. BEDOT-B will be synthesized from coupling 1,4-dibromo-2,5-dihexyloxy-benzene and EDOT. Once the monomer is formed, BEDOT-B will be synthesized using electrochemistry. The 1,4-dibromo-2,5-dihexyloxy-benzene has been synthesized and characterized using ^1H NMR (CDCl_3 , ppm): 7.09 (s), 3.95 (t), 1.80 (m), 1.47 (t). Further characterization will be done using C^{13} NMR, and FTIR. Nanoparticles will be characterized by dynamic light scattering, zeta-potential analysis, fluorescence, absorption spectroscopy, and by transmission and scanning electron microscopy (TEM and SEM, respectively). The photothermal capabilities of the materials will be studied by irradiating an aqueous suspension with a NIR light source. *In vitro* studies will also be conducted to determine the biocompatibility, specificity, and therapeutic efficacy of these photoablation agents.

CHEMICAL ENGINEERING

Ballroom C - 111

A MULTIOBJECTIVE OPTIMIZATION FRAMEWORK FOR THE CONTROL OF SIZE AND SHAPE DISTRIBUTIONS OF CRYSTALLIZATION SYSTEMSDavid Acevedo, Zoltan Nagy.*Purdue University, West Lafayette, IN.*

Optimization studies of batch crystallizers to determine temperature trajectories for controlling properties of the crystal size distribution (CSD) have been commonly performed by using one-dimensional population balance models (PBM). However, the properties of the crystalline products are significantly influenced by both the size and shape distribution of the particles. Crystals experience changes both in size and shape during the process. Size and shape are strongly coupled properties. The purpose of the current work is to provide a systematic investigation of the classes of crystallization systems for which optimal temperature trajectories can be determined that simultaneously control properties of the CSD and shape. A generic, multidimensional PBM is implemented for unseeded crystallization processes. The model is used in optimization studies considering different kinetics such as fast/slow growing systems, and growth versus nucleation dominated processes, and various objective functions. Multiple performance objectives lead to significantly different optimal operating conditions. A multi-objective approach has been implemented that gives rise to a set of Pareto-optimal solutions, which is determined via a sequential quadratic programming (SQP) framework. The equivalent spherical diameter and aspect ratio were proposed as size and shape related performance objectives. The effect of shape related objectives on size objectives is shown through the analysis of the Pareto front for size and size-shape controlled cases. The proposed study provides a systematic understanding of the types of crystallization systems for which size and shape can be manipulated and the level at which shape distribution can be controlled by manipulating the supersaturation only.

CIVIL ENGINEERING

Ballroom C - 120

SUSTAINABLE DEVELOPMENT AND TRANSPORTATION DECISION MAKING: INCORPORATING PUBLIC PREFERENCES USING VISUALIZATION

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The vitality and competitiveness of a region is influenced by a reciprocal relationship between economic growth and transportation. The World Bank identifies roads and highways as the back bone of the economy. In the United States, transportation accounts for nearly 11% of the gross domestic product. However, the increasing growth of infrastructure creates a great pressure on the environment and society. The transportation sector accounts for 30% of the global air pollution and greenhouse gases. For that reason, there have been efforts to manage and reduce the negative consequences of transportation infrastructure investments. Nevertheless, many situations can be found where the interests of communities, environment, and economic development are in conflict. The literature presents efforts at different levels and locations. The involvement of communities is a key element of the social component of sustainability; however, information about techniques available to reach an adequate level of community participation is scarce. In that sense, identification of tools for the evaluation of project alternatives based on communities' preferences was needed. The objective of this project is to evaluate visualization as a tool to assist in a participatory decision making process. It includes three tasks: the identification and classification of sustainability development indicators related to transportation, criteria prioritization based on community preferences obtained through a survey and the analytical hierarchy process, and visualizations design and evaluation. Visualizations reflect a specific transportation project alternative. At the end, the consistency of the preferences in the criteria and the visualizations is evaluated.

COMPUTER/SYSTEMS ENGINEERING

Ballroom C - 19

ENHANCING A HYPERSPECTRAL IMAGE ANALYSIS LIBRARY FOR CROSS-PLATFORM AND HETEROGENEOUS CUDA SUPPORT

Brian Landron, Nayda Santiago.
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High performance computing power provided by general purpose graphical processing units (GPGPUs) has been widely accepted as a component of hyperspectral image (HSI) analysis due to their ability to efficiently process large amounts of data. Aiming for rapid prototyping of HSI analysis algorithms for GPGPUs, an open source software library prototype, libdetect, is being enhanced. This library supports the Reed-Xiaoli (RX) and matched filter (MF) detection algorithms on the NVidia Compute Unified Device Architecture (CUDA). The core of libdetect's infrastructure was built using the CMake development tool in order to incorporate possible cross-platform support. The infrastructure also supports automated testing of coding guidelines with KWStyle and can provide automated compilation reports with CTest. To improve libdetect's ability to process images of various sizes, additional support for NVidia CUDA models with limited memory capacity must be incorporated as well as support for more than one NVidia CUDA model. Furthermore, code that limits libdetect to Linux with a certain version of the CUDA infrastructure has to be replaced. The first issue is being addressed with the design of algorithms that partition the entire HSI analysis process into a set of smaller tasks that a limited NVidia CUDA model can handle. In addition, software that replaces libdetect's dependencies is currently being tested. The resulting libdetect will be a cross-platform, HSI analysis software library with support for more than one NVidia CUDA model.

ELECTRICAL/ELECTRONICS/COMMUNICATIONS ENGINEERING

Ballroom C - 74

TOPOLOGICAL ESTIMATION OF UNKNOWN ENVIRONMENTS USING A BIOLOGICALLY INSPIRED ROBOTIC SWARMAlireza Dirafzoon, Edgar Lobaton.*North Carolina State University, Raleigh, NC.*

Mapping and exploration are essential tasks for swarm robotic systems in applications such as search and rescue or surveillance and monitoring. These tasks become extremely challenging when localization information is not available. In this study, we explore how stochastic motion models and weak encounter information can be exploited to learn topological information about an unknown environment. Our system behavior mimics a probabilistic motion model for cockroaches that incorporates random motion as well as wall-following behaviors. We employ tools from algebraic topology to extract spatial information on the environment based on the neighbor-to-neighbor interactions among the biologically inspired agents with no need for positioning data. This information is used to build a map of persistent topological features of the environment. We explore the performance of our estimation based on the existing mathematical tools and propose a switching control mechanism to extract features of complex environments in an effective way.

Ballroom C - 106

SCALABLE, PARALLEL, DEDICATED FFT CORE WITH FIXED RADIX ON FIELD PROGRAMMABLE GATE ARRAYSFelipe Minotta, Manuel Jimenez.*University of Puerto Rico at Mayagüez, Mayagüez, PR.*

The fast Fourier transform (FFT) is the main block in many communication systems and signal processing applications as it provides the frequency spectrum of any signal. Hardware implementations with this operation are highly regarded as they provide improved performance characteristics with respect to software-based sequential implementations. The purpose of this work is to develop a method for scaling the level of parallelism in an FFT core with upper radix butterflies when implemented in hardware. Our approach is mainly based in $2k$ memory blocks, an address generator, and k radix- r butterflies. The number k of butterflies determines the level of parallelism. The main problem is to develop a block to generate the correct addresses regarding the number of butterflies, radix, size of the FFT, and numeric format. Currently, we are trying to solve the problem using numerical series and studying the different ways of factorization of the original algorithm developed by Fourier. Currently, we have implemented the core with 1, 2, and 4 butterflies independently. The expected high performance of the core lies in the fact it does not need dedicated permutation hardware between stages. Instead, the data flow and order is controlled by an address generator. Using this scheme, the impact on consumed resources is significantly mitigated when the number of points of the FFT core is increased. Our expectation is to develop a fully scalable FFT core including latency, number of points, radix of the butterflies, and numeric format using this approach.

Ballroom C - 42

EXPERIMENTAL ANALYSIS AND SIMULATION OF A PIEZOELECTRIC TRANSDUCER COMPOSED OF HEXAGONAL GEOMETRY TRANSDUCERSJuan Tamez, Amar Bhalla, Ruyan Guo.*University of Texas at San Antonio, San Antonio, TX.*

Piezoelectric transducer (PZT) design involves computer modeling and experimental verification in order to validate the piezoelectric transducer performance. To construct a precise computer model using COMSOL multiphysics, it is necessary to know the piezoelectric material electrical and mechanical properties. The objective is to analyze and model a noncontact piezoelectric transducer capable of being used in the medical field such as tissue imaging. Thus, this work experimentally measures the properties of a low frequency (kHz range) PZT transducer composed of hexagonal tube arrays assembled similar to that of a honey comb. The obtained admittance ($|Y|$), phase (θ) and displacement (d_{33}) measurements are used to calculate the transducer effective coupling coefficient (K_{33}), quality factor (Q) and damping coefficients. These parameters are used to fine tune the computer model to further analyze the sensor under different boundary and electrode conditions to achieve an optimum model. The model and parameter can be further tuned to allow us to design a piezoelectric sensor to desired resonant frequencies and displacement amplitudes.

Ballroom C - 82

POINTWISE SHAPE-ADAPTIVE ALGORITHMS FOR HIGH-QUALITY DE-NOISING AND DE-BLOCKINGEmiliano Morales, Art Grigoryan.*University of Texas at San Antonio, San Antonio, TX.*

Methods of digital image processing are widely used in medical imaging when different types of images with cancer require performing a complex processing of images. For many medical images, it is desired to enhance the quality of images; detect, extract, and analyze the areas with tumors; and accomplish accurately the classification of the type of the tumor. Therefore, the main goal of image enhancement is to improve the visual appearance of images. Existing methods for image enhancement are manifold. Enhancement methods vary with different types of images and noise models. In this proposal, we will develop a novel image filtering approach based on the shape-adaptive discrete cosine transform to effectively de-noise grayscale as well as color images. The shape adaptive approach will be applied to different transform-based image enhancement algorithms such as α -rooting, tensor, and Fourier transforms. Enhanced images will be compared to the same altered images presented utilizing MATLAB to verify results. Besides noise removal, this work will investigate if the other transform-based algorithms are also effective in dealing with artifacts that are often encountered in block-DCT compressed images and videos, suppressing blocking artifacts while preserving salient image features. Due to the proven application of the different transform-based algorithms, the visual quality of the estimates is expected to be high with sharp detail preservation, clean edges, and without unpleasant artifacts introduced by the transforms. (This work is partially funded by the NSF LSAMP-BD 1249284.)

Ballroom C - 67

A STUDY OF SEQUENTIAL ACTIONS AT THE MEAL LEVELRaul Ramos-Garcia, Adam Hoover.*Clemson University, Clemson, SC.*

This work is motivated by the growing prevalence of obesity, a health problem affecting over 500 million people. Measurements of energy intake are commonly used for the study and treatment of obesity. However, the most widely used tools rely upon self-reporting and require a considerable manual effort, leading to underreporting of consumption, non-compliance, and discontinued use over the long term. We are investigating the use of wrist-worn accelerometers and gyroscopes to automatically recognize eating gestures. In order to improve recognition accuracy, we studied the sequential dependency of actions during eating. Using a set of 4 actions (rest, utensiling, bite, and drink), we developed a hidden Markov model (HMM) and compared its recognition performance against a non-sequential classifier (KNN). Tested on a dataset of 20 meals, the KNN achieved 76% accuracy while the HMM achieved 87% accuracy, showing that knowledge of the sequential nature of activities during eating improves recognition accuracy.

ENGINEERING SCIENCES/MECHANICS/PHYSICS

Ballroom C - 47

BINOCULAR ADAPTIVE HOLOGRAPHIC SEE-THROUGH PHOROPTERAshley Valdez, Carl Chancy, Schwiegerling.*University of Arizona, Tucson, AZ.*

The purpose of our research is to develop an automatic adaptive see-through binocular phoropter. The phoropter will automatically measure spherical and cylindrical error and null this error with a compound spherocylindrical fluidic lens. The multi-generation optical system corrects for astigmatism and spherical refractive errors of the eye. Currently, a monocular automated phoropter has been designed and fabricated. The system is comprised of three components required for assembly: a fluidic lens, a relay telescope, and a Shack-Hartmann sensor. The fluidic lens system is a stack of 3 adjustable lenses: a spherical lens and 2 astigmatic lenses. Adjusting the fluid volume within the lenses can modify properties of the fluidic lenses. The modifications change the curvature of the lens, which accommodates for the error by lens power adjustments. Following the fluidic lenses is a relay telescope that directs infrared light toward the final component, the Shack-Hartmann wavefront sensor. The sensor detects scattered infrared light off the eye as a wavefront reconstructing the spherocylindrical refractive error. The reconstruction of the error produces a prescription for the participant. Thus far, our monocular system shows the capability of measuring a spherocylindrical

refractive error from -30 diopters to +30 diopters, visibly concluding that the system is capable of accommodating a wide range of astigmatism and sphero-cylindrical errors of the eye.

ENVIRONMENTAL ENGINEERING

Ballroom C - 129

MONITORING CHLORINATED VOLATILE ORGANIC COMPOUNDS AND PHTHALATE COMPOUNDS IN WATER SAMPLES USING EPA-MODIFIED METHODS

Irmario Cotto, Ingrid Padilla, Perla Torres.

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Puerto Rico has the highest rate of preterm birth in all of the states and territories of the United States, as well as extensive contamination of water sources. For these reasons, Puerto Rico has been selected as a test site by the Puerto Rico Testsite for Exploring Contamination Threats (PROTECT) Program. Groundwater and tap-water samples will be tested to determine the presence of specific threats. Environmental Protection Agency (EPA) methods were modified to extract and analyze the contaminants in environmental matrices. The process consists of performing a careful extraction process and analyzing the collected samples for the study area. These compounds include 10 chlorinated volatile organic compounds (CVOCs) and 3 phthalates. A gas chromatography/mass spectrometer (GC/MS) was used for the phthalates analysis, and a gas chromatography/electro capture detector (GC/ECD) was used for the CVOCs analysis. Different approaches were used to determine the detection and non-detection of the targeted compounds, depending on whether the samples had background or not. Phthalates have been found in most groundwater samples and in some of the tap water samples. These contaminants include di-n-butyl phthalate (DBP), di-ethyl phthalate (DEP), and di(2-ethyl hexyl) phthalate (DEHP). Also CVOCs have been found in some groundwater and tap-water samples. The CVOCs found were chloroform (TCM), carbon tetrachloride (CCl₄), trichloroethylene (TCE), and tetrachloroethylene (PCE). The most commonly found component in tap water was TCM. The modifications made to the extractions and analytical methods showed to be effective in the analysis of the samples.

Ballroom C - 57

ASSESSMENT OF WATER CONTAMINATION FOR HYDRO-EPIDEMIOLOGIC STUDIES OF PRETERM BIRTH

Norma Torres Torres¹, Ingrid Padilla¹, José Cordero², John Meeker³, Akram Alshawabkeh⁴.

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With a preterm birth rate of 17.7%, Puerto Rico has the highest preterm birth rate in the United States. As preliminary investigations indicate, the increase in preterm birth rates in Puerto Rico cannot be explained by known factors. Chlorinated volatile organic compounds (CVOCs) and phthalates have been suggested as causes of adverse reproductive outcomes. Since the 1980s, extensive contamination in the karst groundwater system of Puerto Rico has been found. The Puerto Rico Testsite for Exploring Contamination Threats (PROTECT) is a multidisciplinary research project that attempts to assess the potential relationships between contaminants and preterm birth. The work involves collecting and analyzing historical and field water quality data from the karst aquifer of northern Puerto Rico to assess the spatial and temporal extent of groundwater contamination. The spatial extent is analyzed using geographic information system technologies. Also, pregnant women volunteers were recruited, in coordination with biomedical experts in the area of study, to be monitored during their entire pregnancy. Drinking water samples were collected from their houses to be analyzed for CVOCs and phthalates. Preliminary analysis shows a long-term, extensive level of groundwater contamination, and indicates complex fate and transport processes are affecting the mobility, storage, and release of legacy and emerging contaminants (including nitrates, trichloroethylene, and phthalates). Results suggest that water quality is also affected by hydrologic conditions in the study area. Comparison of detection results suggests that groundwater contamination is reaching drinking water sources and potentially exposing pregnant women.

Ballroom C - 127

ENVIRONMENTAL SURVIVAL OF FECAL INDICATOR BACTERIA *ENTEROCOCCI*Alejandra Ferruffino, Tao Yan.*University of Hawaii, Honolulu, HI.*

The purpose of this experiment is to show the decay of fecal indicator bacteria in beach sand and beach waters with a lack of vegetation. In contrast, it also shows the survival and growth of *Enterococci* fecal indicator bacteria (ENT) in areas where vegetation is available. It is expected that the ENT bacteria collected from sand and beach water will grow exponentially with time when plant tissue powder (PTP) from surrounding areas is fed to it. However, if no PTP is given to bacteria, it is expected that the population will decrease with time and eventually die off. Therefore, the hypothesis of the experiment is that plant vegetation contributes to ENT in beach sand.

INDUSTRIAL/MANUFACTURING ENGINEERING

Ballroom C - 150

HYBRID ANALYTICAL APPROACH FOR EMERGENCY MEDICAL SERVICE TIME RESPONSE IMPROVEMENTCarlos Escobar Sr., Hansuk Sohn.*New Mexico State University, Las Cruces, NM.*

Doña Ana County, New Mexico, has contracted with American Medical Response (AMR) as the community's exclusive 911 and non-emergency ambulance provider since July 2007. In this research, we present a hybrid analytical approach where a linear regression forecasting model and a computer simulation model are combined to analyze the quality of the AMR's Emergency Medical Service (EMS). First, statistical tests of homogeneity were conducted to break down 24-hour periods into several equal-length periods of time such that the time-dependent travel time (speed) and arrival rate can be reasonably viewed as stationary. The forecasting model was used to determine the expected number of calls per shift. According to this volume, the minimum number of ambulances required per shift with 90% reliability were computed. Also a categorical variable is included to predict call locations based on zip code. At the end of the statistical analysis, the number of ambulances per shift was input in the simulations model. Using the hybrid approach, we are able to identify the optimal ambulance location, which enables the AMR not only to reduce response time, but also to increase the reliability of the service. According to our simulation experiment, there are several candidate ambulance locations that provide superior response performance. Our hybrid analytical approach is a valuable tool in determining optimal location in the EMS.

MATHEMATICS & STATISTICS**APPLIED MATHEMATICS**

Ballroom C - 99

THE OPTIMAL STERILE RELEASE POLICIES FOR CONCURRENT MATING FAILURE TECHNIQUESSergio Ramirez, Luis Gordillo.*Utah State University, Logan, UT.*

Sterile insect technique (SIT) is a pest control method that does not contaminate the environment, does not cause damage to other insect species, and is safe for humans. We investigate the use of stochastic search algorithms to find release policies that reduce pests at a desired level in a given time and at a minimal cost. The cost will depend on the rate at which the insects devour crops and the price of producing these sterile insects. We assume that the release of sterile insects is made in pulses with a determined time frequency. This contrasts with current models that assume continuous release. The model that we investigate allows integration of concurrent mating failure techniques, such as pheromone trapping and pheromone release, for species with relatively long lifespans and short reproductive times, such as some species of Coleoptera.

Ballroom C - 56

STEADY STATES AND THEIR TRANSIENTS FOR A FAMILY OF FINITE DYNAMICAL SYSTEMSXavier Teran Batista, Dorothy Bollman.*University of Puerto Rico at Mayagüez, Mayagüez, PR.*

Finite dynamical systems have many applications in engineering and the sciences, including biology, computer science, and social science. In all of these applications, it is important to know what states reach a steady state and, if so, how long they take to reach the steady state, i.e., the transient. In this ongoing work we consider a family of Boolean monomial dynamical systems (BMDS) whose dependency graph is primitive. It has been shown that such a BMDS is a fixed-point system: every state eventually attains a steady-state, fixed point. Furthermore, the transient of such a BMDS is equal to the exponent of the dependency graph. In this work, we characterize transients explicitly in terms of the cycle lengths of the dependency graph, and we show a way to compute transients using programs.

Ballroom C - 113

EXPLICIT SOLUTIONS TO THE HALF-LINE KORTEWEG-DE VRIES EQUATIONSarah Gauntt, Tuncay Aktosun.*University of Texas at Arlington, Arlington, TX.*

The half-line Korteweg-de Vries (KdV) equation is an integrable, nonlinear partial differential equation used to describe propagation of surface water waves in shallow, narrow canals and propagation of acoustic waves in ionized gases. A formula is presented for certain explicit solutions to the half-line KdV equation in terms of three constant matrices A , B , and C with sizes $n \times n$, $n \times 1$, and $1 \times n$ respectively, for any positive integer n . Such solutions include all solitary wave solutions called n -soliton solutions. In addition to their physical importance, such explicit solutions can be used to test the accuracy of numerical methods developed for solving nonlinear partial differential equations. The solution formula is generalized to the case when the matrix size n becomes infinite. This is done by writing the solution formula in terms of a determinant and by interpreting that determinant as a Fredholm determinant as the matrix size n becomes infinite. Thus, explicit solutions are obtained for the half-line KdV equation containing infinitely many solitons.

Ballroom C - 11

MODELING AND COMPUTATION OF TISSUE GROWTH DRIVEN BY STEM-CELL NICHESSeth Figueroa, Jeremy Ovadia, Qing Nie.*University of California, Irvine, Irvine, CA.*

Formation and sustenance of a stem cell niche in stratified epithelia is key in controlling the tissue's growth, morphology, and regenerative capabilities. Often, stratified epithelia develop advantageous finger-like structures, such as rete ridges (or rete pegs) in the epidermis and the palisades of Vogt in the limbal, corneal epithelium, along which the stem-cell niche forms. These structures provide the basal layer of the epithelia with better protection and allow the tissue a more efficient wound response. However, how these undulating structures are formed and the role of the spatial aspects of the niche on its local environment are not fully understood. Interesting questions arising from this include how do extracellular cues and the tissue's underlying genetic system affect niche formation and tissue morphology; how does the tissue's morphology, in return, affect the dynamics of the cell lineage and the stem cell system's regenerative capabilities? Here we present a 2-dimensional multiscale model of stratified epithelial growth. The tissue growth model consists of stem cells, cell lineages, and regulatory diffusive molecules. We have shown that stem cell niche development triggers distorted epithelial morphologies similar to rete ridges with stem cells accumulating along the tips, agreeing with experimental observations. Furthermore, we explore factors affecting niche formation and size as well as potential biochemical regulations that can prompt formation and stabilization of advantageous tissue architecture.

Ballroom C - 75

A GENERALIZED APPROACH TO DARBOUX TRANSFORMATIONS FOR DIFFERENTIAL EQUATIONSMehmet Unlu, Tuncay Aktosun.*University of Texas at Arlington, Arlington, TX.*

A Darboux transformation is a mathematical procedure used to produce a solution to a differential equation when the solution to a related differential equation is known. The basic idea behind a Darboux transformation is to change the discrete spectrum of a linear differential operator in a controlled way without changing its continuous spectrum. For example, by using a Darboux transformation, one can describe the change in a quantum mechanical system when some its quantum levels are removed or some extra quantum levels are added. Darboux transformation formulas

for various differential equations have been developed, but such formulas seem to be specific to those particular equations without much connection among them. In our method, we develop a generalized and unified approach for Darboux transformations that is applicable to a large class of differential equations. This approach uses the solution to a linear integral equation where the kernel and nonhomogeneous terms coincide. We apply our unified approach to some specific differential equations such as the Schrodinger equation, the Korteweg-de Vries equation, and the nonlinear Schrodinger equation, and compare our formulas with the existing Darboux transformation formulas for those specific equations.

Ballroom C - 156

STABILIZING GENE REGULATORY NETWORKS THROUGH FEEDFORWARD LOOPS

Claus Kadelka, Reinhard Laubenbacher.

Virginia Bioinformatics Institute, Virginia Polytechnic Institute and State University, Blacksburg, VA.

The concept of canalization in gene regulation was developed as a possible solution to the question of why the outcome of embryonal development leads to predictable phenotypes in the face of widely varying environmental conditions. The key step of gene expression is fundamentally a stochastic process, which makes the stability of genetic regulation programs all the more surprising. An entirely novel gene regulatory mechanism, discovered and studied during the last decade, which is believed to play an important role in cancer, is shedding some light on how canalization may in fact take place as part of a cell's gene regulatory program. Short segments of single-stranded RNA, so-called microRNAs, which are embedded in several different types of feedforward loops, help smooth out noise and generate canalizing effects in gene regulation by overriding the effect of certain genes on others. In a computational study, we used the modeling framework of generalized Boolean networks to explore the role that microRNA-mediated feedforward loops play in stabilizing the global dynamics of various gene regulatory networks. We compared the degree of stochasticity of a basic gene network and an extended network in which various numbers of microRNAs have been introduced in a biologically inspired way and were able to exactly quantify the stabilizing effect for any gene regulatory network. Thus, this research contributed to an answer for the question as to what extent microRNAs stabilize gene regulatory programs.

Ballroom C - 93

A COMPUTATIONAL FRAMEWORK FOR PENALIZED DISCONTINUOUS GALERKIN METHODS APPLIED TO TIME-HARMONIC MAXWELL'S EQUATIONS IN 3D

Arlin Alvarado Hernandez Sr., Paul Castillo.

University of Puerto Rico at Mayagüez, Mayagüez, PR.

The need to simulate electromagnetic phenomena with characteristics such as complex geometries and heterogeneous materials can be found throughout applied science and engineering, especially models based on Maxwell's equations in the frequency domain. It is well known that without proper care, finite-element methods generate spurious modes: solutions that are not physical. To avoid or at least to minimize this problem, several penalized, discontinuous Galerkin methods have recently been proposed. In this work, we present a computational framework for the penalized local discontinuous Galerkin method and other discontinuous Galerkin methods applied to time-harmonic Maxwell's equations. A simple description of the internal, discrete operators is formulated using tensor notation. The proposed software derives its flexibility from the use of the object-oriented programming paradigm, which can be used for high order approximations on unstructured meshes in 3D. Numerical experiments are presented to assess the performance of the penalized LDG method.

Ballroom C - 144

MIXTURES OF LONG- AND SHORT-RANGE CONNECTIONS IN NEURAL NETWORKS WITH WAVE PHENOMENON

Juan Morales, Virgil Pierce.

University of Texas-Pan American, Edinburg, TX.

A neural network can be studied as a graph where each node represents a neuron in the network. The neural activity is a combination of external stimulus and internal communication from one node to another. Moreover, some networks show synchronous discharges of pulses that form waves within the network. This wave phenomenon can be studied in detail with respect to certain brain regions. Recurring wave activity can suggest patterns that may imply certain brain disorders. In this paper, we will explain some of these ideas and make some assumptions about the topology

of the underlying connectivity with an emphasis on the effects of long-range connections between nodes on the wave phenomenon.

Ballroom C - 79

BIFURCATION ANALYSIS OF A MODEL FOR HORMONAL REGULATION OF THE HUMAN PITUITARY-OVARIAN AXIS

Angelean Hendrix, James Selgrade.

North Carolina State University, Raleigh, NC.

A 16-dimensional model of the human pituitary-ovarian axis is presented. In this study, we present a sensitivity analysis of the model's 70 parameters. The 3 parameters with the largest sensitivity coefficients are investigated for biologically significant bifurcations. The first parameter, κ , represents pituitary gonadotrophs' responses to ovarian testosterone feedback. ι , the second parameter investigated, controls a healthy dominant follicle response to pituitary stimulation. The final parameter, m_2 , controls the growth rate of young follicles. Studying bifurcation diagrams of these parameters suggests a balance of pituitary feedback and follicular growth rate is necessary for successful ovulation. Hopf, saddle-node, transcritical, torus, and period-doubling bifurcations are examined. A unique interval of parameters is identified for a stable, periodic solution that represents ovulatory cycles. A second, nonovulatory but periodic, solution is presented that resembles serum hormone levels consistent with polycystic ovarian patients, often nonovulatory or subovulatory. Bifurcation analysis of the flow of stable, periodic solutions is presented for possible identification of extended-use contraception and infertility treatments.

MATHEMATICS (GENERAL)

Ballroom C - 124

ON TAU FACTORIZATIONS WHEN TAU IS AN EQUIVALENCE RELATION

Cesar Alberto Serna Rapello, Reyes M. Ortiz-Albino.

University of Puerto Rico at Mayagüez, Mayagüez, PR.

In a framework of the theory of generalized factorizations or τ -factorizations, defined by Anderson and Frazier in 2006, the most interesting result holds when τ is a divisible relation. Our work focuses on the characterization of properties in the theory of τ -factorizations on integral domains when τ is an equivalence relation. We also assume τ is multiplicative and associative preserving to obtain results similar to a divisible relationship. If τ is an equivalence relation, it is reflexive and, hence, we cannot assume the divisible property. In addition, such relations are more realistic, in the sense the relationship's domain is all the nonzero, nonunit elements of the integral domain and the historical fact of working with one of the oldest types of relationships. We present several results and examples for better visualization of this theory.

Ballroom C - 63

DISSECTIONS & PARAMETERIZATIONS FOR QUINTIC EISENSTEIN SERIES

Esteban Melendez, Tim Huber.

University of Texas-Pan American, Edinburg, TX.

By analyzing the *Notebook of Ramanujan*, we show that the Eisenstein series for the Hecke-like subgroup of level 5 are expressible as homogeneous polynomials. We see interpretations for some quintic operators that will address conjectures regarding parameterizations for quintic multisections of Eisenstein series on the full modular group. Also, by using different techniques, we can derive congruences for modulo 5^A and generalize Ramanujan's conjectures for the series from Jacobi.

STATISTICS

Ballroom C - 38

EVALUATING THE IMPACT OF NONSAMPLING ERRORS ON SMALL DOMAIN ESTIMATES FOR THE CONSERVATION EFFECTS ASSESSMENT PROJECT

Andreea Erciulescu, Emily Berg.
Iowa State University, Ames, IA.

The Conservation Effects Assessment Project (CEAP) is a series of surveys intended to evaluate environmental outcomes associated with conservation practices. Four sources of error in CEAP are nonresponse error, location error, frame problems, and processing error. Nonresponse error occurs due to refusals and can be evaluated using auxiliary data available for the full sample. Location error, resulting from imperfections in data collection protocols and GPS instruments, refers to differences between the sampled location and the location at which data are collected. Constructing a frame that covers the whole population of interest and does not cover domains that are irrelevant for CEAP is difficult. Only farming operations with land in crops or certain kinds of hay or pasture are eligible for CEAP, but current information on land use is not available at the sample design stage. A fourth source of nonsampling error in CEAP arises because the original collected data are processed through a computer model called the APEX model. The APEX model calculates an erosion value and an erosion index for each respondent as functions of the survey responses and auxiliary information related to climate and soil characteristics. Imperfections in the APEX model may lead to error in CEAP estimates. Possible ways to evaluate the effects of nonresponse error and error due to frame inefficiency on small domain estimates based on the CEAP survey data will be discussed. Limitations in our ability to evaluate location error and error in the APEX model will also be considered.

Ballroom C - 94

APPLICATION OF PRINCIPAL COMPONENT FOR THE DEVELOPMENT OF SOCIAL, ECONOMIC, AND EDUCATIVE INDEXES FOR THE CLASSIFICATION OF THE MUNICIPALITIES OF PUERTO RICO

Ricela Feliciano-Semidei, Edgardo Lorenzo-Gonzalez.
University of Puerto Rico at Mayagüez, Mayagüez, PR.

In this study, indexes for quantifying social, educational, and economic aspects of the municipalities of Puerto Rico are created. In order to construct these indexes, the multivariate technique of principal components was used, then partitioning around medoids (PAM) was applied in order to obtain a classification of clusters for each aspect. The municipalities with the highest social index are in the West, the highest economic index are in the metropolitan area and the municipalities with higher education in the Northeast. In addition, municipalities were categorized into high, medium, or low, depending on a quality of life index. The municipalities with the highest quality of life index are concentrated in the metropolitan area. Several findings in this investigation would be relevant to decision making for government agencies of Puerto Rico.

PHYSICAL SCIENCES

ASTRONOMY/ASTROPHYSICS

Ballroom C - 39

P-MODES IN H α – A COMPARATIVE STUDY OF ACTIVE FLARING REGIONS ALONG WITH THEIR QUIESCENT COUNTERPARTS

Teresa Monsue¹, Frank Hill², Keivan Stassun³, Nathan De Lee³.

¹*Fisk-Vanderbilt Masters-to-PhD Bridge Program, Nashville, TN*, ²*NSO Integrated Synoptic Program, National Solar Observatory, Tucson, AZ*, ³*Vanderbilt University, Nashville, TN*.

P-mode oscillations are studied in the H α region to obtain information regarding the chromospheric structure on the Sun. It has been accepted that around magnetically concentrated active regions, such as sunspots, p-mode power

is suppressed. However, solar flares commonly occur in active regions. Flares are known to induce power to certain frequency oscillation bands. This study aims to take a survey of NSO's GONG H α data of various M and X-Class flares and study how active regions compare to quiet regions around the flares by analyzing frequency distributions of p-mode oscillations. To obtain information on the frequency distribution, power spectra of individual pixels around the flare region are taken utilizing the fast Fourier transform (FFT) with the time series data. We can then study how the frequency distribution evolves with time by constructing a power map movie of that region. We will then be able to study how the acoustic power in the active regions varies with flare intensity at different frequencies of p-mode oscillations. Studying power spectra in active regions in H α such as sunspots on the verge of flaring, and investigating if there are any frequencies that peak in power for certain frequency p-modes, could answer some questions on magnetic flux emergence where acoustic energy from the surface could feed into the corona, one of the biggest mysteries of the Sun.

CHEMISTRY (EXCEPT BIOCHEMISTRY)

Ballroom C - 41

A NOVEL METHOD FOR TRANSCRIPTION FACTOR IDENTIFICATION AND PURIFICATION

Linda Nagore, Harry Jarrett, YanWen Zhou, Yinshan Jia.

University of Texas at San Antonio, San Antonio, TX.

Classical promoter DNA characterization consists of identification of a single transcription factor under a single given condition, which tends to be laborious and time consuming. A method is employed that allows the characterization of any promoter DNA under any condition with minimal sample handling. Here we show a method called Promoter-MALDI-MS where DNA designed for a specific promoter will be absorbed on a polymer-coated MALDI plate. The advantage is that transcriptional complexes bind to DNA in solution, and then the DNA is bound to the plate allowing characterization to be accomplished on one immobilized surface. MALDI-MS conditions will be set to identify proteins as well as show protein-to-protein binding. Cell line HEK293 nuclear extract and the promoter DNA of interest complex in solution, then attach to the surface by pipetting the solution onto the plate and drying. The plate is washed to get rid of any non-specific proteins along with salts and surfactants that are not compatible with MS. On-plate trypsin digestion and collision-induced dissociation is utilized to characterize the transcription factors and observe any protein-to-protein interactions. It is expected that Promoter-MALDI-MS will produce high purity transcription factors with minimal sample handling with any promoter. This will give higher recovery of already low abundant proteins with higher sequence coverage. Based on the nano-molar affinity of transcription factors for DNA, Promoter-MALDI-MS, and the increased accuracy of MS, this method will provide a new high throughput method to screen and identify transcription factors for any gene with a known core promoter.

Ballroom C- 162

ORGANOCATALYTIC ASYMMETRIC MANNICH REACTION OF α -SUBSTITUTED KETONE

Manisha Sharma, John Zhao.

University of Texas at San Antonio, San Antonio, TX.

Mannich reaction is one of the most powerful carbon-to-carbon bond forming reactions for the synthesis of nitrogen-containing compounds. It has been applied numerous times in the synthesis of pharmaceutically valuable compounds and natural products. The asymmetric version of this reaction enables to install one and/or two stereogenic center(s) depending on the substrates used. As a part of asymmetric reactions, we found highly enantioselective Mannich reaction of ketone and imine catalyzed by cinchona alkaloid-derived catalysts. Among the various solvents screened for the reaction, toluene was found as the best solvent. Reaction was carried out at room temperature with 10mol % catalyst loading. The corresponding product was obtained in moderate diastereoselectivity and excellent enantioselectivity.

Ballroom C - 88

ALCOHOL SYNTHESIS FROM CARBON MONOXIDE AND HYDROGEN OVER ALKALI PROMOTED MOS₂ BASED CATALYSTSBelinda Molina¹, Russell Chianelli².¹University of Texas at El Paso, El Paso, TX, ²Materials Research and Technology Institute, University of Texas at El Paso, El Paso, TX.

In 1922, German scientist Franz Fischer and Professor Hans Tropsch discovered a catalytic process between carbon monoxide and hydrogen that produced a variety of synthetic products including alkanes, alkenes, olefins, paraffins, hydrocarbons, and alcohols. During World War II, this process (known as Fischer Tropsch (FT)) made it possible for Germany to produce synthetic fuel from its coal reserves to sustain its armies on the field. During FT synthesis, carbon monoxide and hydrogen in the form of synthesis gas or "rejected gas", is released from coal through a gasification process. Deriving synthetic products from synthesized gas is possible with the aid of a highly-active working catalyst. Catalysts are used in the industrial processing of fuel and synthetic products daily throughout the world. This research thesis aims at developing a catalyst that is selective in the formation of alcohols for synthetic transportation liquid fuels. In other words, the catalyst should be able to change the thermodynamically controlled process to a kinetically controlled process that would favor the production of alcohols. The assembly of a lab scale gas-to-liquid technology is also being developed to test catalytic material for alcohol production. The depletion of oil reserves and an exponentially increasing demand for energy worldwide, combined with the national interest to reduce dependence on foreign oil, makes alcohol production of fuels and chemicals via FT synthesis an attractive option for future sustainability development.

Ballroom C - 105

REMEDIATION OF CU (II) AND PB (II) FROM AQUEOUS SOLUTION USING ENGINEERED IRON OXIDE NANOPARTICLESCarlos Tamez Jr., Jason Parsons.*University of Texas-Pan American, Edinburg, TX.*

Nano-sized Fe_3O_4 and Fe_2O_3 were synthesized using a slow precipitation/titration method and their effectiveness as an adsorbent was tested. The nanoparticles were characterized with powder X-ray diffraction, to ensure the proper iron oxide was obtained. pH dependency studies determined optimum copper and lead binding to Fe_3O_4 and Fe_2O_3 occurs at pH 4. Copper and lead batch studies were conducted using 300 ppb solutions and 5 to 240 min contact time, and showed that both nanoparticles bind at a rate independent of time. Isotherm studies determined the binding capacity of Fe_3O_4 to copper to be 37.04 mg/g and lead to be 166.67 mg/g. Fe_2O_3 binding capacity was calculated to be 19.61 mg/g for copper and 45.45 mg/g for lead. Batch studies using 5 to 500 ppm solutions containing both copper and lead determined higher binding affinity for lead to both nanoparticles. Batch studies also showed no significant reduction in the binding of copper and lead to either Fe_3O_4 or Fe_2O_3 in the presence of Na^+ , K^+ , Mg^{2+} or Ca^{2+} .

Ballroom C - 142

FABRICATION OF AU₁₄₄ NANOCLUSTERS AND ITS INVESTIGATION USING ABERRATION CORRECTED SCANNING/TRANSMISSION ELECTRON MICROSCOPYNabraj Bhattarai, Subarna Khanal, Daniel Bahena, Ulises Satiago, Alfredo Tlahuice, Arturo Ponce, Miguel Jose-Yacaman.*University of Texas at San Antonio, San Antonio, TX.*

The fabrication of monodispersed nanoclusters with atomic precision carries significant attention as the properties can be tuned by altering the number of atoms. The determination of structure of molecular nanocrystal by X-ray diffraction has been achieved only in few cases as it requires homogenous, high degree of ordering, single crystal of oriented molecules. In this paper, we present the fabrication of $\text{Au}_{144}(\text{SR})_{60}$ nanocluster having 144 number of atoms protected by 60 thiol molecules and their characterization using aberration-corrected scanning transmission electron microscopy (STEM). $\text{Au}_{144}(\text{SR})_{60}$ nanocluster were synthesized using modified Brust's method and etching in excess of thiols. The obtained nanoclusters were characterized using UV/visible spectrometry and MALDI TOF mass spectrometry. The mass spectrometry results confirmed the number of atoms present in the cluster. We used the combination of low voltage (80 kV) STEM electron diffraction and high angle annular dark field (HAADF) STEM images in a Cs-corrected JEOL-JEM-ARM STEM to study the crystal structure. The electron diffraction patterns obtained from STEM are compared with the simulated diffraction patterns and HAADF-STEM images are compared with the theoretically simulated images. The simulated images and diffraction patterns are obtained from atomistic structural models

derived through first-principles density functional theory (DFT) calculations. The comparison between experimental (HAADF-STEM) images with the simulated images and the experimental diffraction patterns with the simulated diffraction patterns showed a very good agreement and we are able to determine the structure of $\text{Au}_{144}(\text{SR})_{60}$ to be icosahedral structure.

Ballroom C - 16

DETERMINATION OF NITRITE IN SALIVA USING MICROFLUIDIC PAPER-BASED ANALYTICAL DEVICES

Samir Bhakta, Carlos Garcia.

University of Texas at San Antonio, San Antonio, TX.

The development of novel analytical platforms is critical for the improvement of early diagnosis and for monitoring treatments of diseases. Point-of-care platforms can provide fast responses, decrease the overall cost of the treatment, allow for in-home use without a trained specialist, and improve the success of the treatment. The design of paper-based microfluidic devices can result in powerful diagnostic tools with high efficiency and versatility. Compared to traditional paper-based devices (such as reactive strips or ELISA-based kits), paper-based microfluidics are faster, more efficient, require smaller samples, and can perform multiple or complex biochemical reactions without external power or the risk of cross-contamination. Moreover, instead of being limited to a binary (negative/positive) response (e.g., pregnancy tests), paper-based microfluidic devices can also provide a visual range that is proportional to the concentration of a target marker. Considering the potential impact of this technology in oral health (e.g. periodontitis), the objective of this work was the development of microfluidic paper-based analytical devices (μ PAD) to identify and quantify levels of nitrite in saliva. The devices were fabricated by wax printing and allowed the detection of nitrite (proposed marker of periodontitis) by a colorimetric reaction based on the Griess method. Results related to the design, characterization, and applications of the proposed devices are discussed along with the advantages of this technology.

Ballroom C - 98

NOVEL COPOLYMERS OF TRISUBSTITUTED ETHYLENE MONOMERS, RING-SUBSTITUTED METHYL 2-CYANO-3-PHENYL-2-PROPENOATES AND STYRENE

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Novel copolymers of trisubstituted ethylene monomers, ring-substituted methyl 2-cyano-3-phenyl-2-propenoates and styrene, ($\text{R-PhCH=C(CN)CO}_2\text{CH}_3$, where R is 2,4-dimethyl; 3,5-dimethyl; 4-methoxy-2-methyl; 4-ethoxy-3-methoxy; 3-ethoxy-4-methoxy; 3,4-dibenzoyloxy; 3-benzoyloxy-4-methoxy; 4-benzoyloxy-3-methoxy; 2,3(methylenedioxy); 4-methyl-3-nitro) were prepared at equimolar monomer feed composition by solution copolymerization in the presence of a radical initiator (ABCN) at 70 °C. The composition of the copolymers was calculated from nitrogen analysis, and the structures were analyzed by IR, ^1H and ^{13}C -NMR. Molecular mass and thermal behavior of the copolymers was studied by GPC, DSC, and TGA.

EARTH SCIENCES/OTHER PHYSICAL SCIENCES

Ballroom C - 151

PHASE BEHAVIOUR AND SOLID ELECTROLYTE TRANSITION IN $\text{K}_3\text{H}(\text{SeO}_4)_2$

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The phase behavior of $\text{K}_3\text{H}(\text{SeO}_4)_2$ (TKHSe) above room temperature has been studied by differential scanning calorimetric (DSC), thermogravimetric analysis (TGA), simultaneous thermogravimetric and differential scanning calorimetric analysis (SDT), impedance spectroscopy (IS), and X-ray powder diffraction (PXRD). According to previous reports, around 388 K (114.85 °C), TKHSe presents a superionic phase transition produced by a structural phase transition, with values of the dc-conductivity above the transition temperature greater than $10^{-3} \Omega^{-1} \text{cm}^{-1}$. Looking for new evidences about this process, additional and alternative measurements were performed on well characterized TKHSe samples, reporting new findings which to our knowledge have not been previously reported in literature. The results show a process that start at 388 K which is accompanied by a slow thermal dehydration, at about the

superionic phase transition. We propose that the $K_3H(SeO_4)_2$ undergoes a phase transition and simultaneously a decomposition process. Moreover, the observed decrease of the magnitude of conductivity on successive thermal runs is a consequence of decomposition that starts at the surface of the TKHSe grains, but the jump in conductivity is only a consequence of the order-disorder transition in the TKHSe phase that remains inside the grains.

Ballroom C - 143

TILL LAYER IMAGING BENEATH THE JAKOBHAVN GLACIER, GREENLAND

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Jakobshavn Glacier is one of the fastest flowing glaciers on earth and the major discharging outlet glacier in Greenland, draining approximately 7% of the ice sheet. Studies from satellite imagery suggest that, in the past 2 decades, the Jakobshavn Glacier has experienced significant changes in ice discharge. Given the importance of this glacier to the stability of the Greenland Ice Sheet, ice flow modelers have tried to explain the recent behavior of the Jakobshavn Glacier. Gravitational and magnetic measurements collected over the Jakobshavn Glacier suggest that the ice/bed interface in the main trunk of the glacier is characterized by a sediment wedge of up to 2,400 m thick that reaches more than 54 km inland of the grounding line. Given the importance of this till layer for the flow behavior of the Jakobshavn Glacier, it is necessary to provide more evidence of the existence of this till layer. Therefore, in this investigation, we will re-process a 10 km seismic line collected by the Center for Remote Sensing of Ice Sheets. The seismic source for the line was 500 g of pentaerythritoltetranitrate (PETN) at a depth of 10 m below the surface. Twenty-four vertical-component geophones were placed at a spacing of 20 m along the profile. The minimum and maximum shot-receiver offsets were 10 m and 470 m, respectively. The seismic data will be migrated using multiple migration velocities in order to resolve sedimentary layers beneath the Jakobshavn Glacier and determine the thickness of the till layer for the area of study.

Ballroom C - 115

POSSIBLE ENDOLITH-MEDIATED WEATHERING PROFILE IN 2-BILLION-YEAR-OLD PHOSPHORITE

Chris Crosby, Jake Bailey.

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In 2-billion-year-old (2 Ga) phosphatic rock, we have identified filamentous features with characteristics reminiscent of fungal-like eukaryotes. Further, the rock shows evidence of the *in situ* weathering typical of ancient soil, or paleosol. The significance of organisms, particularly fungal, in weathering is well recognized, the dominant mechanism being secretion of compounds that facilitate both mineral alteration and endolithic access. We hypothesize that this rock may contain remnants of an ancestral fungal-like organism that may have contributed to mineral alteration. Hence, we seek evidence addressing the biogenicity and morphology of the filaments, the presence of secondary minerals, and the relationship between them. In support of biogenicity and possible eukaryotic interpretation, we have obtained Raman spectral evidence of kerogen, a biologically-produced material, and 3D rendering of Raman data clarifying the presence of a central lumen and indicating multicellular morphology largely distinct to eukaryotes. Microprobe EDS indicates the presence of aluminum, which is common to many secondary minerals. Forthcoming micro-XRD analysis should further identify mineralogies and help clarify the stage of iron and/or clay mineral evolution, providing evidence for use in interpretation of this rock. Though morphologically ambiguous microfossils that may represent eukaryotes begin to appear in the rock record around 2 Ga ago, more clearly eukaryotic organisms do not appear for another ~800 million years. Evidence of eukaryotes in the 2Ga rock record would push their advent back hundreds of millions of years. Further, an association between ancient paleosols and eukaryotes may inform our understanding of Paleoproterozoic weathering processes and the rise of atmospheric oxygen.

Ballroom C - 117

2010-2011 BERGY BIT ESTIMATIONS ALONG THE NASA ICEBRIDGE FLIGHT LINE

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Iceberg distribution in the Bellingshausen-Amundsen Seas has not been well studied due to a limited number of ship-based observations and limited temporal coverage of active microwave satellite systems. While synthetic aperture radar satellite coverage has greatly increased the ability to detect medium-to-large icebergs in the southern oceans, small icebergs and bergy bits are still problematic to resolve from space. Digital mapping system (DMS) imagery from the 2010-10-30 flight line show 0.06% of the total coverage area (1,085 sq. km) to contain 0.16% of bergy bits. DMS

imagery from the 2011-10-23 flight line show 0.0009% of the total coverage area (1,773 sq. km) contain bergy bits. The small percentage of bergy bits (0.06% and 0.0009%) has little effect on the estimation of sea ice volume.

GEOLOGY

Ballroom C - 62

DIAGENESIS AND DISTRIBUTION OF DIAGENETIC FACIES IN THE MISSISSIPPIAN OF SOUTH CENTRAL KANSAS

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Hydrocarbon reservoirs in the Mississippian system of south central Kansas are difficult to understand due to subtle rock properties (i.e., arbitrary porosities, complex trends of neomorphism, intricate fracture, and cementation patterns, etc.) that resulted mostly from different diagenetic processes. Inasmuch as the porosity and the permeability of a reservoir result from passage through different diagenetic environments, any reservoir quality evaluation needs a deliberate knowledge of diagenesis in the formation to maximize their production capacity. The objective of this research is to determine the origin and nature of the different diagenetic facies in the Mississippian system and understand their stratigraphic distribution in south central Kansas. Five cores are being described to determine the different depositional facies and diagenetic facies. Transmitted light microscopy, cathodoluminescence, and scanning electron microscopy will be used for thin-section descriptions of each core. Petrographic descriptions will be accompanied by geochemical analysis (stable isotopes, Fe and Mn concentrations, TOC concentrations, and x-ray diffraction) to determine the diagenetic environment at which minerals are precipitated and the source of the diagenetic fluids that altered the rock. The distribution of diagenetic facies will be determined by developing 3D static models from the correlation of diagenetic facies from core descriptions and different lithologies from petrophysical interpretations of wire line logs. This research will potentially provide information that can be used for reservoir quality assessment and reservoir architecture modeling. Also, it will further enhance subsurface stratigraphic interpretations in the Mississippian of Kansas.

Ballroom C - 155

FRANCEVILLITE [(BA,PB)(UO₂)₂(V₂O₈)•5H₂O] IDENTIFIED IN THE URANIUM VANADIUM DEPOSITS IN THE PRYOR MOUNTAIN MINING DISTRICT, MONTANA, AND THE LITTLE MOUNTAIN MINING DISTRICT, WYOMING, MAY PROVIDE A LINK TO THE ELEVATED LEAD IN THE BIGHORN RIVER

Anita Moore-Nall, David Lageson.

Montana State University, Bozeman, Bozeman, MT.

The Bighorn River is a declared 303d-impaired waterway once it passes through the Pryor Mountains on the Crow Reservation. The 303d designation is due to elevated lead and mercury. Uranium vanadium deposits in the Pryor Mountains of Montana and the Little Mountain Mining District of Northern Wyoming are characterized by collapse breccia features in a paleokarst horizon of the Madison Limestone. Both districts are located in Laramide structures. The Little Sheep Mountain anticline, a similar structure located near Lovell, Wyoming, hosts a cave with uranium-bearing hydrothermal fluids. This structure is superimposed by the Bighorn River and may provide a modern-day analogue to the depositional mode of mineralization for these 2 districts. Rock samples were collected from several mines, and water and mud samples were collected from Lower Kane Cave for analytical work. Francevillite [(Ba,Pb)(UO₂)₂(V₂O₈)•5H₂O] was identified using X-ray diffraction analysis (XRD) and scanning electron microscope (SEM) spot elemental analysis with energy dispersive X-ray spectrometry (EDS). The mineral was found with and closely resembles metatyuyamunite [Ca(UO₂)₂V⁵⁺₂O₈•3(H₂O)], the primary ore of the two districts. Variations of barite, disseminated sulfides, purple fluorite, green radioactive calcite, and quartz, sometimes of the Herkimer style, are common in the mineralized portions of the two districts. Lead was detected in mud and water samples from Lower Kane Cave and analyzed at Energy Laboratories in Billings, Montana. This study may show that structurally controlled migration of warm, metal enriched fluids may be the mode of mineralization for the 2 districts and the source of lead in the Bighorn River.

Ballroom C - 8

THE 1.4 EVERGREEN VALLEY GRANITE-GABBRO COMPLEX - IMPLICATIONS FOR TECTONIC-MAGMATIC SETTING IN THE MIDDLE PROTEROZOICAndrew Romero, Jennifer Lindline.*New Mexico Highlands University, Las Vegas, NM.*

The Mesoproterozoic Evergreen Valley Plutonic Complex (EVPC) exposed in the southern Sangre de Cristo Mountains of New Mexico is a bimodal granite-gabbro intrusion that shows field evidence for hybridization. Bimodal magmatism has typically characterized intraplate magmatic settings, though bimodal magmatism in intraoceanic arc settings is not atypical. Studies of the 1.4 Ga Sandia pluton, the 1.4 Ga Priest pluton, and others demonstrate that the 1.4 granites were emplaced under a regional NW-SE compressive regime, which support granite emplacement during a terrane collision event. Reconnaissance field study of the EVPC, however, reveals that these rocks are non-foliated and undeformed, conflicting with studies arguing for a 1.4 Ga orogenic event. The purpose of this study is to assess the mechanism of pluton emplacement as well as to determine the igneous processes (magma mingling, magma mixing, fractional crystallization, and assimilation) that affected its final composition. Field and microscopical structural relationships will assess the setting of pluton emplacement (syntectonic versus post-tectonic). Petrological and geochemical analysis will aid in the determination of the crystallization history and petrogenic relationships between the various rock types within the complex. This study will situate the emplacement of the complex into the appropriate tectonic regime at 1.4 Ga.

PHYSICS (EXCEPT BIOPHYSICS)

Ballroom C - 138

FABRICATION AND ANALYSIS OF HIGHLY EPITAXIAL PRBaCo₂O_{5.5+δ} THIN FILMSErik Enriquez, Xing Xu, Shanyong Bao, Chonglin Chen.*University of Texas at San Antonio, San Antonio, TX.*

Double perovskite cobaltate PrBaCo₂O_{5.5+δ} thin films are grown on various substrates by pulsed laser deposition technique. The films are layered perovskites with alternating Co-O square pyramid and octahedral layers along c-axis. Depending on the oxygen content, there are various cobalt valences (Co²⁺ / Co³⁺ / Co⁴⁺), resulting in a variation of the structure as well as the magnetic and electrical transport properties. Microstructural characterizations from X-ray diffraction and electron microscopy indicate that the as-grown films have good single crystalline quality and epitaxial behavior. The response of the films to changes in temperature and ambient environment are systematically studied. The effects of several dopants to the A-site or A- and B-site cations (Ca doping, or Sr and Fe doping, respectively) on the resulting physical properties of the films will be presented.

Ballroom C - 89

MAGNETIC PROPERTIES AND PHASE TRANSITIONS OF GADOLINIUM-INFUSED CARBON NANOTUBESAbdiel Quetz¹, Igor Doubenko¹, Tapas Samanta¹, Herbert Vinson¹, Saikat Talapatra¹, Naushad Ali¹, Shane Stadler².¹*Southern Illinois University at Carbondale, Carbondale, IL,* ²*Louisiana State University, Baton Rouge, LA.*

Carbon nanotube (CNT)/metal-cluster-based composites are envisioned as new materials that possess unique electronic properties which may be utilized in a variety of future applications. Superparamagnetic behavior was reported for CNTs with Gd ions introduced into the CNT openings by internal loading with an aqueous GdCl₃ chemical process. In the current work, the magnetic properties of the CNT/Gd composites were obtained by the joining and annealing of Gd metal and CNTs at 850 °C for 48 h. Energy dispersive X-ray analysis shows the presence of Gd intermingled with the CNT walls with maximum and average Gd concentrations of about 20% and 4% (by weight), respectively. The Gd clusters have a non-uniform distribution and are mostly concentrated at the ends of the CNTs. A ferromagnetic-type transition at T_c ~ 320 K, accompanied by jump-like change in magnetization and temperature hysteresis typical for the temperature-induced first order phase transitions has been observed by magnetization measurements. It was found that Gd infused into the CNTs by annealing results in a first order paramagnetic-ferromagnetic transition at T_c = 320 K. Complementary research is being performed with shorter carbon nanotubes.

Ballroom C - 43

OFF-AXIS ELECTRON HOLOGRAPHY USED TO EXTRACT STRUCTURAL PROPERTIES IN NANOSTRUCTURED MATERIALS

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An electron hologram is a fringe-modulated image containing the complete information, amplitude, and phase of an electron transparent object. Electron holography is an interferometric technique that has recently been a very reliable technique to extract quantitative information such as electro and magneto static fields, impurities in solids, determination of the thickness, and the lattice distortion in nanostructured materials. Since electrons have a high spatial coherence, electron holography has a significant potential in the determination of physical properties at high spatial resolution and sensitivity. The holograms are collected by the interference between one reference and one object Fresnel pattern generated using a biprism excited by a bias voltage. The characteristics of the Fresnel fringes range from a few microns to nanometer spacing as a function of the applied voltage. In this work, we report a variable magnification method for off-axis electron holography using a variable dual-lens system in the objective lens in a JEOL ARM-200F transmission electron microscope that achieves ultra-high resolution. We have applied this technique to compute thickness and inner potentials in metallic and bimetallic nanoparticles. The reliability of the microscope performance with these parameters was validated with the reconstructed phase of the hologram in Au-decahedral nanoparticles in which the topographic shape and 3D visualization have been extracted. In addition, the relationship between strain and chemical composition of bimetallic Au/Pd core-shell nanoparticles has been measured.

PSYCHOLOGY & SOCIAL SCIENCES

ANTHROPOLOGY/ARCHEOLOGY

Ballroom C - 163

USING A COMMUNITY-GUIDED APPROACH TO IDENTIFY ILLNESSES AND HEALTH CARE CONCERNS OF UNINSURED MEXICAN IMMIGRANTS ALONG THE US-MEXICO BORDER

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Hidalgo County in South Texas is one of the most medically underserved areas of the US, characterized by gaps in public health services, poor access to care, significant environmental health concerns, elevated rates of chronic disease, endemic poverty, the highest rate of obesity in the US, and the highest uninsured rate in the country at almost 40%. This pilot project used free-listing and ranking interviews to document the most prevalent self-identified illnesses and health care concerns for low-income Mexican immigrants living in the borderlands of South Texas. Data were derived from semi-structured interviews with 80 uninsured Mexican immigrants in public spaces. The first 50 free-listing interviews allowed participants to generate their own responses to what they perceived were the most serious and prevalent illnesses and health care problems. In the next 30 interviews, participants ranked illnesses and health care issues derived from the free-list interview responses according to their own experiences and then by the larger concerns specific to Hidalgo County. Analysis was guided by the theoretical framework of syndemics. Moreover, data document how this population negotiates illness and accessing health care within the context of extreme poverty, social marginalization, and an increasingly dangerous political landscape. These themes and community-guided health care concerns will guide a dissertation project that will contribute to the anthropology of immigration, human rights and health care, and transnationalism as well as local outreach efforts to improve health and health care in Hidalgo County.

OTHER PSYCHOLOGY

Ballroom C - 100

THE RELATIONSHIP BETWEEN PERINATAL CHANGES IN SLEEP, DEPRESSION, STRESS, AND BIRTH OUTCOMES IN PREGNANT MEXICAN-AMERICAN WOMENEsmeralda Garcia, Kimberly D'Anna-Hernandez.*California State University, San Marcos, San Marcos, CA.*

Mexican-Americans are the fastest growing population in the US, and Mexican-American women experience adverse perinatal outcomes. It has been suggested that these adverse perinatal outcomes may be related to changes in sleep during pregnancy, but this has yet to be investigated. The present study examined if changes in sleep relate to stress, depression, and other negative perinatal outcomes in pregnant Mexican-American women. It was hypothesized that disruptions in the quality and quantity of sleep would alter levels of depression and stress during pregnancy as well as gestational age and birthweight of offspring. Pregnancy-specific stress levels and depressive symptoms were measured via the New Prenatal Distress Questionnaire Revised and the Edinburgh Postnatal Scale of Depression during early, mid, and late pregnancy in 43 Mexican-American women. Women also self-reported on quantity and quality of sleep in a sleep diary. Correlational analyses revealed that more stress in early and mid pregnancy is associated with less quality of sleep ($r = -.33$, $p = .01$) and more hours slept ($r = .40$, $p = .008$). Low birthweight was associated with more hours slept in early ($r = -.36$, $p = .02$) and mid pregnancy ($r = -.37$, $p = .01$), and lower gestational age was related to more stress ($r = -.367$, $p = .01$) and less quality of sleep ($r = .40$, $p = .01$). Depression was not associated with any perinatal outcomes. The data suggests stress may be a better indicator of adverse outcomes than depression, and variations in sleep patterns and sleep quality early in the prenatal period may affect maternal and infant outcomes.

Ballroom C - 46

EFFORTFUL RETRIEVAL IN TESTING EFFECTAlda Rivas, Jess Logan.*Rice University, Houston, TX.*

The testing effect is the finding that retention of information is higher after taking a test than after restudying such information. Previous research has shown increasing support for an "effortful retrieval explanation," where a higher level of effort to retrieve information during a learning phase will result in higher accurate recall on a final test. In the present study, during the learning phase, participants read four one-page essays and then either reread the essay or took a test. The tests differed in the level of effort required to produce an answer: multiple choice or short answer. During this learning phase, we introduced a multiple-choice generate (MCG)-format of testing, which is a combination of multiple choice and short answer. After one week, during the final recall phase, participants took short answer tests on the four essays. During this final phase, as expected, the percentage of correct recall was higher for all the testing conditions compared to the restudy condition (testing effect). A comparison between initial and final tests indicated that a higher level of effort during the initial test provides more protection against forgetting than a lower level of effort. The initial short answer tests produced the least forgetting over a week, while the typical multiple-choice format produced the greatest forgetting, with the MCG format somewhere in between. These findings offer a simple way to increase the retrieval effort and benefits of a multiple-choice test while maintaining the practical benefits of multiple-choice formats for use in the classroom.

OTHER SOCIAL SCIENCES

Ballroom C - 3

CHANGING PERCEPTIONS AND PRACTICES IN ALASKAN SUBSISTENCE AND SPORT FISHERIESMaggie Nga Chan, Anne Beaudreau.*University of Alaska Fairbanks, Juneau, AK.*

In southeast and south-central Alaska, Pacific halibut (*Hippoglossus stenolepis*) is a commercially valuable species, a primary target for sport fishing, and an irreplaceable subsistence resource for rural communities. In recent years, Pacific halibut populations have faced increasing pressures from fishing, climate change, and shifts in stock structure. In addition to biological changes to halibut populations, resource users have to adapt to economic fluctuations and

changing regulations. It is essential to understand how users adapt to a combination of pressures in order to evaluate the socioeconomic impact of management measures. This project will examine how regulations affect users' fishing behavior, access to halibut, and the effect on other fishery resources. Additionally, we will examine whether existing regulatory categories capture the diversity of fishing practices in the sport and subsistence sectors. Methods include in-depth interviews combined with available historical catch data to evaluate changes to fishing behavior over time. Interview questions will focus on changes to fishing locations, fishing effort, and target species as well as changes attributed to specific management regulations. While this study is in its beginning stages, it has widespread fisheries and natural resource policy implications. Understanding the socioeconomic impact of policy decisions, especially in communities that depend on fisheries, is essential to creating innovative solutions to natural resource issues.

TRADITIONAL KNOWLEDGE

Ballroom C - 73

DECOLONIZING MEDICINE: THIRD-WORLD INDIGENOUS TECHNOLOGIES OF HEALING CONFRONTING THE MEDICAL COLONIAL COMPLEX

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Scholars have located the value of curandera (healer)-scholar-activist texts, authored by writers including, but not limited to, Gloria E. Anzaldúa, Ana Castillo, and Aurora Levins Morales, within the field of Chicana/Latina-Indigenous studies and cultural studies at large. Within literature and oral history fields, scholars have analyzed how these texts actively work to dismantle patriarchy, colonial legacies, compulsory heteronormativity, criminalization, militarization, and both physical and cultural borders. Within health and medical science, physicians and scholars have critiqued the medical-industrial complex and offer first-hand, scientific accounts of differential healing. Nurse-curandera (nurse-healer) scholarship in particular has begun to bridge critical studies and health medicine science with Chicana/Latina-Indigenous healing philosophies and practices. This scholarship inherently threatens the Eurocentric, capitalist, and imperialist nature of the institutions of medicine and healthcare and thus serves as the basis for culturally conscious healthcare and medicine models. Decolonizing medicine situates itself within and develops on this decolonial vision for culturally conscious, democratic, egalitarian medicine by bridging Chicana/Latina-Indigenous studies with critical health and medicine science. It argues that love forms the basis of not only the curandera-scholar-activist texts and parallel oral histories, but also the philosophical underpinnings of a vision toward healing justice. Decolonizing medicine employs Chela Sandoval's methodology of emancipation as a theoretical tool to analyze the curandera-scholar-activist texts as well as the traditional healing oral histories, bridging scholar-activism, and community intellectualism. Decolonizing medicine demonstrates a transdisciplinary approach to dismantling supremacy in science and medicine, an urgency central to the legacy of traditional knowledge in the sciences.

GRADUATE ORAL ABSTRACTS

BIO/AGR/ENV LIFE SCIENCES

BIOCHEMISTRY/BIOPHYSICS

Room 214B

MODE OF ACTION STUDIES OF THE NATURAL PRODUCT SUBLANCIN 168

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Infectious diseases are a continuous threat to human health, and the rapid development of bacterial antibiotic resistance not only decreases the effectiveness of known antibiotics but also increases the need for the discovery of novel drugs. A rapidly expanding class of such compounds is the ribosomally synthesized and post-translationally modified peptide (RiPP) natural products. Sublancin 168, produced by *Bacillus subtilis* 168, contains a glucose moiety linked to a cysteine residue, an unprecedented post-translational modification. In addition, sublancin 168 has been shown to be extremely stable and has a narrow spectrum of activity with an unknown mode of action. Its extreme stability and unique structure have led us to hypothesize that sublancin has a novel antimicrobial mechanism of action. We have employed the use of various biochemical, microbiological, and genomic tools to characterize sublancin's activity. Data obtained from comparative genomic analysis and global gene expression using DNA microarrays has identified the PTS-glucose specific transport system as a possible mechanism by which sublancin could enter the cell. Current efforts include investigating sublancin's localization in the cell by creating fluorescent sublancin analogues. In addition, we synthesized a sublancin analogue lacking the glycan to investigate the role of the sugar and are refining a solution NMR structure of sublancin for clues regarding its mechanism of action. A clear understanding of how this unique antibiotic exerts its antimicrobial activity may facilitate the development of new antibiotics. Ultimately, we will attempt to shed light on exploitable pathways to better understand, target, and treat bacterial infections.

Room 217A

USING SPECTROSCOPIC PROBES AS A TRACKING NUMBER: FOLLOWING COPPER(I) TRANSPORT AND DELIVERY IN THE ASSEMBLY OF *THERMUS THERMOPHILUS* CUA

Kelly Chacón, Ninian Blackburn.

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Copper is an essential but potentially toxic metal ion in all living organisms. To manage this metal, an army of metallosensors, chaperones, and efflux pumps are needed for copper homeostasis and delivery of the ion to its ultimate destination in the cell, but our knowledge of these processes is still limited. In particular, the mechanism of metallation of CuA, the binuclear copper center present in cytochrome c oxidase, is still incompletely understood. *In vivo*, both Sco and PCuAC have been implicated in the transfer of copper to CuA. Because these putative chaperones bind copper in a mononuclear environment, yet the CuA center is dinuclear, the nuclearity of the transfer intermediates is an open question. Here we address this topic via investigations of the reaction between Cu(I)-loaded PCuAC and apo CuA from the thermophilic bacterium *Thermus thermophilus*. We use a technique based on labeling the chaperone or the target with selenomethionine and monitoring the transfer of copper by way of multiedge X-ray absorption spectroscopy (XAS). Here we present a variety of spectroscopic data that suggest that Cu(I) is transferred in a facile manner to form a mononuclear intermediate in CuA and also show progress in developing rapid kinetic approaches in examining this mechanism. These results allow for a more informed approach toward studying the role of Sco and other putative copper chaperones because of common threads in the underlying copper chemistry.

Room 211

STRUCTURAL STUDIES OF AN ER AND MITOCHONDRIAL TETHERING COMPLEX

Andrew Ah Young, Pascal Egea.

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In the highly compartmentalized eukaryotic cell, many cellular processes require communication and cooperation between organelles. One of the best-characterized models of interorganellar communication is the intimate liaison

between the endoplasmic reticulum (ER) and mitochondria at sites called mitochondrial-associated membranes (MAMs). MAMs are implicated in the transport of calcium, maintenance of mitochondrial morphology, and the exchange of phospholipids. Deficiencies that alter the association of ER and mitochondria at MAMs are associated with several neurodegenerative disorders including Alzheimer's disease and Charcot Marie Tooth Type-IIA. Despite the biological and medical relevance of MAMs, the molecular mechanisms that govern membrane tethering at these sites are poorly characterized. The goal of this research is to establish a structural understanding of the membrane-tethering reactions that link the ER and mitochondria. A powerful system to study this is the ER-mitochondria encounter structure (ERMES) complex. ERMES is a multimembrane protein complex that tethers the ER and mitochondria. It is composed of the cytoplasmic subunit Mdm12, ER-resident protein Mmm1, and outer-mitochondrial membrane proteins Mdm34, Mdm10, and Gem1. To determine the structure of ERMES, we will use X-ray crystallography, electron microscopy, and mass spectrometry. We have already obtained crystals of Mdm12, which we are optimizing in order to solve the crystal structure. Despite the challenges associated with the crystallization of membrane proteins, we have successfully expressed, purified, and crystallized a stable complex between Mdm12 and the cytoplasmic domain of Mmm1. Soluble domains of Mdm34 and Gem1 have been purified and are currently being screened for crystallization and association into higher order complexes.

Room 214B

BINDING TO BCOR DEFINES A SUBFAMILY OF PSC ORTHOLOG-MEDIATED POLYCOMB GROUP COMPLEXES

Sarah Junco, Renjing Wang, Alexander Taylor, P. John Hart, Chongwoo Kim.

The University of Texas Health Science Center at San Antonio, San Antonio, TX.

Polycomb group (PcG) proteins form transcriptionally repressive complexes that mediate epigenetic modifications of histones. The *Drosophila* polycomb group (PcG) protein Psc has 6 human orthologs: NSPC1/PCGF1, MEL18/PCGF2, PCGF3, BMI1/PCGF4, PCGF5, and MBLR/PCGF6. Each of these proteins contains 2 main structural domains: an N-terminal RING finger domain and a C-terminal RAWUL domain for protein-protein interactions. Binding studies suggest the presence of at least 2 distinct functional classes of Psc orthologs: Class I, (BMI1 and MEL18) that binds Ph, and Class II (PCGF3, NSPC1, and likely PCGF5) which binds BCOR and its homolog, BCOR-like1 (BCOR-L1). We believe existence of different classes of Psc homologs demonstrates the evolution of the PcG in order to diversify its silencing function. We solved the crystal structure of the minimal binding regions of both BCOR and BCOR-L1 in complex with the RAWUL domain of PCGF1 to 2.1 Å and 1.9 Å, respectively. Analysis of the crystal structures reveals unique contacts made by residues not conserved in BMI1 and MEL18. The minimal binding regions of BCOR and BCOR-L1 to NSPC1 contain a novel domain, which we have named PCGF ubiquitin-like fold discriminator (IPUD). Comparison of the solution structure of the IPUD region of BCOR with the crystal structure of this region bound to NSPC1 reveals a conformational tightening of the IPUD on binding. This conformational tightening may be necessary to bind other proteins in the repressive BCOR complex, such as KDM2B. These observations lead to the hypothesis that PcG repressive complexes may form in a hierarchical manner.

Room 217A

USING BIOMOLECULAR NMR AND BIOPHYSICAL TECHNIQUES TO INVESTIGATE PROTEIN-RNA INTERACTIONS

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MicroRNAs are critical post-transcriptional regulators of gene expression, and their precursors have an A-form helical geometry that prevents proteins from identifying the sequence-determining hydrogen bonding groups on the nucleobases. This suggests that global structural features such as bulges or mismatches play a central role in specific double-stranded RNA (dsRNA) selection from cellular dsRNA pools by double-stranded RNA binding domain (dsRBD)-containing proteins. Furthermore, the processing enzymes in the maturation pathway require tandem-dsRBD cofactor proteins for optimal function, suggesting a mechanistic role for cooperative, intrachain binding of dsRNA between domains. Here, we focus on one tandem-dsRBD, TRBP, which has been shown to tightly bind perfect dsRNA duplexes. It is our hypothesis that, although dsRBDs bind dsRNA in a nonsequence-specific manner, their presence is essential for the enzymes in the maturation pathway to efficiently locate the proper cleavage sites along the RNA. We present a combination of circular dichroism, electrophoretic mobility shift assays, and isothermal titration calorimetry-based assays demonstrating that TRBP binds dsRNA cooperatively because of intra-chain interactions. In contrast, we demonstrate that the individual dsRBDs behave in a noncooperative fashion. Application of multiple nucleic acid lattice models to our data suggests the microstates accessed by an individual dsRBD binding to RNA are

indeed different from those accessed by the tandem dsRBD construct; furthermore, allosteric effects may be present in the tandem construct.

Room 214B

IMPAIRED METABOLISM OF THE ABNORMAL GLYCOGEN IN LAFORIN KNOCKOUT MICE

Christopher J. Contreras, Dyann M. Segvich, Anna A. DePaoli-Roach, Peter J. Roach.

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Lafora disease (LD) is a rare, fatal, early onset form of myoclonus epilepsy that is characterized by the formation of Lafora bodies (LB) in many tissues, including the brain, heart, and skeletal muscle. Laforin is a dual specificity phosphatase that is mutated in about 50% of LD patients and has been shown to be a glycogen phosphatase that is responsible for maintaining low levels of glycogen phosphate. The absence of laforin results in the formation of LB, which are composed of abnormal glycogen that is poorly branched, insoluble, and hyperphosphorylated. The goal of this study was to determine whether such glycogen could be metabolized normally. Mice lacking laforin form LB and display myoclonus. However, the symptoms are less severe than in humans and occur later in life. Twelve-month-old laforin knockout (LKO) and wild-type (WT) mice were exercised to exhaustion to deplete skeletal muscle glycogen. After exercise, WT mice degraded 75% of their skeletal muscle glycogen while the LKO mice had a small, statistically insignificant decrease in total glycogen levels. However, the possible decrease in LKO glycogen correlated with an increase in glycogen phosphate content. Interestingly, the soluble glycogen in low speed supernatants of tissue extracts did decrease in both the WT and LKO mice after exercise, while the abnormal glycogen in the low speed pellet of the LKO mice did not decrease. This project is ongoing but the data suggest that the abnormal glycogen accumulated in LKO mice is metabolically inert and not subject to normal degradation pathways.

BIOLOGY (GENERAL)

BOTANY

Room 207 A

TABLE BEET (*BETA VULGARIS*) AS THE MODEL SYSTEM TO STUDY THE TYROSINE BIOSYNTHETIC PATHWAY AND ITS REGULATION IN PLANTS

Samuel Lopez Nieves, Irwin Goldman, Hiroshi Maeda.

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Tyrosine (Tyr) is a precursor of important secondary metabolites in plants (i.e., alkaloids, betalains, vitamins, etc.). Animals are unable to synthesize Tyr and thus must uptake Tyr from external sources such as plants. While most of our knowledge of Tyr biosynthesis is derived from microbial studies, limited research on Tyr synthesis has been conducted in plants. Previous studies reported that Tyr can be produced via two different pathways, the 4-hydroxyphenylpyruvate and arogenate pathways, in microbes. The objectives of this study are to clarify the main biosynthetic pathway of Tyr and to investigate its regulation in plants. Here, we use the table beet (*Beta vulgaris*) as a model system that produces high levels of nitrogen-containing Tyr-derived pigments called betalains. We aim to first identify and characterize *B. vulgaris* genes and enzymes involved in Tyr biosynthesis. We have detected arogenate dehydrogenase (ADH) activity in the root extracts of the table beet, suggesting that the main production of Tyr in *Beta vulgaris* is likely via the arogenate pathway. Based on the draft, sugar-beet genome, 2 genes homologous to previously-reported *Arabidopsis* ADH genes have been identified. In addition, we have successfully transformed beet roots using *Agrobacterium rhizogenes*, which can now be used to study the *in vivo* function of ADH genes through gene silencing. ADH suppression in table beet can alter Tyr production and lead to change of color derived from betalains, which will allow us to clarify the main biosynthetic pathway of Tyr and begin to investigate its regulation in plants.

Room 207A

FLORISTIC STUDY OF THE TULE RIVER SOUTH-FORK WATERSHED

Jessica Orozco, Travis Columbus.

Claremont Graduate University, Claremont, CA.

Historically, field studies that involve Indian reservation lands have been few and far between, and seldom are floristic inventories carried out. This past summer, we used the Consortium of California Herbaria (CCH) database to identify herbarium collections from Indian reservation lands in California and mapped them using Google Earth and 2010 US Census tract maps. Overall, many reservation lands appear to be undercollected. We identified the Tule River Indian Reservation to be of particular interest as it occupies the majority of the Tule River South Fork watershed, yet there are only 50 collections from that area in the CCH. For this study, we are conducting a floristic study of the watershed. The objectives of our floristic study are to document all vascular plant species that occur within the watershed; create an annotated, vouchered checklist of the flora; and assess the status of rare and culturally significant plants to determine if protection under existing laws or guidelines is warranted. Plant samples will be taken across a variety of habitats and will involve removal of only enough plant material to be representative and necessary for identification and that can be preserved or vouchered on herbarium sheets. We are working with the elders and community members of the reservation to understand the cultural importance of these plants. This project is motivated by a desire to call attention to the poorly documented botanical diversity on California Indian lands, where native plants have great cultural significance.

CELL/MOLECULAR BIOLOGY

Room 210B

EVALUATION OF THE SYSTEMIC INFLAMMATORY REACTION TO ANTIHELMINTIC TREATMENT IN PONIES

Alejandra Betancourt, John Stewart, Eugene Lyons, David Horohov, Martin Nielsen.

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Grazing horses are widely exposed to parasite infections, which can largely be controlled with administration of anthelmintic formulations. However, treatment can inadvertently induce inflammatory reactions and clinical disease. Little research has been performed evaluating the inflammatory response to anthelmintic treatment. In this study, we explored the differences in inflammatory response following treatment with 3 different anthelmintic drugs: moxidectin, pyrantel pamoate, and oxbendazole. A population (n = 30) of healthy, naturally parasitized ponies were divided into 3 treatment groups based on age and worm fecal egg counts. All ponies received the labeled anthelmintic dosage. Treatment efficacy was evaluated using the fecal egg count reduction test over 8 weeks, with weekly egg counts. The inflammatory response was assessed 4 times post treatment. Measurements involved characterization of cytokine gene expression and systemic inflammatory reaction. The objective of this study was to determine the effect of deworming treatment on proinflammatory cytokine gene expression in the peripheral blood and to evaluate any correlation between the expression of inflammatory cytokines with levels of acute phase proteins and inflammatory markers. Fecal egg counts from the study confirmed resistance levels in the parasite population. Treatment with oxbendazole and pyrantel pamoate was unsuccessful in the elimination of luminal parasites. Moxidectin, however, was very effective and egg counts of 0 persisted for several weeks. Preliminary analysis of cytokine gene expression data shows a trend towards elevated levels of Interleukin-1beta in the moxidectin group; acute phase protein levels did not follow this trend, thereby negating the correlation between the 2 measurements of systemic inflammation.

Room 210B

THE DYNEIN ADAPTOR, PAC1P/LIS1, IS REGULATED BY SUMO AND UBIQUITIN

Annabel Alonso, Rita Miller.

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The function of Pac1p, the yeast homologue of Lis1, is closely associated with the minus-end directed motor protein, dynein. Mutations in Lis1 result in lissencephaly, a developmental brain syndrome caused by defects in neuronal migration. *Pac1p* is important for recruiting dynein to the plus-end of the microtubule. Dynein is subsequently off-loaded to the cortex where it pulls on cytoplasmic microtubules to move the mitotic spindle across the bud neck, a key step in positioning the mitotic spindle. Although Pac1p plays a vital role in microtubule function, little is known about how it is regulated. Sumoylation is a post-translational modification that covalently attaches the small ubiquitin-like

modifier (SUMO) protein to target substrates. Whereas sumoylation regulates many cellular processes, it has only recently been shown to regulate spindle positioning. Pac1p displayed an accumulation of higher molecular weight bands in an ubiquitin-like-protease (Ulp1) temperature sensitive strain, suggesting that SUMO can accumulate on Pac1p. Pull-down assays suggest that Pac1p is modified by both ubiquitin and SUMO. We have identified two sites of modification on Pac1p. Mutation of these sites created the Pac1p double mutant, *pac1-2K→R*. Analysis of the *pac1-2K→R* mutant revealed that it was only partially able to suppress the nuclear positioning defect observed in large-budded cells of *pac1Δ*. Of the large-budded *pac1Δ* cells containing the *pac1-2K→R* mutant, 12% displayed binucleate mother cells, in contrast to 2% containing WT-PAC1. The *pac1Δ* strains containing an empty vector displayed 18% aberrant cells. This data suggest that dynein is regulated by the ubiquitin and/or ubiquitin-like modifications on Pac1p.

Room 210A

ONCOGENIC K-RAS PROMOTES BASAL EXTRUSION OF EPITHELIAL CELLS

Gloria Slattum, Yapeng Gu, Jody Rosenblatt.

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Epithelia provide a protective barrier for the organs they encase, yet the cells comprising the epithelia are constantly turning over via cell death and cell division. To maintain a protective barrier during homeostasis, epithelia extrude cells destined to die by contracting a band of actin and myosin. Although extrusion can remove cells triggered to die by apoptotic stimuli, during homeostasis, epithelia extrude live cells, which then die by anoikis. Because transformed cells may override anoikis and survive after extrusion, the direction of extrusion has important consequences for the extruded cell's fate. As most cells extrude apically, they are eliminated through the lumen, however, cells with upregulated survival signals that extrude basally could potentially invade the underlying tissue and migrate to other sites in the body. We found oncogenic K-Ras cells extruded basally, rather than apically, in a cell-autonomous manner and can survive and proliferate following extrusion. Expressing oncogenic K-Ras^{V12} downregulates the bioactive lipid sphingosine 1 phosphate (S1P) and its receptor S1P₂, both of which are required for apical extrusion. Surprisingly, the S1P biosynthetic pathway is not affected, as the S1P precursor, sphingosine kinase, and the degradative enzymes S1P lyase and S1PP phosphatase are not altered. Instead, we found that S1P is degraded by autophagy, which is highly pronounced in extruding Ras^{V12} cells. Disruption of autophagy chemically or genetically in K-Ras^{V12} cells rescues S1P localization and apical extrusion. We propose that basal cell extrusion provides a novel mechanism for cells to exit the epithelium and initiate invasion of the surrounding tissues.

Room 210A

IDENTIFYING THE ROLE OF CODANIN IN ERYTHROID DIFFERENTIATION

Linette Bosques, Gary Kupfer.

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Improving understanding of rare diseases has historically led to major advances in medical science. Our studies with the rare red blood cell disorder, congenital dyserythropoietic anemia type 1 (CDA-1), have similar potential outcomes. CDA-1 is an autosomal recessive disorder marked by specific morphological abnormalities of erythroblasts in the bone marrow, resulting in ineffective erythropoiesis and anemia. Light microscopy of bone marrow shows binucleated erythroblasts connected by internuclear bridges. Electron microscopy of bone marrow shows erythroblasts with spongy heterochromatin and invagination of the nuclear membrane. The gene responsible for causing CDA-1, *CDAN1*, encodes a ubiquitous protein, codanin, with unknown function. Our goal is to understand how codanin regulates erythropoiesis because codanin deletion mutants are embryonic lethal in mice and null alleles do not occur in humans. Preliminary data shows that codanin binds to erythroid-specific promoters and its expression is maintained during erythropoiesis. We chose to analyze how the founder mutation (R1040W) in *CDAN1* affects erythroid differentiation. Expression of the R1040W mutant in human erythroleukemia cells deficient for endogenous codanin phenocopies the CDA-1 spongy heterochromatin and retards KLF1 and β -globin expression. Conversely, wild-type codanin overexpression stimulates erythropoiesis, increasing expression of erythroid genes. These studies suggest codanin regulates the expression of key erythroid genes. Determining the pathophysiology of CDA-1, and thus better understanding normal erythropoiesis, will have a broad impact as we can translate our findings to improve treatment for rare blood disorders.

Room 210A

IDENTIFICATION OF POTENTIAL BIOMARKERS AND THERAPEUTIC TARGETS FOR MULTIPLE SCLEROSIS BY M2 PROTEOMICS

Itay Raphael, William E. Haskins, Thomas Forsthuber.

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Despite extensive research, multiple sclerosis (MS) remains a disease that lacks a definitive diagnostic test. Even after a diagnosis of MS has been established, currently it cannot be reliably predicted whether and when disease relapses will occur, thus patients may undergo years of unnecessary treatments. Additionally, because the current treatments for MS can produce dramatically different outcomes in individual patients, there is a critical need to develop biomarkers for treatment efficacy and resistance. We have recently developed a novel quantitative microwave & magnetic (M²) proteomics method to quantitatively measure changes in proteome expression during experimental autoimmune encephalomyelitis (EAE), the standard murine model of MS. Our data revealed significant consistent changes in the proteome over the disease course. Changes in the expression of protein isoforms correlated either with time (days after EAE induction) or disease severity (clinical score). Interestingly, we have identified unique changes in the proteome prior to the onset of clinical symptoms. Those preonset changes may allow us to predict the subsequent severity of the disease. Last, we have identified that glucocorticoid-drugs (GCs) have an effect on these changes with a strong statistical correlation to EAE severity and more importantly, these changes closely mirror disease progression independent of any cytokine response to the GCs. Thus, homologous human biomarkers may be useful to accurately and reliably predict disease initiation, clinical severity, and GC drug efficacy. Importantly, these biomarkers illuminate some of the key mechanisms that contribute to the disease and may be useful to develop new therapeutic targets for multiple sclerosis.

Room 210B

THE PHOSPHOGLYCERATE GENE FAMILY – AN EXAMPLE OF EVOLUTION BY GENE DUPLICATION

Pedro Trejo Jr., John R. McCarrey.

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Susumo Ohno proposed the principle of evolution by gene duplication, by which one duplicate copy maintains the original gene function while the other diverges and undertakes new gene function(s) by acquiring key sequence changes. We postulate that the mammalian phosphoglycerate kinase (*Pgk*) gene family exemplifies Ohno's principle. We used a bioinformatics approach to mine mammalian genome databases to identify such key sequence changes in the 5' regulatory region, responsible for transcriptional regulation; the 3'-UTR region, responsible for post-transcriptional regulation; and the coding sequence, responsible for protein functions. Among 11 eutherian species examined, we found that *Pgk1* promoters have conserved a CpG-island, a pair of GC-boxes, a pair of CAAT-boxes, and an NF-1 sequence, whereas *Pgk2* promoters have lost the CpG-island, retained a single GC-box and a single CAAT-box, and gained an enhancer sequence (E3/E4) with homology to an NF-1 element. We also found that *Pgk1* 3'-UTRs have retained several conserved elements, but that the *Pgk2* 3'-UTRs have evolved two unique polypyrimidine-tract binding-protein, 2 elements not present in the *Pgk1* 3'-UTRs. We have not yet identified sequences in the coding region related to sperm-specific localization. We are currently examining *Pgk* genes from metatherian (opossum and tammar) and prototherian (platypus) species to discover more extensive evolutionary history of the divergence of the mammalian *Pgk* promoters and 3'-UTRs. Our results to date support the idea that the mammalian *Pgk* gene family is an example consistent with Ohno's theory. (Partially funded by NIGMS MBRS-RISE GM060655.)

Room 211

DETERMINING MITOTIC INHERITANCE OF THE ENDOPLASMIC RETICULUM

Anthony Eritano, Blake Riggs.

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A well studied aspect of cell biology is mitosis, specifically DNA segregation. Despite decades of study that have gone into examining DNA segregation, little is known about the segregation of the cytoplasm and its components. Golgi and mitochondria have been the focus of the cytoplasmic inheritance research; mitotic partitioning and inheritance of the endoplasmic reticulum (ER) are poorly understood. Recent studies from our laboratory demonstrated a centrosomal localization of ER during mitosis, which suggests a possible mechanism of inheritance. We hypothesize that the ER follows a set pattern of inheritance dictated by the selective passage of newly created ER from an original, unaltered (template) ER. Transgenic flies will be created expressing a photo-convertible GFP tagged to the ER resident protein,

PDI (PDI-EOS). We will photo convert ER membrane patches in actively dividing cells in the developing *Drosophila* embryo and track patterns of movement and inheritance. To identify potential genes that act as a template for ER inheritance, we will perform a small-scale RNAi screen in *Drosophila* S2 cells that express PDI-GFP and RFP tagged histones. Genes were selected that have been classified as ER stress proteins to disrupt proper function, motor proteins to disrupt movement, and ER structure and morphology proteins to disrupt ER topology. These targets will be examined for proper ER movement in embryos. These selected targets will allow for the identification of templates for ER partitioning and will help identify proteins that are vital for ER segregation during mitosis and lead to a mechanism of inheritance.

Room 211

CHARACTERIZATION OF THE CELL MORPHOLOGY DIFFERENCES BETWEEN PREDIAPAUSE AND DIAPAUSE EMBRYOS OF THE KILLIFISH *AUSTROFUNDULUS LIMNAEUS*

Lee Toni, Pamela Padilla.

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Austrofundulus limnaeus is a freshwater, annual killifish from Venezuela that produces embryos capable of entering three distinct stages of diapause. Diapause II (DII) is a state of developmental arrest that can last over 100 days and confers extreme anoxia tolerance. Diapause I and III are inducible while II is obligate. DII occurs in ideal conditions (25 °C) whereas incubation at 30 °C induces a bypass of diapause II. DII provides an opportunity to study an arrest of development in a vertebrate animal without exposing the organism to compounding stresses. Currently, little is known about the molecular mechanisms that induce and maintain this developmentally arrested state. We hypothesize that downregulation of gene expression is central to inducing DII. Our aim is to use assays that are principally based on immunohistochemistry to characterize, at the cellular level, differences in cell morphology between pre-DII and DII embryos. We are looking at changes in chromatin modifications, which are known to be involved in the repression or activation of developmental genes, as well as changes in mitotic cell division. Preliminary results show a change in the signal localization of H3K27, which is associated with gene silencing, as the animal transitions between stages of pre-DII and DII. Analysis of H3K4, which is associated with active transcription, shows little change across diapause states although this may represent an energy homeostatic strategy. This research is leading to a greater molecular understanding of the remarkable phenomenon of obligate developmental arrest in a vertebrate embryo.

Room 210B

POST-TRANSLATIONAL REGULATION OF ENOS VIA ESTROGEN RECEPTORS-ALPHA/BETA AND G PROTEIN-COUPLED ESTROGEN RECEPTOR IN UTERINE ARTERY ENDOTHELIAL CELLS

Mayra Pastore, Saira Talwar, Rosalina Villalon-Landeros, Ronald Magness.

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Endothelial nitric oxide production is partly responsible for maintenance of vasodilatation during physiologic states of high estrogen levels such as pregnancy. Estrogen receptors (ER- α - β) are nuclear transcription factors; however, they induce vasodilatory responses via activation of endothelial nitric oxide synthase (eNOS). Recently, the G protein-coupled estrogen receptor (GPER) has been implicated in estrogenic regulation of the vasculature. It is unknown if eNOS regulation is dependent on ER- α - β or GPER. We hypothesize that ER- α - β and GPER localize to the plasma membrane of uterine artery endothelial cells (UAEC) and change eNOS phosphorylation patterns indicative of activation. Vehicle or estradiol-17 β treated UAECs were fixed and immunogold-labeled for visualization of caveolae, ER- α , ER- β , and GPER using transmission electron microscopy. UAECs were treated with vehicle or increasing concentrations of estradiol-17 β , ER- α (PPT), or GPER (G1) agonists. GPER expression and changes in eNOS stimulatory phosphorylation sites Ser1177 and Ser635 vs. inhibitory site Thr495 were evaluated via western blot. Immunogold labeling revealed that ER- α - β localize to the plasma member, the cytosol, and the nucleus. GPER was also detected. Increasing estradiol-17 β concentrations augmented eNOS phosphorylation at Ser1177 and Ser635 with decreased phosphorylation at Thr495. PPT (0.1 nM and 100 nM) only increased the eNOS phosphorylation at Ser635. G1 (100 nM and 1 μ M) increased eNOS phosphorylation at Ser1177, not Ser635, but decreased Thr495 phosphorylation at all doses. In conclusion, ER- α - β localizes to the plasma membrane, cytosol, and nucleus; estradiol-17 β mediates changes in eNOS multisite phosphorylation; ER- α mainly mediates an increase in stimulatory phosphorylation of eNOS; and eNOS multisite phosphorylation also occurs via a GPER and ER- α - β -independent mechanism.

Room 211

A GENETIC SUPPRESSOR OF PEROXISOME DEFECTS REVEALS COMPENSATORY MUTATIONS IN INTERACTING PEROXINS IN *ARABIDOPSIS*

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Peroxisomes are eukaryotic organelles necessary for development in plants and humans because they are home to essential metabolic functions such as fatty acid oxidation. Enzymes enter peroxisomes with the assistance of peroxins (PEX proteins), but the mechanistic details of peroxin functions are incompletely understood. In humans, defects in peroxins can cause peroxisomal biogenesis disorders, inherited disorders often conferring mental retardation and death during infancy. A subset of peroxisomal biogenesis disorders, Zellweger syndrome, is often caused by mutations in *PEX1* and *PEX6*, genes encoding interacting ATPases essential for peroxisome biogenesis. *PEX1* and *PEX6* assist in recycling PEX5, a receptor for proteins targeted to the peroxisomal matrix. In plants, *pex6* mutants display defects in development, peroxisome metabolism, PEX5 recycling, and peroxisomal matrix protein import. Suppressor screens often reveal interacting proteins and reveal dependent or related cellular processes. We have isolated and characterized mutants that ameliorate the physiological defects of the loss-of-function *pex6-1* mutation in *Arabidopsis thaliana*. Intriguingly, one suppressor carries a mutation in *PEX1*. The *pex1-1* allele partially suppresses the metabolic and physiological defects of *pex6-1*, but does not seem to restore PEX5 recycling to wild-type levels. Our ongoing experiments are examining the allele- and peroxin-specificity of the *pex1-1* suppression. Completion of this research will reveal strategies to compensate for defects in peroxins and possibly rescue defects in other organisms with peroxisomal biogenesis disorders. (This research is supported by the NSF and the Welch Foundation.)

ECOLOGY

Room 209

PREDICTING SMALL SCALE DISTURBANCE FROM LARGE SCALE ENVIRONMENTAL FORCES

Dan Orr, Corey Garza.

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Understanding and predicting small-scale disturbance by large scale environmental forces has important implications for natural resource management and understanding potential consequences resulting from climate change. This is particularly important when considering disturbance to the foundation species within a community such as coral reefs or large trees in a forest. The California mussel *Mytilus californianus* is a sessile foundation species that forms massive aggregations along rocky shores in the north-eastern Pacific. In a multilayer mussel bed, each subsequent layer is more weakly attached than the next. The bottom layers can become a sediment trap leading to mortality and weakening the entire structure. This counters the traditional understanding that disturbance is generated solely by external forces distributed randomly across the mussel bed and suggests disturbance across mussel beds may be predictable. We hypothesized that small-scale mussel bed disturbance by large-scale environmental forces can be predicted. Here we began by linking large-scale environmental forces to small-scale sites. We measured maximum wave velocity across mussel beds at 3 sites. We calculated the mean maximum wave velocity (MMWV) experienced at each site for each 24-hour sampling period. Using GIS and remote sensing technologies, we fit a model to the observed MMWV. This was the first step in the empirical testing of our hypothesis. Understanding and predicting small-scale disturbance from large scale environmental forces would have implications on other communities that depend on foundation species. This has important implications regarding climate change and natural resource and ecosystem management.

Room 209

THE VALUE OF HABITAT DIVERSITY IN MARINE RESERVES: SPINY LOBSTER AND SHEEPHEAD USE OF THE INTERTIDAL ZONE AT THE SANTA CATALINA ISLAND MARINE PROTECTED AREA

Sean Windell, Corey Garza.

California State University, Monterey Bay, Seaside, CA.

Marine protected areas (MPAs) are a relatively new approach to managing exploited marine species. However, in order for MPAs to be effective, a diversity of habitats that incorporate all necessary ecosystem services for targeted

species must be included in their design. The Southern California spiny lobster (*Panulirus interruptus*) and California sheephead (*Semicossyphus pulcher*) are 2 exploited species for which MPAs have been designed. Previous work suggests these two species forage within the intertidal zone at high tide; however, the relative importance of this habitat in the early design of MPAs was not considered. As part of a study to test the efficacy of a long-standing MPA on Catalina Island, California, snorkel and scuba surveys recording abundance, size, and gender were conducted along transects within the MPA and outside the MPA at high tide. Intertidal habitat composition was also assessed at low tide. These data were paired with a historic dataset beginning before the establishment of the MPA to conduct a before-after control impact (BACIPS) and general linear model (GLM) analyses to quantify the impact of the MPA and importance of the intertidal zone. We hypothesized that spiny lobster and sheephead demographics were higher in the MPA. We also hypothesized demographic patterns were higher in the intertidal zone relative to the subtidal zone at high tide. Preliminary results suggest current demographic parameters are higher outside the reserve due to more suitable intertidal habitat for foraging. These results provide insight to how MPAs require ecosystem-based management that incorporates habitat types used over the entire lifetime of managed species.

Room 206B

CAN PREEXISTING TRAIT VARIATION PREDICT THE OUTCOMES OF PARASITOID COMPETITION IN NOVEL HABITATS

Gabriela Hamerlinck, Andrew Forbes.
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Parasitoid wasps often specialize on just one or a few hosts, and shifts to new hosts may explain the tremendous amount of parasitoid diversity if parasitoids using novel hosts become reproductively isolated from their source population. In this study, we ask whether, when different parasitoids compete for a novel resource, some species possess preexisting trait variations that enable them to better colonize particular novel hosts. Further, we ask whether we can predict successful host shifts based on analyses of ancestral characters. To this end, we have designed a mathematical model to describe the population dynamics of parasitoid populations competing for a novel host. As a case study to parameterize this general model, we use races of the wasp *Diachasma alloeum* that attack *Rhagoletis* larvae in hawthorn and blueberry fruit to determine their ability to attack *Rhagoletis* larvae in a new plant host, apple. Specifically, this model evaluates preexisting morphological characters that may allow one *D. alloeum* race to successfully use its host in a novel fruit over the other. Preliminary analyses focus on the interaction between ovipositor length and host habitat characteristics, and how this interaction may predict the outcome of competition. Preliminary results show threshold values of ovipositor lengths result in competitive exclusion and no instances of coexistence, though coexistence is possible within the model. While the empirical evidence used to parameterize the model comes from a specific system, the model is broad in scope and can be expanded for use in other models of insect host shifts.

Room 207A

DOES WHITE-TAILED-DEER BROWSING AFFECT FOREST SONGBIRD COMMUNITIES

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White-tailed deer (*Odocoileus virginianus*) numbers in the eastern United States have increased dramatically over the past 3 decades. Human-induced forest fragmentation, extirpation of natural predators, and the setting aside of expansive areas in which hunting of deer does not occur have all contributed to this population boom. While impacts on natural ecosystems are predictable, few empirical, large-scale studies have examined the effects of deer browsing on avian community composition. The objective of our study was to evaluate the effects of deer abundance on forest bird communities in both rural and suburban landscapes. To correlate deer habitat use with avian species composition, we used point counts to survey birds: Virginia Peninsula, n = 125; Shenandoah River Valley, n = 99; and deer fecal pellet transects (same sample sizes as point counts) to estimate relative use of habitat by deer. We estimated bird and deer pellet densities based on distance sampling to correct for imperfect detections. We predicted that the densities of species nesting and foraging in the shrub layer would be negatively correlated with deer pellet abundance. Preliminary analyses indicate that the avian community varies with deer habitat use. High deer use was correlated with low densities for bird species breeding and foraging in understory vegetation. Our results suggest that habitat modification by deer browsing promotes measurable changes in bird community composition, with conservation implications for declining forest songbirds. The results of our study can be used to inform land use planning within a context of bird conservation.

Room 209

ANALYSIS OF THE LINEAGE-SCALE GENETIC STRUCTURE OF THE CORAL *PORITES LOBATA* IN MAUNALUA BAY, HAWAII

Kaho Tisthammer, Robert Richmond.

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Corals in Maunalua Bay, Hawaii, are under chronic pressures from sedimentation and terrestrial run off containing multiple toxicants. However, some individuals thrive despite the prolonged exposure to environmental stressors, which suggests that these individuals may have been under selection to withstand such stresses. A recent study shows increasing levels of cellular stress response in the coral *Porites lobata* along the environmental gradient that exists from the mouth of the bay toward offshore. Therefore, the lineage-scale genetic structure of *P. lobata* was investigated to understand the genetic basis for observed differential stress responses. The genetic structure was analyzed for indication of selection using known mitochondrial and nuclear DNA markers as well as using newly isolated candidate genes specifically related to stress responses. Preliminary results suggest that genetic differentiation in *P. lobata* is expected to be present due to selection in Maunalua Bay. The individuals near shore are likely to have genotypes associated with higher tolerance to toxicants, which will be further investigated by laboratory exposure experiments. Understanding the little-known genetic structure may be a key for saving severely degraded corals in Maunalua Bay, since the ability of corals to cope with environmental stressors depends on the underlying genetic networks. The results may also provide critical information for successful coral reef conservation as well as estimating the effects of climate changes on coral reefs.

Room 209

INTERTIDAL FORAGING HABITS OF FISHED AND PROTECTED CALIFORNIA SPINY LOBSTERS OF CATALINA ISLAND, CALIFORNIA

Mary McCormick¹, Corey Garza¹, Steve Litvin².

¹*California State University, Monterey Bay, Seaside, CA*, ²*Hopkins Marine Station, Leland Stanford Junior University, Pacific Grove, CA.*

In efforts to combat overfishing of valuable species like the California spiny lobster (*Panulirus interruptus*), managers have increasingly implemented marine protected areas. During nighttime high tides, the rocky intertidal zone, both in and external to these protected areas, serves as an important foraging habitat. There, lobsters feed on mussels, chiton, and limpets. However, on Catalina Island, this pattern of intertidal foraging may vary where protection from fishing has spurred increased lobster abundance and shifts in their population size structure, potentially impacting the types and size of prey targeted. We compared protected and fished populations by estimating spiny lobster trophic position using nitrogen stable-isotope analysis. We also inferred the relative importance of prey species that comprise the diet of spiny lobsters by applying carbon and nitrogen stable-isotope data to Bayesian mixing models. We predict that protected spiny lobster muscle tissues will exhibit depleted $\delta^{15}\text{N}$, indicative of feeding at a lower trophic level. Mixing models may indicate variation in the order of importance of prey species between fished and protected sites and between sites with and without mussel beds, a key foraging habitat for lobsters. The strategy of closing areas to fishing can impact local trophic dynamics, but habitat quality, regardless of fishing pressure, remains an important factor in determining prey availability and community trophic dynamics. For coastal management, this study highlights the value of incorporating a variety of habitats, such as intertidal habitat, into the design of marine reserves.

ENVIRONMENTAL SCIENCE/STUDIES

Room 213A

AN ASSESSMENT OF MERCURY CONTAMINATION IN FISH AND WILDLIFE OF LAKE CHAPALA: IMPLICATIONS FOR HUMAN AND ENVIRONMENTAL HEALTH

Zaria Torres, Miguel Mora, Robert Taylor.

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The Lerma-Chapala Basin has industrial, agriculture, and urban areas that contribute a variety of environmental contaminants into the Rio Lerma and ultimately, Lake Chapala. It is the largest tropical lake in Mexico and is a primary water source for the city of Guadalajara. It is also a popular wintering area for the American White Pelican (AWPE, *Pelecanus erythrorhynchos*), a species of concern in the United States. This project assesses the effects

of mercury (Hg) on fish and wildlife of Lake Chapala over a 2-year period. We measured mean Hg concentrations for water, sediments, and 3 fish species: silverside, *Christoma* spp.; carp, *Cyprinus carpio*; and tilapia, *Oreochromis mossambicus*. Mean Hg concentrations were also measured in feathers from migratory AWPEs and resident birds: the great egret (GREG), *Ardea alba*; and snowy egret, (SNEG), *Egretta thula*; as well as feathers from AWPE collected in North Padre, Texas. Our results show mean Hg concentrations as follows: water = 15.3 ± 2.05 ng/kg, sediment = 0.705 ± 0.185 µg/kg dry wt, carp = 0.373 ± 0.125 µg/g wet wt, charal = 0.1505 ± 0.015 µg/g wet wt, and tilapia = 0.0407 ± 0.028 µg/g wet wt. Carp samples, also taken from a nearby reservoir, San Antonio Guaracha, Michoacan, had mean Hg concentration levels of 0.0787 ± 0.035 µg/g wet wt. Lake Chapala AWPE feathers = 4.08 ± 2.485 , GREG/SNEG = 5.104 ± 2.846 , and North Padre AWPE = 2.871 ± 0.870 . Further analysis will help to determine risks to wildlife and human populations that use resources from the lake.

Room 217C

CLIMATE WARMING AND NUTRIENT ADDITION INCREASES EXOTIC PLANT COMPETITIVE ABILITY AND EXOTIC APPLE SNAIL REPRODUCTION (*POMACEA MACULATA*) IN NATIVE WETLAND COMMUNITIES

Maria Meza-Lopez, Evan Siemann.

Rice University, Houston, TX.

Habitats are often invaded by multiple invasive species, which may result from common responses to environmental conditions. Climate warming has been predicted to enhance invasion success. Our current knowledge on warming effects on invasions is primarily based on bioclimatic models that often neglect other environmental factors and their interactive effect. In this study we asked how nutrient addition, warming, and their interaction influence exotic plant and herbivore invasions and whether herbivore invasions depend on plant origin. We addressed these questions using a 2 x 2 x 2 factorial mesocosm experiment with 5 replicates for 16 weeks. Forty freshwater, native wetland communities were established and randomly assigned to 3 classes: warming, ambient or increased 2 °C; nutrient addition, control or 6 ppt N and 1.7 ppt PO₄; and plant origin, second round of planting with exotic plants or additional native plants. All mesocosms received apple snails (*Pomacea maculata*). Results showed that apple snail reproduction increased 4 fold with warming and was independent of other factors, while snail mass was higher with nutrients only and warming. These results suggest that warming will increase snail population growth rate, and that warming with nutrients will contribute to snail invasions but are limited in current climate conditions. Native plant biomass increased with nutrients without exotic plants, while warming reduced native plant fitness with no effect on exotic plants. This suggests that, independently, nutrients and warming would accelerate plant invasions in wetlands. This study emphasized that interactive effects among multiple environmental factors are critical to predict invasion success and invader impacts on native species.

Room 217C

PREDICTION OF THE KEY DEVELOPMENTAL STAGES OF WINE GRAPES

Diana Zapata Rojas, Melba Ruth Salazar, Lynn Mills, Markus Keller, Gerrit Hoogenboom.

Washington State University, Prosser, WA.

Weather conditions are considered significant in affecting crop development. The main controlling factor is temperature, which controls the rate of development in plants. Phenological models such as thermal time models have been widely applied to predict the development of several species. They are expected to be successfully applied to wine grapes by including specific cultivar parameters in order to describe their complete development. In addition, to help in decision making for management and site selection, phenological models optimize vineyard production systems for cost, quality, and environment, tending to indicate sustainability over time. This study evaluated the starting date and threshold temperature for the prediction of 4 growing stages and 4 *Vitis vinifera* L. cultivars. Heat requirements for individual consecutive growing stages were used to run a complete model from budbreak until veraison. The model's performance was tested at several interactions of starting date and threshold temperature. Results found significant differences in heat demands between cultivars and developmental stages in an early and late cultivar. The highest requirements were obtained for the growth stages of bud burst to first bloom and full bloom to veraison where major changes in phenology occurred during the transition period from vegetative to reproductive. The preliminary results obtained provide valuable information to determine the start of grapevine development from available weather data. Despite the first approximation of a cultivars-specific model being made, an experimental approach is currently being conducted to validate the results obtained.

Room 213A

SCALE DEPENDENCE IN THE RELATIONSHIP BETWEEN TOPOGRAPHIC COMPLEXITY AND INTERTIDAL COMMUNITY STRUCTURE

Benjamin Walker, Corey Garza.

California State University, Monterey Bay, Seaside, CA.

Many factors drive population distribution of species in intertidal communities. Traditionally, it is expected that physical stressors, like desiccation, dictate upper limits for organisms in the intertidal. Biological stressors, like predation and competition, are expected to influence the lower limits for these species. However, small-scale variations in the rocky intertidal may play a significant role in species distribution. Differences in rugosity, relief, and complexity can control habitat suitability for various organisms. In order to isolate the importance of these traits, we scanned 4 rocky intertidal sites within 50 miles of Monterey, California, using a terrestrial laser scanner (TLS). This TLS recorded coordinate and elevation data within each site at a resolution of 5 centimeters. We used geographic information systems to translate this data into high resolution, 3-dimensional maps. We then performed spatial analyses on these maps to quantitatively assess the relationship between topographic complexity and community structure in the rocky intertidal. The results of our study suggest that, not only is there a strong relationship between intertidal topographic complexity and the structure of intertidal communities, this relationship exhibits scale dependence. More broadly, our results suggest that the strength of ecological drivers acting on communities may in part arise from variation in local geological features.

Room 217C

DETERMINATION OF CARBON NANOTUBE UPTAKE, TRANSLOCATION, AND BIOACCUMULATION IN CORN GROWN IN SOIL

Amanda Parra, Babina Shrestha, Fahmida Irin, Micah Green, Jaclyn Canas-Carrell.

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Carbon nanotube (CNT) applications are expanding in industries such as wastewater treatment, environmental remediation, and agriculture. With their increasing usage, there is a higher possibility of CNTs entering the terrestrial environment, where potential plant uptake and human dietary exposure may occur. This study assessed the uptake and bioaccumulation of different types of CNTs in corn (*Zea mays* L.) using a newly invented microwave technique that quantitatively determines CNT concentrations in biological samples. The characterization of CNTs was done using thermogravimetric analysis and scanning electron microscopy (SEM). Corn was grown in 10, 100, and 1,000 mg/kg of multiwalled carbon nanotubes (MWNTs) for 40 d in soil. MWNTs were taken up into roots. Concentrations were < 10 µg/g in plants exposed for 40 d. MWNTs were also translocated to above ground portions of the plant but at lower concentrations ($\leq 6\mu\text{g/g}$). Uptake and accumulation studies with single-walled carbon nanotubes (SWNTs) are ongoing. Corn was grown for 40 d in 0, 10, and 100 mg/kg of unfunctionalized, covalently functionalized, and surfactant-stabilized SWNTs in soil. After harvest, roots, stems, and leaves were dried, ground, and analyzed using a microwave technique to determine CNT concentrations. Further studies of CNT uptake, translocation, and accumulation in plants will lead to awareness of potential human exposure and risk assessment.

Room 213A

MERCURY CONCENTRATIONS IN THE TISSUE OF TERRESTRIAL ARTHROPODS FROM THE CENTRAL CALIFORNIA COAST

Cruz Ortiz Jr., Peter S. Weiss-Penzias, Russell Flegal.

University of California, Santa Cruz, Santa Cruz, CA.

The aim of this project was to obtain a baseline understanding and investigate the concentration of total mercury (HgT) in the tissue of terrestrial arthropods from the central California coast. Recent findings from this region discovered monomethyl mercury (MMHg) concentrations in fog precipitation to be a factor of 5 higher than those seen in rain water. Mercury concentrations in the tissue of arthropods (Insecta, Malacostraca, and Arachnida) from the central California region are not well documented, so the impact that MMHg deposition in fog has on coastal ecosystems is not yet well understood. Arthropod samples were collected during a 7-month sampling campaign that took place around Monterey Bay between March and October of 2012. Total mercury concentrations in dry weight for the captured specimens ranged from 22 - 188 ng g⁻¹ in Jerusalem crickets (Orthoptera: Stenopelmatidae), 65 - 233 ng g⁻¹ in camel crickets (Orthoptera: Rhaphidophoridae), 25 - 227 ng g⁻¹ in pill bugs (Isopoda: Armadillidiidae), 19 - 563 ng g⁻¹ in ground beetles (Coleoptera: Carabidae), 140 - 441 ng g⁻¹ in variegated meadowhawk dragonflies (Odonata: Libellulidae), 607 - 657 ng g⁻¹ in pacific spiketail dragonflies (Odonata: Cordulegastridae), and 81 - 1,249 ng g⁻¹ in wolf

spiders (Araneae: Lycosidae). Preliminary comparison of the data suggests that HgT concentrations are higher in the summer months when fog is frequent. It is hypothesized that coastal fog may be a contributor to this increase of HgT in the tissue of central California arthropods.

Room 213A

DEVELOPMENT OF MOLECULAR BIOMARKERS FOR THE DETECTION OF SUBLETHAL STRESS IN THE CORAL *PORITES LOBATA*

Narrissa P. Spies, Robert Richmond.

Kewalo Marine Laboratory, University of Hawaii at Manoa, Honolulu, HI.

Coral reefs are a vital component of tropical marine ecosystems. Threats to coral reefs are increasing as a result of global climate change and other anthropogenic stressors. A coral stressor can be any event or stimulus that can alter or hinder the ability of a coral to function or reproduce. There is currently no method for detecting the effects of stressors before total or partial coral colony death. The development of molecular biomarkers allows us to examine the expression of gene products associated with stressors such as increased water temperature, heavy metal contamination, soil runoff, and pesticide exposure. With these tools, we are able to detect harmful effects at the molecular level before the manifestation of physical symptoms. Using coral-specific sequences, we have designed Taqman qPCR primers and probes for multiple biomarker genes. We have also identified constitutively expressed genes that can be used for relative quantification of biomarkers at affected sites. Samples were collected at Maunalua Bay, Oahu, Hawaii, known for high levels of runoff and marine pollution, as well as from a reference site. Our data show that biomarker expression levels are differentially expressed between sites and that sublethal stress can be detected in corals using molecular biomarkers.

Room 217C

NITRATE REMOVAL AT THE MOLERA TREATMENT WETLAND

Gwen Miller, Fred Watson.

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The goal of this study is to analyze the long-term effectiveness of nitrate removal within a constructed wetland along the California Central Coast. The wetland used for this analysis was the Molera Treatment Wetland (MTW) located in Castroville, California. The California Central Coast is home to a vast area of agricultural land. Fertilizer runoff from these farms has led to an elevated concentration of nitrate within surface waters; consequently, many of these water bodies are listed as a 303d-impaired water body. Water samples were collected over a 1-year period and analyzed for nitrate and dissolved organic carbon at the inlet and the outlet of the wetland. A total organic carbon analyzer and Lachat were used to measure nutrient samples within the water. Physical parameters such as salinity, temperature, and dissolved oxygen were measured using a Hydrolab water-quality sonde. A tracer test using Rhodamine WT dye was used to determine the residence time at the wetland, allowing for a parcel of water to be traced. Preliminary results indicate that the MTW reduces nitrate concentrations throughout every season. Nitrate removal ranged from an addition of 5.3 mg/L to a removal of 70.6 mg/L of nitrate-N. Preliminary results also indicate that carbon may be limiting denitrification within the wetland. In conclusion, the MTW is a sink for nitrate and can be used as a tool to remove nitrate from agriculturally polluted water. Furthermore, additions of carbon into the system would result in higher rates of nitrate removal.

GENETICS

Room 212B

EQTLs FROM SKELETAL MUSCLE AND ADIPOSE TISSUE ACCOUNT FOR MOST OF THE HERITABILITY OF TYPE 2 DIABETES ESTIMATED IN MEXICAN AMERICANS, MEXICANS, AND EUROPEANS

Jason Torres¹, Eric Gamazon¹, Jennifer Below², Swapn Das³, Heather Highland⁴, Esteban Parra⁵, Adan Velledares-Salagado⁶, Jorge Escobedo⁷, Miguel Cruz⁶, Craig Hanis⁴, Victoria Prince¹, Nancy Cox¹

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Previous studies have shown that top signals from genome-wide association studies (GWAS) on type 2 diabetes (T2D) are enriched for expression quantitative trait loci (eQTLs) identified in skeletal muscle and adipose tissue. We therefore hypothesized that such eQTLs might account for a disproportionate share of the phenotypic variance in liability to type 2 diabetes (T2D) estimated from all SNPs interrogated through GWAS. To test this hypothesis, we applied genome-wide complex trait analysis (GCTA) to GWAS on T2D from Mexican Americans living in Starr County, TX, (837 cases, 781 controls), and Mexicans from Mexico City (965 cases, 345 controls), as well as to the GWAS on T2D from the WTCCC on subjects from the UK (1,924 cases, 2,938 controls). We estimated the proportion of phenotypic variance attributable to additive effects of all variants interrogated in these GWAS (i.e., chip-based heritability), as well as from a much smaller set of variants identified as eQTLs for muscle or adipose tissue. Estimates of chip-based heritability were appreciable and statistically significant in all 3 samples (58%, 77%, and 55%, respectively). However, the smaller set of muscle eQTLs accounted for more of the variance in T2D liability (with stronger statistical significance) in the Starr County and Mexico City GWAS than was observed using all SNPs. Results were similar in all 3 datasets for the set of eQTLs characterized in adipose tissue. These results support our hypothesis that common eQTLs mapped in insulin-responsive tissues account for a substantial portion of the variance in liability to T2D.

MICROBIOLOGY

Room 217B

IFN- γ IS PROTECTIVE IN EXPERIMENTAL AUTOIMMUNE ENCEPHALOMYELITIS BY ACTIVATING CNS-RESIDENT MICROGLIA TO PHAGOCYTOSE NEUROTOXIC MYELIN DEBRIS

Rebecca Sosa, Astrid Cardona, Thomas Forsthuber.

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Multiple sclerosis (MS) is the most common autoimmune demyelinating disease of the central nervous system (CNS), and studies in experimental autoimmune encephalomyelitis (EAE) have shown that neuroantigen-specific CD4⁺ T cells are the critical mediators of pathology. Mice deficient in the CD4⁺ Th1 lineage-derived cytokine IFN- γ develop more severe disease, implicating that its role in EAE and MS is protective. Using a novel quantitative immunofluorescence (qIF) technique to analyze confocal images of antigen-presenting cells (APCs) in the CNS of wild-type (Wt) and IFN- γ ^{-/-} or IFN- γ R^{-/-} C57BL/6 mice, we found this higher disease severity corresponded to decreased myelin Ag uptake by CNS APCs. The novel qIF further showed that the lack of antigen uptake corresponded to a lack of myelin debris cleanup at CNS lesions. Surprisingly, IFN- γ R^{-/-} APCs from EAE mice or *in vitro* cultures with exogenous myelin Ag and 2D2 tg T cells produced more IL-17 and GM-CSF in cytokine ELISPOT assays. Flow cytometry for phagocytosis and antigen presentation markers revealed that CD11b⁺CD45^{lo} microglia were affected most by the absence of IFN- γ signaling with a dramatic reduction in activation markers, while CD11b⁺CD45^{hi} infiltrating macrophages were also less activated. However, CD11c⁺ dendritic cells (DCs) only experienced a slight decrease in activation markers. These results illuminate IFN- γ 's primary protective role via activation of CNS-resident microglia to promote removal of myelin debris, thus facilitating remyelination. Importantly, the activation of DCs to present myelin Ag to encephalitogenic T cells appeared independent of IFN- γ signaling and thus represents a potential therapeutic target for slowing MS progression.

Room 217B

ADENOVIRUS E1A-MEDIATED MODULATION OF HOST CELL TRANSCRIPTIONMiguel Nava, Arnold Berk.*University of California, Los Angeles, Los Angeles, CA.*

The adenovirus small e1a protein is a potent transcriptional modulator. Following infection of IMR90 cells, e1a causes a dramatic decrease in H3K18ac, a robust induction of genes involved in cell cycle progression, and a repression of genes involved in fibroblast homeostasis. Small e1a must interact with both RB and p300/CBP to transcriptionally reprogram IMR90 cells and to transform rodent cells. Our lab has conducted chromatin immunoprecipitation experiments followed by massive parallel sequencing (ChIP-seq) for Pol II following infection of IMR90 cells with adenoviruses that express wild-type e1a and e1a mutants that do not bind to p300/CBP (p300 - e1a) and RB (RB - e1a). We have also conducted corresponding RNA-seq experiments following infection of IMR90 cells with our panel of e1a adenoviruses. Preliminary analysis of ChIP-seq studies for Pol II and RNA-seq data indicates a strong positive correlation between Pol II enrichment and RNA levels in uninfected cells and cells infected with an adenovirus that expresses wt e1a. Additional analysis will need to be carried out to determine the significance of Pol II localization and distribution. The genome-wide distributions of p300 and e1a remain unknown. Therefore, we propose to conduct ChIP-seq studies for p300 and e1a. We hypothesize that e1a relocalizes p300 genome wide and that e1a will colocalize with p300 and RB. We hope to determine the mechanisms by which adenovirus coopts cellular machinery to transform the refractory host environment into a conducive one for viral replication.

Room 214D

A BIOCHEMICAL AND BIOPHYSICAL CHARACTERIZATION OF AZOC, THE AZOREDUCTASE ENZYME OF *CLOSTRIDIUM PERFRINGENS*Jessica Morrison, Shuo Dai, Jie Ren, Amanda Taylor, Mitchell Wilkerson, Cristee Wright, Aihua Xie, Gilbert John.*Oklahoma State University, Stillwater, OK.*

Azo dyes are used widely across industries as colorants. Many microorganisms are able to reduce azo dyes by use of an azoreductase enzyme. It is through the reduction of the azo bonds of the dyes that carcinogenic metabolites are produced. The field of research on azoreductases is growing, but there is very little information available on azoreductases of strictly anaerobic bacteria. The azoreductase gene was identified in *Clostridium perfringens* (AzoC), a strict anaerobe that is found in human intestinal tracts. AzoC was biochemically characterized via UV-VIS spectroscopy and was found to have high activity, especially with Direct Blue 15. AzoC was found to work best at pH 9.0, 25 °C, and with NADH and FAD as cofactors. AzoC was biophysically characterized using mass spectroscopy, FTIR, circular dichroism, and SDS PAGE. FAD was identified as the noncovalently bound cofactor of AzoC in a 1:1 ratio. By SDS-PAGE, AzoC was determined to be a trimer connected by disulfide bonds. The trimeric form does not seem to add to structural stability, as determined by thermal melt studies. Computational analysis showed that the secondary structure of AzoC is consistent with the structural characteristics of other azoreductases, suggesting that gut enzymes of similar function will have related structures.

Room 214D

THE BACTERICIDAL EFFECT OF SILVER NANOPARTICLES AND IONSDulce Romero-Urbina, J. Jesus Velazquez, Patrick Ketter, Joshua Davidson, Miguel Jose-Yacamán.*University of Texas at San Antonio, San Antonio, TX.*

Nanomaterials have the potential to provide solutions to technological and environmental challenges in the areas of solar energy conversion, catalysis, medicine, and water treatment. Recently, silver nanoparticles and their applications have attracted great interest due to the important antimicrobial activities of these nanomaterials, which allow their use in several industrial sectors. Silver nanoparticles can be used in various products to kill different types of bacteria and offer an alternative to antibiotics. The mechanism of how silver nanoparticles kill bacteria is not well understood. It is known that free silver ions (Ag^+) are highly toxic to a wide variety of organisms including bacteria. Several silver nanoparticle solutions were prepared to test their antibacterial effectiveness. We found that solutions with larger amounts of free silver ions (Ag^+) were most effective in killing bacteria. The preliminary results from inhibition curves show an increased antibacterial effect of Ag^+ ions in the treatment of *Escherichia coli*, *Bacillus cereus*, *Staphylococcus aureus*, and *Staphylococcus epidermis*. Transmission electron microscopy (TEM) and scanning electron microscopy (SEM) techniques were used to characterize the treated bacteria. Understanding the mechanism of how silver nanoparticles and ions attack bacterial cell is of great importance in order to most effectively design products that will kill bacteria.

Room 214D

HOW DOES THE POXVIRUS K1 PROTEIN INHIBIT NUCLEAR FACTOR KAPPA B ACTIVATION?

Ariana Bravo Cruz, Joanna Shisler.

University of Illinois at Urbana-Champaign, Urbana, IL.

Nuclear factor kappa B (NF- κ B) is a transcription factor that regulates the expression of multiple proinflammatory genes. Poxviruses have evolved multiple mechanisms to modulate the host inflammation response by encoding several proteins that inhibit NF- κ B activation. One such protein is the K1 protein. The mechanism by which K1 inhibits NF- κ B activation remains unclear. Recently, our lab demonstrated that the K1 protein inhibits virally induced PKR, an upstream activator of NF- κ B. We initially hypothesized that the K1 protein prevented NF- κ B activation solely by inhibiting PKR activation. However, recent evidence suggests that the K1 protein can inhibit NF- κ B activation in a PKR-independent manner. First, ectopically expressed K1 inhibits the PKR-independent NF- κ B activation pathway triggered by TNF and PMA via luciferase assay. Second, the K1 protein does not inhibit I κ B α degradation, an event downstream of PKR activation. To confirm this PKR-independent mechanism, we used PKR^{-/-} cells and observed that K1 still inhibited TNF and PMA-induced NF- κ B activation. The K1 protein allows NF- κ B nuclear translocation, representing the first report of a vaccinia virus protein that targets NF- κ B while in the nucleus. In addition, we observed that the K1 protein coassociates with the p65 subunit of NF- κ B. We hypothesize that the K1 protein binds to NF- κ B to block NF- κ B-DNA binding, an event required to drive the transcription of target genes. Increasing knowledge of how viruses modulate the host environment to promote infection is beneficial for the immunology field. New therapies and viral vectors could be developed and applied to both basic research and recombinant vaccine development.

Room 214D

ENZYMATIC AND BIOPHYSICAL CHARACTERIZATION OF AZOM AND MUTANTS

Shelby Rice, John Cooper, Brian Couger, Gilbert John.

Oklahoma State University, Stillwater, OK.

Enterococcus faecium (*E. faecium*) is a microorganism naturally found in the human intestine, and it has been found to contain the gene *azoef1*, which encodes for azoreductase activity. Azoreductase reductively cleaves azo dyes commonly used as colorants for food, beverages, manufacturing of textiles, cosmetics, pharmaceuticals, and plastics. The metabolic byproducts can be carcinogenic and mutagenic, thereby becoming detrimental to human health and the environment. Little information is known about the structure and function of AzoEf1. Therefore, the goal of this study was to identify important binding sites for azo substrates and cofactor interaction. Using *in silico* modeling methods, specific residues were determined to be functionally relevant for binding based on their spatial location within the enzyme's active site. Therefore, 3 mutants were generated, and enzymatic and biophysical techniques were used to characterize the wild-type (AzoM) and mutant proteins. The results will provide a better understanding of the structure and function of azoreductase and contribute to the broader azoreductase field, thereby having an impact on human health, industry, and the environment.

Room 217B

GLYCOSYLATION OF PSR IS IMPORTANT FOR DISEASE IN STREPTOCOCCUS PNEUMONIAE

Anel Lizcano, Ramya A.S. Badu, Cecilia A. Hinojosa, Carlos Orihuela.

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Streptococcus pneumoniae is the leading cause of community-acquired pneumonia. PsrP (pneumococcal serine-rich repeat protein) is a virulence factor in *S. pneumoniae* that mediates lung-cell adhesion, facilitates biofilm formation, and is important for virulence. *psrP-secY2A2*, is the pathogenicity island which encodes PsrP; 10-glycosyltransferases (GTFs), *glyA-glyG*, *nss*, *gtfA*, and *gtfB*; and 7 components of an alternate secretion system. The accessory proteins in *psrP-secY2A2* glycosylate transport PsrP to the bacterial surface. However, the importance of PsrP glycosylation during virulence in *S. pneumoniae* has not been investigated. Using western blots, we determined that glycosylation of PsrP is important for stability in 6 out of 10 GTF-deficient strains expressing recombinant PsrP. To investigate if deletion of each GTF affected virulence, we performed *in vitro* lung-cell adhesion assays. These resulted in alternate adhesion patterns: 4 out of 10 GTF deletion strains were attenuated for adhesion similar to the *psrP* deficient strain. One GTF-deletion strain had a 3-fold increase in adhesion pattern compared to the wild-type strain. We also tested the ability to form *in vitro* biofilms in each GTF-deficient strain. They all showed a different biofilm phenotype as imaged by confocal microscopy. To test virulence *in vivo*, we infected mice intratracheally with each of the GTF-deficient strains. Five out of the 10 GTF-deletion strains were attenuated *in vivo*. Our findings indicate that

glycosylation of PsrP in *S. pneumoniae* is important for protein stability, adhesion, biofilm formation, and virulence of PsrP. These studies provide evidence that protein glycosylation is an important post-translational event that can impact pathogenesis.

Room 217B

IDENTIFICATION OF CRITICAL RESIDUES IN THE FLA-A FLAGELLIN OF *VIBRIO CHOLERA*

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Vibrio cholerae is the causative agent of the human diarrheal disease, cholera. The bacterium possesses a single polar flagellum that is required for motility and contributes to virulence. The *V. cholerae* genome encodes 5 distinct flagellins (FlaA, B, C, D, and E), but only FlaA is essential for flagellar synthesis and motility. The flagellins have been identified as causing reactogenicity in current vaccine strains; however, nonflagellated strains do not confer the same level of protective immunity. Thus, identifying the critical residues for motility can lead to targeted efforts for a motile vaccine strain lacking reactogenicity. Transcription of *flaA* is controlled by a class III (σ^{54} -dependent) promoter, while transcription of the other 4 flagellins is controlled by class IV (σ^{28} -dependent) promoters. Class III expression does not contribute to the critical function of FlaA because *flaA* expressed from a class IV promoter still allows flagellar synthesis. This suggests that specific residues in FlaA contribute to its critical role in flagellar synthesis. To identify important residues in FlaA, we constructed chimeric FlaA-FlaD proteins, and screened for their ability to provide motility in a *flaA flaD V. cholerae* strain. These studies have revealed that a critical residue lies in the N-terminus at aa 96, and in the C-terminus at aa 328, and these are predicted to be located in the D1 and D2 domains of the flagellin. The D1 and D2 domains lie in close proximity to each other in the assembled flagellum and may interact. Further analysis should reveal how these specific FlaA residues contribute to flagellar synthesis.

Room 214D

A STICKY SITUATION: CELL-TO-CELL ADHERENCE BETWEEN *C. ALBICANS* AND ORAL BACTERIA

Jonathan Dornell, Michael Gustin.

Rice University, Houston, TX.

Cell-to-cell adhesion is the binding of one cell to another by means of adhesin molecules. This phenomenon enables *Candida albicans* to colonize host tissues and form biofilms. This mechanism also enables *C. albicans* to indirectly establish itself through *C. albicans*-bacteria adhesion. The ability to adhere to distinct cell types is an essential virulence factor for *C. albicans* infections such as oral candidiasis and denture stomatitis. Despite the importance of cell-to-cell adhesion for *C. albicans* colonization, there are many questions that remain unanswered. *C. albicans* and oral bacteria have been coisolated from varying microenvironments in the oral cavity, including the tongue, periodontal pockets, and dental plaque. Furthermore, the ability of *C. albicans* to establish itself in the oral cavity is influenced by the surrounding bacteria. In order to expand our understanding of pairings between *C. albicans* and oral bacteria, a coadhesion assay was developed using fluorescence measurements with a plate reader to quantitatively identify which bacterial species adhere with *C. albicans*. Additionally, this assay is flexible enough to further investigate *C. albicans*-bacterial pairings with different techniques such as fluorescence microscopy. This coadhesion assay has demonstrated that *C. albicans* strongly adheres with the initial colonizer *S. gordonii* with the potential to identify novel pairings with pathogenic oral bacteria such as *P. gingivalis*. The results obtained from this project will contribute to our knowledge of *C. albicans*'s ability to colonize the oral cavity and which oral bacteria potentially facilitate *C. albicans* infections in the mouth.

OTHER BIOLOGICAL SCIENCES

Room 210A

IMPAIRED CHEMOTACTIC SIGNALING WITHIN PRIMARY CD4⁺ T CELLS RESULTS FROM DOWNMODULATION OF CCR7 BY HIV-1 VPUPeter Ramirez¹, Marylinda Famiglietti², Alberto Bosque¹, Vicente Planelles¹.¹University of Utah, Salt Lake City, UT, ²San Raffaele Scientific Institute, Milano, IT.

HIV-1 belongs to the genus *Lentivirus*, a group of retroviruses characterized by their ability to cause long lasting infection and encode nonprototypical accessory genes. The HIV-1 accessory protein Vpu is a small 81-amino-acid (16 kDa), type-I integral membrane phosphoprotein that is unique to HIV-1 and some simian immunodeficiency viruses (SIVs). Structurally, Vpu contains an N-terminal transmembrane (TM) domain along with two cytoplasmic alpha helices that are separated by highly conserved, constitutively phosphorylated serines. To date, Vpu has been shown to antagonize four host proteins: CD4, BST-2, CD1d, and NTB-A. We have recently discovered a novel function of Vpu in the downmodulation of the chemokine receptor CCR7 from the surface of infected CD4⁺ T cells. Our studies have found Vpu to be both necessary and sufficient for CCR7 surface downregulation. Interestingly, total levels of CCR7 remained unchanged in infected cells, suggesting Vpu sequesters rather than degrades the chemokine receptor. Downregulation of CCR7 from the surface was abrogated when cells were infected with a Vpu TM mutant. In contrast, mutation of Vpu's 2 conserved serines did not affect CCR7 surface downmodulation by Vpu. Additionally, we found, through coimmunoprecipitation (co-IP) studies, that Vpu specifically interacts with CCR7 and that both proteins preferentially colocalize within the trans golgi network (TGN). Finally, initial studies have shown that HIV-infected cells display some chemotactic signaling defects in response to calcium flux and Erk phosphorylation, suggesting these cells may be compromised in their ability to recirculate and initiate a proper immune response against the virus.

Room 206B

AN EVALUATION OF THE IMPACT OF FECAL MATERIAL FROM CATTLE EGRET (*BUBULCUS IBIS*) HERONRIES ON WATER QUALITY IN TEXASJudlyn Telesford, Miguel Mora.

Texas A&M University, College Station, TX.

The impairment of watersheds by pathogens, as indicated by the detection of high levels of *Escherichia coli* (*E. coli*), has been a problem in Texas for many years. Avian species such as Egrets establish large heronries in close proximity to water. To our knowledge, no information is available on the *E. coli* and nutrient loads contributed to Texas watersheds by these birds. The objective of this study was to determine the direct and indirect impact of heronries on water quality by quantifying *E. coli* and nutrient loads. A heronry at Murphy Park [MP] was used to study the indirect impact while another at Richland Creek [RC] was used to study the direct impact. Water samples were collected 3 times during the breeding season around MP and beneath RC. *E. coli* counts in all samples exceeded the criteria for primary contact recreation (126 CFU/100 ml) set by the Texas Commission on Environmental Quality. Nitrogen concentrations at MP ranged from 11,200 to 40,000 mg/l. Phosphorus concentrations were as high as 0.38 mg/l, and dissolved oxygen (DO) was as low as 5.8 mg/l. At Richland Creek, *E. coli* counts were as high as 230, 000 CFU/100ml and total N concentrations ranged from 12,000 to 66,600 mg/l. DO was as low as 4.5 mg/l. These results have improved our understanding of the potential contribution to Texas watersheds of *E. coli* and nutrients from heronries and can aid in the development of best management practices and other strategies to address bacterial and nutrient loads in Texas.

Room 210A

IMPROVING PANCREATIC CANCER CHEMOTHERAPY THROUGH THE ADDITION OF COMPOUNDS DERIVED FROM NEXRUTINE®Amanda Muñoz¹, Florastina Payton-Stewart², Addanki Pratap Kumar¹.¹University of Texas Health Science Center at San Antonio, San Antonio, TX, ²Xavier University of Louisiana, New Orleans, LA.

Pancreatic cancer (PanCA) is one of the more challenging forms of cancer to treat and, as such, is the fourth leading cause of cancer-associated deaths in the US. Currently, patients diagnosed with PanCA have a 5-year survival rate of less than 10%. Poor drug delivery and effectiveness are 2 factors known to complicate therapeutic strategies in PanCA and contribute to the observed low survival rates. Therefore, we need to improve the current drugs or develop novel therapeutics with greater efficacy to improve patient survival. Our laboratory has focused on improving the

current treatment options by supplementing chemotherapeutics with Nexrutine® (Nx). Nx is an herbal supplement, which has been shown to inhibit PanCA cell growth through modulation of inflammatory signaling pathways. Based on this and preliminary data, we hypothesized that compounds derived from the active components of Nx may induce a synergistic or additive anticancer effect on pancreatic cancer in combination with standard-of-care chemotherapeutic agents. In this presentation, we will identify a derivative that can exert synergistic or additive growth-inhibitory activities in combination with oxaliplatin, gemcitabine, 5-fluorouracil, and paclitaxel. Methods used to obtain our results include cell culture, proliferation assays, combination indices analysis, cell cycle assays, and colony formation assays. Our results suggest that some of the derivatives examined could potentially be used as an adjuvant or neoadjuvant to chemotherapy regimens in PanCA patients to improve patient survival.

Room 211

A GENOMICS APPROACH TO UNDERSTANDING THE TOXICITY OF DRINKING WATER CONTAMINANTS

Vanessa De La Rosa, Jonathan Asfaha, Chris Vulpe.

University of California, Berkeley, Berkeley, CA.

Trichloroethylene (TCE) is an industrial solvent and the most common drinking water contaminant in the US. TCE is a human carcinogen and highly toxic, yet the molecular events mediating toxicity and cancer remain convoluted. We aim to use a functional genomics approach in model organisms to gain insight into the genes and cellular pathways that modulate TCE toxicity. Initial functional studies used the yeast deletion library consisting of 4,600 mutant strains, each with a single gene knocked out. Screening the yeast library with TCE identified a subset of mutagenic DNA repair genes important in the response to TCE. This suggests TCE damages DNA and requires a repair response to mediate toxicity in yeast. Subsequent functional studies were conducted in transformed avian lymphocyte cell lines to determine if TCE DNA damage and the mutagenic DNA repair response were conserved. Various DNA repair knockouts exposed to biologically relevant TCE doses exhibited decreased viability, and biochemical analysis of posttranslational modifications showed initiation of DNA repair during TCE exposure. Results from these functional studies suggest TCE-induced DNA damage and repair response is conserved in higher eukaryotes. Ongoing studies using human cell lines and mass spectrometry will provide physical evidence of DNA damage and further support TCE-induced damage as a modulator of toxicity. In conclusion, these studies have identified previously unknown cellular targets that potentially modulate TCE toxicity and progression of cancer in humans. Furthermore, we show that a functional genomics approach is a viable platform for understanding toxicity mechanisms in higher organisms.

Room 212B

ALTERED GABAergic SIGNALING CONTRIBUTES TO AGE-RELATED MEMORY DECLINE

Cristina Banuelos, Sofia Beas, Ryan Gilbert, Barry Setlow, Jennifer Bizon.

University of Florida College of Medicine, Gainesville, FL.

Impairment in working memory functions supported by the prefrontal cortex (PFC) are a common feature of normal aging. Working memory critically involves GABAergic signaling in PFC; yet, surprisingly little is known about GABAergic alterations in PFC during normal aging or whether such changes contribute to age-associated impairments in working memory. To investigate this, young adult (7 mo) and aged (25 mo) male F344 rats were characterized on an operant-based delayed response test of working memory. Rats were required to remember the location of a sample lever over a delay period (0 - 24 s) to obtain a food reward. Aged rats performed comparably to young rats under no-delay conditions, but exhibited deficits relative to young rats at long delays. Immunoblots of PFC homogenates showed that the GABA synthesizing enzyme GAD67 was increased, but the transporter important for reuptake of GABA after synaptic release (GAT-1) was decreased in aged PFC. GABA(B) receptor, GABA(B)R, expression was also reduced in aged PFC and was inversely related to working memory performance among aged rats. We next tested whether reducing GABA(B)R activation could improve working memory in impaired, aged rats. Systemic injections of CGP55845 (0.1 mg/kg), a GABA(B)R antagonist, enhanced performance in aged rats, and these effects were mimicked by microinjections of CGP55845 into PFC. Together, these data suggest that age-related dysregulation of GABAergic signaling in PFC may play a causal role in impaired working memory and that targeting GABA(B)Rs may provide therapeutic benefits for age-related impairments in executive functions.

Room 212B

A *XENOPUS* TADPOLE MODEL FOR VALPROATE-INDUCED NEURODEVELOPMENTAL DISORDERS

Eric James, Jenny Gu, Arseny Khakhalin, Carlos Aizenman.

Brown University, Providence, RI.

Autism spectrum disorder (ASD) is the most prevalent neurodevelopmental disorder afflicting children. Prenatal exposure to valproic acid (VPA), a commonly prescribed anticonvulsant, increases the risk for ASD in children. Rodents exposed to VPA *in utero* have been used to generate a VPA-induced rodent model of autism. The overarching neuronal phenotypes of these “autistic” mice are reduced cell excitability and hyperconnected local networks. However, the mechanisms by which prenatal VPA exposure produces ASD in humans and animal models is not understood. The retinotectal circuit of the *Xenopus* tadpole is a well-characterized neural circuit that has been used to study mechanisms of neuronal development. We exposed tadpole embryos to 1 mM VPA and tested excitability and connectivity of tectal neurons using whole-cell patch-clamp recordings. The results of exposing tadpoles to VPA during this critical period were a reduction in cell excitability and network hyperexcitability, thus recapitulating neuronal phenotypes of other VPA-induced animal models of ASD. Behavioral research has demonstrated autistic children and VPA-induced models of ASD have an increased sensitivity to sensory stimuli. We conducted behavioral assays on the VPA-treated tadpoles and observed an increased response to sensory stimuli. *Xenopus* tadpoles are a high-throughput model organism with well-understood neural organization useful for studying mechanisms that govern development of neural circuits. When these attributes of *Xenopus* are combined with the results of our experiments, it is clear the *Xenopus* tadpole is a viable and efficient model to study the mechanisms by which VPA-induced ASD occurs.

PHYSIOLOGY/PATHOLOGY

Room 212B

RESCUE EFFECTS OF CERAMIDE INHIBITION BY MYRIOCIN IN CHRONIC ALCOHOLIC LIVER DISEASE

Teresa Ramirez¹, Lisa Longato¹, Ming Tong², Valerie Zabala², Jack Wands¹, Suzanne de la Monte¹.

¹*Brown University, Providence, RI*, ²*Rhode Island Hospital, Providence, RI*.

Alcohol-related liver disease (ALD) causes steatohepatitis with insulin resistance. Insulin resistance impairs hepatocellular growth, survival, and metabolism. Disrupted lipid metabolism leads to increased ceramide accumulation in the liver. Attendant lipotoxicity promotes endoplasmic reticulum (ER) and oxidative stress, which worsen inflammation and insulin resistance. Adult male Long Evans rats were pair-fed with isocaloric liquid diets containing 0% or 37% ethanol (caloric) for 8 weeks. After 3 weeks on the liquid diets, they were intraperitoneally injected with myriocin (0.3 mg/kg) or saline (vehicle) in 100 µl volumes. Myriocin is a serine palmitoyl transferase (*de novo* pathway) inhibitor that blocks ceramide synthesis. We characterized the effects of myriocin treatment on the histopathological and ultrastructural features of steatohepatitis, biochemical and molecular indices of hepatic steatosis; insulin resistance, signaling through the insulin receptor, insulin receptor substrate (IRS), and Akt pathways; and ER stress pathway activation. Myriocin reduced the severity of alcohol-related steatohepatitis, including the abundance and sizes of lipid droplets and mitochondria, inflammation, and architectural disruption of the ER. In addition, myriocin-reduced hepatic lipid and ceramide levels were associated with constitutive enhancement of insulin signaling through the insulin receptor and IRS2 and modulation of ER stress signaling mechanisms. Ceramide accumulation in liver mediates tissue injury, insulin resistance, and lipotoxicity in ALD. Reducing hepatic ceramide levels can help restore the structural and functional integrity of the liver in chronic ALD due to amelioration of insulin resistance and ER stress. However, additional measures are needed to protect the liver from alcohol-induced necroinflammatory responses vis-à-vis continued alcohol abuse.

PLANT SCIENCES

Room 207A

TIGHT, INDUCIBLE EXPRESSION OF PATHOGEN EFFECTOR PROTEINS IN RESISTANT PLANTS ACHIEVED WITH AN ALTERNATIVELY SPLICED SUICIDE EXON

Tania L. Gonzalez, Brian J. Staskawicz, Ming C. Hammond.
University of California, Berkeley, Berkeley, CA.

Plant disease is a constant concern for our agriculture industry and for world-wide food security. Pathogens circumvent the primary immune system in plants by secreting effector proteins into plant cells to disrupt the signaling pathway. Effector-triggered immunity (ETI) is a secondary pathway activated when plants possess disease resistance (R) genes that recognize specific effectors. ETI includes a defensive hypersensitive response (HR), which involves localized cell death at the site of pathogen recognition, quarantining the pathogen. Although many known R and effector protein pairs trigger HR, the signaling events that lead to ETI remain unclear. Generating transgenic plants that inducibly express effector proteins for research is problematic or impossible because of the HR phenotype triggered by background levels of effector protein because of leaky transcription. This problem can be circumvented by employing an inducible promoter- and splicing-based regulation strategy to tightly regulate effector genes. Our lab developed an alternatively spliced suicide exon called HyP5SM, which renders the transcript nonproductive by default. Inducing HyP5SM exon skipping recovers protein expression. In transiently transformed *Nicotiana benthamiana*, this dual regulation eliminates detectable background HR triggered by AvrBs2, a conserved bacterial effector from *Xanthomonas euvesicatoria*. RT-PCR and western blots show that the *avrBs2* gene has been tightly regulated and that leaky protein expression is undetectable using our dual regulation. Furthermore, plants inducibly recover the HR phenotype. We plan to generate transgenic plants to investigate transcriptional changes on expression of a pathogen effector. This strategy can be used to regulate other genes with toxic effects in plants.

ZOOLOGY/ENTOMOLOGY

Room 209

A NEW WAY OF MEASURING CORAL HEALTH AT LAOLAO BAY, SAIPAN

Sean Macduff, Robert H. Richmond.
Kewalo Marine Lab, University of Hawaii, Honolulu, HI.

Coral reefs in Laolao Bay, Saipan, Commonwealth of the Northern Mariana Islands, have deteriorated over the past several decades. Land-based sources of pollution such as eutrophication, sedimentation, and toxicant-laced runoff are somewhat to blame. However, the bay still contains a highly diverse, culturally significant, and economically important coral reef community. Corals in response to stressors will upregulate various proteins or biomarkers. Heat-shock proteins and detoxification enzymes are examples of molecular biomarkers used to evaluate coral health. Local government agencies have begun to restore the Laolao Bay watershed in hopes of improving coastal water quality and associated coral reef health in the bay. Our research will investigate the change in coral health in response to the Laolao Bay watershed restoration project. Stress-associated biomarkers in *Porites lobata* will be quantified from samples collected before and after the restoration project. The results of this study will provide resource managers with key information on the specific stressors affecting the corals studied and provide baseline information for future comparison and for tracking the effectiveness of mitigation measures. Knowing the causal effects of coral stress is an important element in the real-time conservation and management of Laolao Bay for current and future generations.

Room 213B

AUGMENTED REALITY SYSTEM FOR TRAINING LAPAROSCOPIC SURGEONS

Jose Jaime Farrington-Zapata, Gian-Luca Mariottini.
University of Texas at Arlington, Arlington Texas.

Laparoscopic surgery gives surgeons the ability to perform complicated surgical procedures in a less invasive manner and with reduced trauma for the patient. Despite these advantages, hand-eye coordination is difficult for the surgeon who has to remotely manipulate tiny surgical tools and a small endoscopic camera. Simulators or plastic models are available for training, but no automatic system is available to show surgeons which tool position or posture is the best for a particular task. The goal of this project is to design and develop a novel augmented-reality system for training

laparoscopic surgeons that will overlay on top of the current endoscopic view a virtual image of how the surgical tool should be positioned and oriented. In this way, the surgeon will be efficiently guided to achieve the task in the fastest time and with the best set of motions. We are developing our system to work in real time using OpenCV and ArUcO. This is a joint collaboration with the Urology Department at the University of Texas, South Western Medical Center.

EDUCATION

EDUCATION RESEARCH/ADMINISTRATION (EXCEPT EDUCATIONAL/SCHOOL PSYCHOLOGY)

Room 217D

IMPROVING NATIVE AMERICAN STUDENTS' INTERESTS IN MATHEMATICS AND SCIENCE USING A COMBINATION OF AN ASTROBIOLOGY CURRICULUM AND SELECTED PEDAGOGIES

Meredith Berthelson, Ke Wu.

University of Montana, Missoula, MT.

Across the nation, Native Americans are the most underrepresented racial group in science and mathematics. The Astrobiology in the Native American Classroom project was designed to provide students from an underrepresented group with opportunities to engage in scientific activities centered around the highly interdisciplinary and exciting field of astrobiology. The goal was to use the field of astrobiology as a platform to introduce concepts in astronomy, planetary sciences, microbiology, geosciences, and other related fields of study causing students with negative or apathetic attitudes towards the sciences and mathematics to consider incorporating these fields into their higher education and career goals. In order to enhance the integrative approach of the astrobiology curriculum, the use of pedagogical methods comprising place-based pedagogy, cognitively-guided instruction, the use of hands-on materials, and cooperative learning were used. This study took place on a reservation in Montana in the 9th grade biology course. Over the course of the unit, 31 students, of which 30 were Native American, participated in the study. At the completion of this project, interest in mathematics and science increased and there was a significant improvement on the pre- to post-test on the content knowledge of astrobiology. This suggested the astrobiology unit improved the students' knowledge of the subject matter. A program that uses a balance of engaging curriculum with educational theories specific to Native American students can enhance interest in science and mathematics

OTHER EDUCATION

Room 217D

GATEWAY TO THE BACCALAUREATE: THE ROLE OF DEVELOPMENTAL EDUCATION IN THE PERSISTENCE AND GRADUATION OF LATINAS EARNING A STEM UNDERGRADUATE DEGREE AT A HISPANIC-SERVING INSTITUTION

Diane Elizondo, Anne-Marie Nunez.

University of Texas at San Antonio, San Antonio, TX.

Although Latinas are participating in greater numbers in higher education, they have lower levels of achievement in STEM (science, technology, engineering, and math). Few studies describe how Latinas perceive and experience STEM. Additionally, there is little research about Hispanic-serving institutions (HSI). HSIs graduate a large number of Latina/o STEM undergraduates, but receive less funding per student, and their students have less college preparation and financial resources. This study examined the phenomenon of the persistence and graduation of Latinas who completed developmental coursework and earned a STEM undergraduate degree at an HSI. Through the use of transcendental phenomenology, the researcher conducted qualitative interviews with Latinas majoring in STEM at a single HSI to understand the essence of their experiences by examining their perceptions about their major, coursework, expectations, peers, and the faculty at their HSI. After conducting multilevel coding and

analyses, the findings highlight the interconnections among personal characteristics, academic preparation, STEM acculturation, and campus climate in increasing Latina STEM success. Additional themes and subthemes include the role of developmental education as a gateway to the university, gender and ethnic consciousness, mentor and family support, and finances in a student's ability to persist and achieve in their STEM major. The research calls for expanding the study to include participants who completed developmental coursework but did not succeed in their studies in order to better inform institutional policy, practice, and program decisions such as aligning P12 and postsecondary academic curricula, programs, and services and redefining the calculation of retention and graduation rates.

TEACHER EDUCATION

Room 217D

PRE-SERVICE MIDDLE SCHOOL TEACHERS' NOTICING OF STUDENTS' ALGEBRAIC THINKING

Lynette Guzman, Sandra Crespo.

Michigan State University, East Lansing, MI.

Algebra plays a prominent role in mathematics education reform efforts because it is an important conceptual category in mathematics. Stein, Kaufman, Sherman, and Hillen found that an increasing number of K-12 students are taking algebra courses, and an increasing number of these students are unprepared to take these courses. Consequently, the STEM education communities must address issues related to broadening perspectives on algebraic thinking and learning, including support for future STEM teachers. Sherin and van Es argue that developing pre-service teachers' capacity to notice students' mathematical thinking is a way to support and sustain their continued learning of mathematics teaching after teacher preparation. Although noticing skills may develop through teaching experience, the demands of current reform push for addressing and shaping these skills during teacher preparation. This study seeks to better understand pre-service middle school teachers' noticing of students' algebraic thinking. Through one-on-one interviews, we presented a task-based video clip for pre-service teachers to interpret and respond to students' understandings related to equivalence and variable. With a focused video clip and content-specific questions, we intended to concentrate pre-service teacher notice on student thinking and algebraic concepts. Additionally, we asked participants to self-report experiences inside and outside teacher preparation that have contributed to their own noticing skills. We will report on a design to identify pre-service middle school teachers' noticing of students' algebraic thinking related to equivalence and variable, findings regarding participants' levels of noticing, and self-reported experiences that contribute to their noticing.

ENGINEERING

BIOENGINEERING/BIOMEDICAL ENGINEERING

Room 217A

DETERMINATION OF THE EFFECTS OF HYPERBARIC CONDITIONS ON CMRO₂ IN RATS DURING FOREPAW STIMULATION USING FMRI

Damon Cardenas¹, Shiliang Huang², Eric Muir², Timothy Duong².

¹University of Texas at San Antonio, San Antonio, TX, ²Research Imaging Institute, San Antonio, TX.

Hyperbaric oxygen therapy (HBOT) is currently used to treat a variety of ailments by increasing systemic oxygen, thus aiding in metabolic activity in the body. More recently, HBOT is being considered for use with neurological injuries such as traumatic brain injury. The research presented here used fMRI to characterize the effects of oxygen and high-pressure conditions on neurological activity. In particular, changes in the cerebral metabolic rate of oxygen (CMRO₂) in response to forepaw stimulation during different pressure conditions, was measured. Based on results from literature, it was hypothesized that high pressure, with air or O₂ inhalation, would cause a decrease in CMRO₂ in response to

somatosensory stimulation. A custom-made, MRI-compatible hyperbaric chamber was constructed for use in *in vivo* experimentation. Sprague Dawley rats ($n = 2$) were anesthetized and placed into the chamber. Forepaw stimulation was performed at the following gas and pressure conditions: normal air inhalation at 1 and 3 ATA, and 100% O_2 inhalation at 1 and 3 ATA. From analysis of fMRI images obtained for each condition, $CMRO_2$ was determined. For normal pressure conditions, we observed $CMRO_2$ of 19% (air) and 16% (O_2). For high-pressure conditions, we observed $CMRO_2$ of .32% (air) and .41% (O_2). The large increase in $CMRO_2$ from normal to hyperbaric conditions suggests that the body makes use of the increase in systemic O_2 differently at high pressures than normal pressures. These results could be beneficial in providing direction for the advancement of HBOT in medicine.

Room 217A

A STRUCTURAL ANALYSIS OF TWISTED VEINS

Justin Garcia, Hai-Chao Han.

University of Texas at San Antonio, San Antonio, TX.

In the human body, veins can become twisted with body movement (e.g., internal jugular vein with head turning) or after surgical procedures (e.g., saphenous vein bypass surgery), thereby elevating the risk for heart attack, blood clotting, and organ dysfunction. Excessive rotation causes veins to become mechanically unstable and deform into a twist-kink. Engineers refer to this phenomenon as a form of buckling. Due to the health risks, it is necessary to determine the critical loads (i.e., torque and twist angle) and key factors associated with twist buckling. Therefore, the goal of this work was to experimentally investigate the twist buckling behavior of veins and determine the critical buckling torque and twist angle. Twist experiments were performed for both saphenous and internal jugular veins. A custom machine was built to test the twist stability of veins at various levels of pressure and stretch corresponding to each vein-model tested. The results demonstrated that twist buckling of veins is characterized by a sudden kink formation and sharp decrease in torque. In both vein models, the critical twist angle was significantly affected by the level of stretch, and the critical torque was significantly affected by pressure. Pressure had a significant effect on the critical twist angle in jugular veins only. This study provides a better understanding of vein twist behavior and will serve as a guide for improving surgical techniques. Furthermore, these results further our knowledge of vascular mechanics and help identify key factors associated with the formation of twisted veins.

CHEMICAL ENGINEERING

Room 212A

COLLOIDAL SYNTHESIS OF AU-CONTAINING BIMETALLIC CATALYSTS

Alexandra Landry, Enrique Iglesias.

University of California, Berkeley, Berkeley, CA.

The combination of two different metals to form bimetallic nanoparticles can result in catalysts with improved reaction activity and selectivity. Conventional synthesis procedures, however, seldom distribute metals uniformly or require catalytically poisonous additives to prevent agglomeration. Impurities and compositional non-uniformity have prevented rigorous conclusions about the effects of alloying. We propose a colloidal synthesis method that has been successful in producing uniform bimetallic AuPt and AuPd nanoparticles (3-4 nm diameter). These particles are prepared using ethanol or ethylene glycol as reducing solvents and polyvinylpyrrolidone or polyvinylalcohol as protecting polymers. Such materials contain only C, H, O, and N, which can be removed by postsynthetic O_3 treatment without significant change in size or composition. The formation mechanism was studied using *in situ* UV-visible spectroscopy and TEM. Results suggest a galvanic exchange formation mechanism. This mechanism involves the surface atoms of the seed nanoparticle (Pt or Pd) reducing Au^{3+} ions in solution onto the particle surface as Au^0 . This redox reaction is thermodynamically favored due to the higher standard redox potential of Au relative to Pt and Pd. Pt^{2+} or Pd^{2+} ions generated by the reaction are then redeposited onto the surface by the reducing solvent. Developing rigorous conclusions about the size and composition effects of bimetallic clusters is key to designing valued catalysts for environmentally relevant reactions such as methanol oxidation in fuel cells and CO oxidation in automobile catalytic converters. Mechanistic knowledge of how to produce uniform clusters, such as those made in this study, is crucial to making such conclusions.

Room 212A

ENHANCED CHARGE STORAGE CAPACITY OF CONDUCTING POLYMER ELECTRODES BY THE ENTRAPMENT OF P-BENZOQUINONEMargarita Arcila-Velez, Mark Roberts.*Clemson University, Clemson, SC.*

There is currently a strong need for high energy/high power storage devices for small- and large-scale applications such as transportation, load leveling, storage for intermittent energy sources, and portable technologies. The performance of current energy storage technologies (batteries and supercapacitors) falls well short of requirements for using electrical energy efficiently. Pseudocapacitors, a supercapacitor type, have the ability to store great amounts of charge due to the inherent properties of their faradaic storage mechanism. In these supercapacitors, the bulk redox material stores energy by a transfer of charge between the electrolyte and the electrode. Furthermore, low-cost, environmentally friendly, and highly abundant materials are necessary for feasible stationary energy storage. Electroactive conductive polymers have the potential to address these major issues, along with having good intrinsic conductivity ranging from a few S cm^{-1} to 500 S cm^{-1} in the doped state, fast doping and de-doping processes, and ease of manufacture, particularly as thin films. Conducting polymer electrodes, however, still require improvement of their electrical charge capacity and stability. In this work, we report an increase in capacitance and charge capacity of conducting polymer electrodes through the entrapment of an abundant prototypical organic redox molecule such as 1,4-benzoquinone. This 1,4-benzoquinone is entrapped within a polypyrrole network through electrochemical polymerization, showing chemical and physical interaction with the polymer structure. This work will enable the development of supercapacitor materials that combine the high storage capacity properties of redox molecules with the high conductivity and capacitance of intrinsically conducting polymers such as polypyrrole.

COMPUTER/SYSTEMS ENGINEERING

Room 213B

A COMBINED ENCRYPTION AND AUTHENTICATION SCHEME FOR SECURE FIELD-PROGRAMMABLE GATE ARRAY DESIGN AT REDUCED LATENCYJuan Portillo, Bao Liu.*University of Texas at San Antonio, San Antonio, TX.*

Existing schemes for securing a field-programmable gate array (FPGA) design include encryption and authentication in separate steps wherein the FPGA chip contains a private key for decryption and a public key for authentication. These cryptographic keys are subject to side channel analysis and other hardware security attacks. In this paper, we propose a combined encryption and authentication scheme, where an FPGA designer encrypts the bitstream based on its digital signature such that an FPGA chip only needs to contain a public key to verify the digital signature and correctly decrypt the bitstream. A supply chain adversary achieving the public key will not be able to program a new circuit on the FPGA chip. Our scheme is compared against the ElGamal scheme using ModelSim cycle accurate simulation to determine latency. Our scheme achieves a 12% decrease in latency. Our experimental results show that the proposed scheme achieves enhanced security against supply chain adversaries at lower execution latency.

ELECTRICAL/ELECTRONICS/COMMUNICATIONS ENGINEERING

Room 208

A VARIATIONAL METHOD FOR MULTI-TARGET PATH PLANNING OF CURVILINEAR DEVICESJeremy Cole, Edgar Lobaton.*North Carolina State University, Raleigh, NC.*

We present a path planner that uses variational methods to construct 3D, locally optimal, collision-free paths for a curvilinear device that must reach multiple targets while satisfying a bounded curvature constraint. This planner is analyzed in the context of steerable medical needles used for minimally invasive surgeries. Our planner uses partial path retracing and produces paths that consistently cut less tissue than paths obtained without partial path retracing. We capture the shape of the needle's path and retracing information using a binary tree structure. Our approach accommodates topological changes in the tree structure by performing an initial node swapping optimization followed

by a shape optimization step. Results are shown for scenarios with 3 targets and compared with other planning approaches.

ENGINEERING SCIENCES/MECHANICS/PHYSICS

ENVIRONMENTAL ENGINEERING

Room 213B

ESTIMATION OF PREFERENTIAL CONTAMINANT TRANSPORT IN KARST GROUNDWATER SYSTEMS USING MIXED MODELS AND CONSERVATIVE TRACER APPROACHES

Angel Anaya, Ingrid Padilla.

University of Puerto Rico at Mayagüez, Mayagüez, PR.

Karst groundwater systems are highly productive and provide an important fresh water resource for human development and ecological integrity. Their high productivity and anisotropy are often associated with conduit flow and high matrix permeability. The general objective of this work is to characterize transport processes in conduit and diffusion-dominated flow under base flow and storm flow conditions. This work focuses on the development of geohydro statistical tools to characterize flow and transport processes under different flow regimes and their validation with conservative tracers. Laboratory-scale geo-hydrobed models were used for this purpose. Experimental work entailed making a series of point injections in wells while monitoring the hydraulic response in other wells. Statistical mixed models were applied to spatial probabilities of hydraulic response to determine the best spatial correlation structure to represent paths of preferential flow in the limestone units under different groundwater flow regimes. Transport experiments were also conducted using a CaCl_2 tracer to validate the preferential flow path estimates and characterize dual porosity transport. Results show that the system can be used to represent the variable transport regime characterized by conduit and diffuse flow in the karst systems. Initial hydraulic characterization indicates a highly heterogeneous system resulting in large preferential flow components. Temporal distributions of Cl^- in the model show varying responses according to the location of the sampling cluster and support the preferential flow network distribution generated from the statistical modeling, allowing identification of transport mechanisms. [This work is supported by the National Institute of Environmental Health Sciences (Grant Award P42ES017198).]

MATERIALS ENGINEERING (INCLUDING CERAMICS/TEXTILES)

Room 212A

COMPARISON OF COMPUTATIONALLY SIMULATED FISSION PRODUCT DISTRIBUTION WITH CORRELATIVE CHARACTERIZATION TECHNIQUES IN SURROGATE NUCLEAR FUEL MATERIALS

Billy Valderrama¹, Hunter B. Henderson¹, Lingfeng He², Todd R. Allen², Michele V. Manuel¹.

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During the fission process, uranium dioxide (UO_2) fuel material is irradiated, forming fission products. The addition of these fission products alters the path phonons travel in UO_2 , adversely altering the heat transfer properties of the fuel material and overall fuel performance. To improve performance, a deeper understanding of the role of insoluble fission products, such as xenon (Xe), during microstructural evolution is critical. In this investigation, atom probe tomography (APT) is combined with transmission electron microscopy (TEM) to provide insights into the segregation behavior of fission products. Connecting these techniques with computer simulations of fission product distribution provides a more complete understanding of fission product migration during use in the reactor. In this investigation, Xe-ion-irradiated cerium dioxide (CeO_2) was used as a surrogate for irradiated UO_2 . CeO_2 is a model material with properties similar to UO_2 such as lattice parameter, fluorite crystal structure, thermal conductivity, and irradiation behavior. Although each technique individually has limitations, greater insight into material behavior can be gained when pairing

experimental and computational techniques. This work will show the importance of combining correlative experimental and computational techniques to enhance the understanding of fission product behavior in nuclear fuel.

MECHANICAL ENGINEERING

Room 208

DESIGN OF NETWORKED SYSTEMS USING DISTRIBUTED DELAYS

Marcella M. Gomez, Richard M. Murray.

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The effect of delays in dynamics is understudied; correspondingly, current results for control of delayed systems are conservative and until now have been sufficient for the problems at hand. We believe a future need for extended work in systems with delays will arise in large-scale network systems due to the amount of information being processed and the potential for large distances between plants and controllers distributed through the span of a city for example. It is a difficult task in itself to design distributed or decentralized controllers for nondelayed systems. It would be beneficial to deal with delays in a decentralized fashion independent of controllers. Thus far, we have investigated methods of analyzing stability and performance of systems with multiple and stochastic delays for scalar systems. We have shown the potential stabilizing effects of adding delays in parallel to already delayed feedback systems using the Nyquist stability criterion. Furthermore, if delays are present, they are often not fixed, so we investigated stability of feedback systems with stochastically varying delays in discrete time. We arrived at a condition for point-wise asymptotic stability of these stochastic systems under the condition the delays are identically independently distributed at each time step. We explore how to extend and apply these results to the design of network systems with delays. Given the topology of a network system, we will investigate how to add the minimal number of edges to increase robustness, improve performance, and perhaps even achieve stability if the system is unstable.

Room 208

A PERIDYNAMIC MODEL OF DIFFUSIVE FLUID FLOW THROUGH A DEFORMABLE POROUS MEDIA

Jason York, John Foster.

University of Texas at San Antonio, San Antonio, TX.

There are several engineering problems, such as hydraulic fracturing and carbon-dioxide sequestration, in which cracks in a porous media are initiated and driven by high pressure fluid flow. In addition to the challenges involved in accurately modeling such fractures, classical continuum mechanics introduces a singularity at the crack tip, which has proven to be problematic in predicting nonplanar crack propagation. The peridynamic formulation of solid mechanics is a relatively new, nonlocal approach that is continuing to display its potential in modeling material failure. Recently, peridynamic theory has been applied to fields other than solid mechanics, such as heat transport and fluid flow. This work incorporates a nonlocal formulation of diffusive mass transport with the existing nonlocal formulation of solid mechanics. Preliminary results display the capability of modeling coupled, damage-induced flow and failure propagation in a reactive porous media. (Partially funded by NSF LSAMP-BD 1249284.)

HEALTH

MEDICINE (E.G., DENTISTRY, SURGERY, OPTOMETRY, VETERINARY)

Room 212B

LONG-TERM OUTCOME OF BRAIN STRUCTURE IN PRETERM INFANTS: EFFECTS OF LIBERAL VS. RESTRICTIVE TRANSFUSIONSAmanda Benavides, Peg Nopoulos.*University of Iowa, Iowa City, IA.*

Preterm infants are at risk for multiple morbidities, including motor, cognitive, and behavioral deficits. Investigation of long-term outcomes of brain structure in preterm infants who receive red blood cell transfusion in the neonatal period may increase understanding of the developing brain in association with anemia and its treatment. The objective of this study was to compare the brain structure of preterm females, at an average age of 13 years, who were randomized at birth to receive either a liberal or restrictive transfusion threshold for anemia of prematurity. This study was designed as a long-term follow-up supplemental study to the Iowa trial for anemia of prematurity. As neonates, participants were randomized to receive either a liberal or restrictive transfusion threshold. Quantitative structural magnetic resonance imaging scans for 44 of the original 100 subjects were obtained. Only the female infants of each transfusion group were included. Main outcome measures were volumes of multiple brain areas. General white-matter volumes were significantly decreased in females randomized to the liberal transfusion threshold, including total white and cerebral white volumes; total cerebral volume was also decreased in liberal females. Regional white matter volumes for all cerebral lobes were not different between the 2 transfusion groups though all measures were lower in the liberal group. White matter volumes, including total white and cerebral white, demonstrated significant negative correlations with average hematocrit levels. Decreased white matter volumes in females of the liberal transfusion threshold suggests adverse long-term neurodevelopmental outcomes in liberally transfused premature infants.

MATHEMATICS & STATISTICS

APPLIED MATHEMATICS

Room 214C

SEMIGROUPS OF MAPS AND HIGHER DIMENSIONAL PERIODIC DIFFERENCE EQUATIONS: AN APPLICATION TO A 2-STAGE POPULATION MODEL WITH MIGRATIONSelenne Garcia-Torres, Robert Sacker.*University of Southern California, Los Angeles, CA.*

We study a class of monotone mappings from \mathbb{R}^n to \mathbb{R}^n motivated by applications from population dynamics. Monotone maps have received much attention in the field of dynamical systems because of their applications to finding fixed points but have not been applied to the study of periodic systems in higher dimensions. We define monotonicity and concavity with respect to a cone and show that such a mapping satisfying certain conditions has a globally asymptotically stable fixed point. Moreover, this class of mappings forms a semigroup under composition. Thus, we are able to show that a periodic solution is obtained by finding the fixed point of the composition of the various maps. We apply this to a multidimensional, nonlinear discrete system that describes the dynamics of a 2-stage population model with migration. A structured population is one with consistent differences among the members of the population as a function of some attribute such as age, size, or physiological condition as they develop. Here, we partition the population by reproductive maturity. We take 2 such populations of the same species in adjacent locations and consider migration between the 2 locations. When constant breeding and migration are considered, we propose simple conditions under which the model has a unique globally attracting periodic state. These conditions are much

simpler than those given by other authors. We apply our theory to a generalized version of the model with a larger number of patches and a periodically varying environment and under different, but still simple, conditions, reach the same conclusion.

Room 214C

MODELING THE EFFECTS OF THE INTRODUCTION OF A UNIVERSAL VACCINE FOR INFLUENZA

Jorge A. Alfaro-Murillo¹, David Durham², Zhilan Feng¹, Alison Galvani², Carlos Castillo-Chavez³.

¹Purdue University, West Lafayette, IN, ²School of Public Health, Yale University, New Haven, CT, ³Computational and Modeling Sciences Center, Arizona State University, Tempe, AZ.

Influenza represents a high burden for the population worldwide; annual epidemics produce up to 5 million cases of severe illness, and cause between 250 to 500 thousand deaths per year. Vaccines against flu are produced every year and are considered the best way to prevent or reduce the chances of infection. Nevertheless, the influenza virus is constantly mutating, and current vaccines only offer partial protection against the disease or no protection at all in the case of a pandemic. Yet, the picture for the future is encouraging. Several novel approaches are on the way to develop an influenza vaccine that offers long-term protection for several years against any strain of influenza. In this study we develop a model, in which 2 types of vaccines are available: seasonal and universal, for the dynamics of influenza during several seasons. Our model assumes that individuals may obtain different levels of immunity from the seasonal or universal vaccines, or from an infection, and that the immunity wanes at different rates in each case. The strain that the population confronts changes each year and is determined with a stochastic parameter that also accounts for the possibility of the appearance of a completely new strain. Finally, we provide a cost-effectiveness analysis of several strategies of vaccination. The outcomes of this study could help public health authorities design optimal vaccination strategies when the universal flu vaccine becomes available.

Room 214C

AN EXACT SOLUTION FORMULA FOR THE KADOMTSEV-PETVIASHVILI EQUATION

Alicia Machuca, Tuncay Aktosun.

University of Texas at Arlington, Arlington, TX.

The study of integrable nonlinear partial differential equations (NPDEs) is interesting to mathematicians, engineers, and physicists because they have physically important solutions that can be expressed in terms of elementary functions. In general, NPDEs do not yield exact solutions and are solved using numerical methods. The goal of this research is to find nontrivial explicit solutions to an integrable NPDE, the Kadomtsev-Petviashvili equation, expressed in terms of elementary functions. Taking advantage of the well-known inverse scattering theory for NPDEs of one spatial dimension and one temporal dimension, we have been able to extend the theory to an NPDE with more than 1 spatial dimension. A study of the associated Marchenko integral equation reveals an explicit formula of exact solutions in terms of matrix exponentials. This systematic method is generalizable to integrable NPDEs with an associated Marchenko integral equation and produces exact solutions dependent on a quadruplet of constant matrices.

Room 214C

MODELING DNA UNKNOTTING BY XERCD-FTSK ENZYMES USING THE TANGLE METHOD

Crista Moreno, Mariel Vazquez.

San Francisco State University, San Francisco, CA.

Simplifying the topology of DNA is vital to the health of a cell. Knotted and linked DNA causes complications during DNA replication and transcription. DNA topology simplification is usually mediated by enzymes. Research on the unknotting of DNA by enzymes, like topoisomerases, has led to the development of anticancer drugs. In *Escherichia coli*, in the absence of the topoisomerase IV, the XerCD-FtsK complex has been found to effectively unlink replication links. By observing changes in DNA topology (knotting and linking) we can characterize the local enzymatic action through the use of knot theory and tangle calculus. The tangle method models the enzyme together with the bound DNA as a tangle. A tangle is a 3-dimensional ball with 2 arcs which intertwine in nontrivial ways. Given the observed knot types of the DNA substrates and products, the tangle method constructs a system of tangle equations. One of these tangles represents the region of DNA bound to the enzyme and another tangle represents the action of the enzyme. Using tangle calculus we can solve for the unknown tangles. We aim to incorporate new results in tangle theory into the tangle method and its computer implementation TangleSolve. Then, we will use these tools to study DNA unknotting by XerCD-FtsK. We will give an overview of both the mathematical and computational methods used in the analysis of XerCD-FtsK.

Room 214C

RESONANT SPATIAL INSTABILITY AND NONLINEAR WAVE INTERACTIONS IN ELECTRICALLY FORCED JETS

Saulo Orizaga¹, Daniel N. Riahi², L. Steven Hou¹.

¹*Iowa State University, Ames, IA*, ²*University of Texas-Pan American, Edinburg, TX*.

We investigate the problem of linear spatial instability of the modes that satisfy the dyad resonance conditions and the associated nonlinear wave interactions in jets driven by either a constant or a variable external electric field. A mathematical model based on the governing equations of electro-hydrodynamics, which is developed and used for the spatially growing modes with resonance and their nonlinear wave interactions in electrically driven jet flows, leads to equations for the unknown amplitudes of such waves. These equations are solved for both a water-glycerol mixture and glycerol jet cases, and the expressions for the dependent variables of the corresponding modes are determined. The results of the generated data for these dependent variables versus spatial direction indicate, in particular, that the instability that is generated by the nonlinear wave interactions of such modes is mostly of amplifying effect. The energy exchanged during the interaction is very strong and for most cases the domain of the dependent variables was significantly reduced. The amplified instability was also found to provide a significant reduction in the jet radius, which is a favorable result for practical applications.

Room 205

CONTROLLABILITY AND REGULARITY OF SOME 1-DIMENSIONAL THERMAL SYSTEMS WITH INTERNAL POINT MASSES

Jose de Jesus Martinez, Scott W Hansen.

Iowa State, Ames, IA.

We investigate the controllability and regularity of coupled systems of partial differential equations describing heat flow across interior point masses. First, we describe a possible model for heat flow between 2 chambers divided by a thin wall that acts as a thermal barrier between them. In the idealized 1-dimensional model, 2 heat equations on respective domains $(-a, 0)$ and $(0, b)$ are coupled through a differential equation that describes the temperature of the thermal barrier at $x = 0$. For this system, we show that by controlling the temperature at one end, for any $T > 0$, any initial state can be controlled to the zero temperature state in time T . Our approach is based on the moment method. Then, we consider other possible models. For example, we consider the case in which there is more than one thin wall acting as a thermal barrier. Results about controllability and regularity are then discussed.

OTHER MATHEMATICS

Room 205

A FIRST MATHEMATICAL MODEL FOR THE DYNAMICS OF SOLUBLE REACTIVE PHOSPHORUS IN LAGUNA CARTAGENA USING ORDINARY DIFFERENTIAL EQUATIONS AND SOFTWARE STELLA (V8)

Brenda C. Torres-Velasquez, Yashira Sánchez-Colón, Marlio Paredes-Gutiérrez, Fred Schaffner.

Universidad del Turabo, Gurabo, PR.

Laguna Cartagena (LC) is a tropical freshwater wetland located in southwestern Puerto Rico and impacted by unnaturally high nutrient loading, particularly phosphorus, since the latter half of the 20th century. Eutrophication leads to excessive plant productivity that contributes to wildlife habitat degradation and enhanced greenhouse gas (methane) emissions. The main objectives of the research project were to develop a mathematical model to reproduce the dynamics of phosphorus inside Laguna Cartagena and to predict future behavior of soluble, reactive phosphorous (SRP) using the model developed. A first step in this analysis was the documentation of phosphorous dynamics within the lagoon using field and laboratory data. The primary variable is SRP concentration taken from samples of water entering and exiting LC at its inlet and outlet points and at 3 locations in the western, eastern, and center sectors of the lagoon. Samples for all 5 sites were collected in triplicate on 18 occasions from August 2010 to September 2011. STELLA (v8) was used to model SRP dynamics based on the net amount of SRP ($\mu\text{g/L}$) in the system. An ordinary differential equations system (ODES) was developed and solved. Simulations were run for $n = 17, 50$, and 100 days. The ODES solution was the logistic function with estimated parameters $M = 16.78 \text{ g/L}$ and $r = -0.15$. Results show that SRP flow going in and out of Laguna Cartagena occurs in cycles. Even in periods when SRP concentrations at the inlet canal are less than SRP concentrations at the outlet canal, Laguna Cartagena's SRP stock concentrations increase over time.

STATISTICS

Room 205

THE OBJECTIVE AND ROBUST BAYESIAN STUDENT T TEST

Israel Almodovar-Rivera¹, Luis Pericchi².

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Over 100 years has passed since the development of one of the most fundamental tests in statistics: the Student t-test. Subjective Bayesian approaches for the Student t-test are common, while objective Bayesian procedures are still needed. In this research, we argue that the Bayesian t-test, based on conjugate priors, is inconsistent and strongly subjective. We propose objective procedures that are consistent: Bayesian information criterion (BIC), Zellner and Siow's conventional approach, modified Jeffreys' prior, intrinsic priors, and Berger robust priors (referred to here as robust priors). We test this procedure in the case of strongly unbalanced samples. Classifying two sets of Bayes factors, BIC and Zellner and Siow, depends on the t-statistics and the sample size n . Jeffreys' prior, intrinsic, conjugate, and robust approaches depend on the t-statistics, n and the term $n_0 = n_1 n_2 / (n_1 + n_2)$. We argue that the second set of Bayes factors are better suited for unbalanced problems, acknowledging that the conjugate Bayes factor has problems of its own. Jeffreys, intrinsic, and robust Bayes factors all have the same qualitative behavior and are close to each other for moderate to large sample sizes. For small sample sizes, the robust Bayes factor has the edge because it is the only one that is in closed form. Choosing the right version of objective Bayes factor is critical for scientists and will allow them to use them in a more efficient and frequent way.

Room 205

DEVELOPING AN ESTIMATOR FOR FISHERY WITHDRAWALS BY THE FOR-HIRE RECREATIONAL SECTOR IN THE GULF OF MEXICO

Vianey Leos Barajas, Mark Kaiser.

Iowa State University, Ames, IA.

The Gulf of Mexico supports the largest recreational fisheries in the country in terms of economic value, total effort, and contributions to total fisheries removals. In 2006, the National Research Council recognized that, in the Gulf of Mexico, the magnitude of the for-hire sector and the potential scale for fishery removals warrant the use of mandatory logbooks as the source of catch and effort data. We developed an estimator $\tau = N\kappa\Psi$, where N represents total trips taken, κ is the expected effort per trip, and Ψ is the expected catch per unit effort, for estimation of total catch during any given time period, as long as there is sufficient fishing activity. Effort is defined as the fishing hours multiplied by the number of anglers per trip, and catch is one of four types of fishery removals: harvest, release < 120 ft, release > 120 ft, and mortality. We take a Bayesian approach to the estimation of τ by obtaining a posterior distribution via a combination of direct sampling from known distributions and Markov chain Monte Carlo methods. Through this approach, uncertainty is automatically captured in the quantiles of the posterior distribution. Red snapper data is used to demonstrate the uses of the estimator τ and the usefulness of logbook report data when compared to data obtained through more expensive sampling methods.

PHYSICAL SCIENCES

ATMOSPHERIC SCIENCES/METEOROLOGY

Room 213B

AEROSOL DISCRIMINATION THROUGH THE POLARIZATION OF SCATTERED LIGHTPatricio Piedra, Patrick Hamill.*San Jose State University, San Jose, CA.*

Despite considerable efforts by many atmospheric scientists, distinguishing between types of aerosols in Earth's atmosphere is still a big issue. Current techniques for aerosol discrimination through light scattering are based on statistical clustering by optical characteristics. These methodologies often depend on the geographic location of the observations. For example, aerosols with optical characteristics similar to those of Mexico City are grouped into aerosols of type urban-industrial. In contrast, the degree of linear polarization (DLP) is extremely sensitive to the particular characteristics of the scattered particle and constitutes a more accurate method. Hansen, who used DLP to determine the characteristics of the particles of the atmosphere of Venus in 1973, demonstrated this fact. With this motivation, a similar theoretical analysis is being attempted to identify the physical characteristics of Earth's aerosols. The study focuses on inferring the DLP as a function of the angle of scattering for aerosols interacting with sunlight. A computer program has been developed and performs Mie scattering calculations to determine the parallel and perpendicular components of the electric field of scattered light. In addition, the program allows for any continuous particle size distribution and outputs the DLP as a function of the angle of scattering. The relationship between the DLP and the angle of scattering is distinctive for each particle size distribution and effective size parameter. The implementation of linear polarization methods allows the identification of aerosol types. The DLP method establishes the particle size distribution and index of refraction as the main physical basis for discrimination between aerosols.

CHEMISTRY (EXCEPT BIOCHEMISTRY)

Room 206A

ARTIFICIAL PHOTOSYNTHESIS SYSTEM FOR WATER OXIDATION BASED ON ETS-SUPPORTED COBALT CLUSTERSJoselyn Del Pilar-Albaladejo, Prabir Dutta.*Ohio State University, Columbus, OH.*

Solar-driven, artificial photosynthetic systems promise to be a viable alternative for H₂ production as fuel. Three elements are essential for artificial photosynthetic systems: membrane, photosensitizer, and catalyst. In our current work, we have successfully created zeolite-supported cobalt clusters of 200 nm for water oxidation, which is known to be the most challenging reaction in water splitting. Oxygen evolution was tested in the presence of photochemically generated Ru(bpy)₃³⁺ at pH 6. Organic photosensitizers for light harvesting, such as Ru(bpy)₃³⁺, are susceptible to degradation, and this presents a major drawback for artificial photosynthetic systems. ETS-10 is a microporous titanasilicate that contains O-Ti-O-Ti- chains surround by insulating SiO₂ layers that allow quantum confinement of electrons and holes, which leads to interesting optical properties. As zeolites, they also have ion-exchanging properties and are thermally stable, which makes them ideal for catalyst deposition. ETS-10 has a band gap of 4.03 eV that can be moved to lower energies by partial substitution of oxygen by nitrogen. The tunable optical properties of ETS-10 make it an ideal material for solar light harvesting and charge transport. We propose to couple the cobalt clusters with nitrated ETS-10 and examine their water oxidation properties using silver ions as electron acceptors. Eventually, the goal is to assemble a visible-light absorbing ETS-10 membrane that allows light harvesting and charge separation with the opposite sides of the membrane hosting water oxidation (cobalt based) and reduction (initially Pt) catalysts for water splitting.

Room 217A

ELECTROCHEMICAL DNA-BASED SENSORS FOR ATP MONITORING IN THE BRAINMelissa E Davila Morris, Samiullah Wagan, James Taylor, Ryan White.*University of Maryland, College Park, MD.*

Recent studies have demonstrated that nonneuronal cells in the brain, or glial cells, play a much more active role in central nervous system function than was previously thought. For example, recent reports demonstrate that dynamic interactions between astrocytes (a type of glia) and neurons play a crucial role in dendritic formation and the development of abnormalities in the developmental disorder known as fragile-X syndrome. Astrocytes achieve this through the release of specific chemical messengers known as gliotransmitters. In this study, we developed an electrochemical, aptamer-based (E-AB) sensor to monitor adenosine triphosphate (ATP), a known gliotransmitter. E-AB sensors are specific, selective, and sensitive. They are capable of detecting target analytes even in the most challenging complex matrices (e.g., cerebral spinal fluid). The ATP E-AB sensor comprises an electrode-bound DNA aptamer that specifically binds ATP and is modified at the distal end with a redox marker for electrochemical interrogation. Here we demonstrate the fabrication and characterization of these sensors as microcylinder electrodes (50 μm diameter) suitable for monitoring in real time the release of ATP directly in the brain.

Room 206A

A NOVEL MODULAR SCAFFOLD FOR CYSTEINE-DERIVED LIPID ANALOGUES AS TISSUE TARGETING LIGANDS IN LIPOSOME FORMULATIONSMagaly Salinas¹, Idaira Hueso-Falcon², Adelphé Mfuh¹, Shaunak Pandya¹, C. Mauli Agrawal¹, George R. Negrete¹.¹*University of Texas at San Antonio, San Antonio, TX*, ²*Instituto Universitario de Bio-Organica Antonio González, Universidad de La Laguna, Tenerife, ES.*

Lipopeptides are biologically active compounds that constitute a promising family for future antibiotics and as anchored ligands for directing liposomes to target tissues. A novel class of lipid analogues was developed from L-cysteine via cyclocondensation with *m*-nitrobenzaldehyde and acylation with acryloyl chloride yielding a trifunctionalized thiazolidine core with carboxylic acid, aryl nitro, and acryloyl substituents. The core can be used to generate an array of compounds in a highly modular process with hydrophobic units, ligand units for binding to target tissues, and fluorophores for binding and localization studies. The fatty component of the cysteine-derived lipid analogue (CLA) is appended via conjugate addition of thiol analogues to the acrylamide functionality of the core. The amino terminus of a linker is connected at the carboxylate end of the thiazolidine via carbodiimide coupling chemistry. Subsequently, a peptide ligand is coupled to the carboxylate end of the attached linker. Reduction of the aryl nitro group to the corresponding amine allows the attachment of a fluorophore for diagnostic techniques. We will demonstrate the use of these novel targeting CLAs in various liposomal formulations to improve drug delivery and binding affinity for $\alpha_v\beta_3$ integrin receptors that are over-expressed on human cancer cells. (Partially funded by NIGMS MBRS-RISE GM060655.)

Room 206A

SYNTHESIS OF AG PD/PT CORE-SHELL MULTIPLY TWINNED NANOPARTICLES AND THEIR ATOMIC RESOLUTION IMAGING BY USING CS-CORRECTED SCANNING TRANSMISSION ELECTRON MICROSCOPYSubarna Khanal, Nabraj Bhattarai, J.Jesus Velazquez-Salazar, Daniel Bahena, Arturo Ponce, Miguel Yacamán.*University of Texas at San Antonio, San Antonio, TX.*

The synthesis of noble metal (e.g., Pd, Pt, Au, and Ag) nanoparticles with controlled atomic distributions has attracted significant interest due to their size-tunable properties, which depend on the variation of composition and structure. Recently, multimetallic nanoparticles have attracted extensive research attention because of their diverse potential applications as compared to monometallic nanoparticles. Controlling the morphology of nanostructures can provide a great opportunity to stimulate their possible applications by tuning their catalytic, electronic, and optical properties and enhancing their reactivity, selectivity, and stability. AgPd/Pt core-shell trimetallic nanocrystals with multiply twinned structures, possessing an icosahedral morphology with a high density of compressed twins and a high fraction of Pt atoms on the (111) surfaces are expected to be the most active catalysts with many applications in fuel cells. In this work, we have successfully synthesized AgPd/Pt core-shell multiply twinned particles with icosahedral morphology. Cs-corrected scanning transmission electron microscopy in combination with high angle annular dark field (HAADF), bright field (BF) and energy dispersive X-ray spectroscopy (EDS) detectors allowed us to probe the structure of these nanoparticles at the atomic level revealing the core and the shell regions. The core is AgPd alloy, and the shell is Pt.

Moreover, the line profile of the EDS analysis reveals the elemental composition of these nanostructures and confirms the structures are core-shell, which is expected to be the most active catalysts.

Room 214B

ISOMERASE ACTIVITY OF *CANDIDA RUGOSA* LIPASE IN CONVERSION OF RACEMIC PROFENS TO (S)-PROFENS

Saideh Mortazavi, James Salvador.

University of Texas at El Paso, El Paso, TX.

Profens are sold as racemic mixtures where the (S)-enantiomer has the desired effect and the (R)-enantiomer may have harmful side effects. Thus the efficacy of profens can be improved and side effects reduced by isolating (S)-profen as opposed to consuming its racemic mixture. We propose a new method to convert racemic profens to (S)-profens using inexpensive chemicals and enzymatic methods, whereas previous methods wasted the undesired (R)-profens. The *Candida rugosa* lipase (CRL)-catalyzed dynamic kinetic resolution (DKR) of ibuprofen methyl ester (IME) was optimized to convert racemic ibuprofen to (S)-ibuprofen in 3 days. The best concentration of various buffers for these reactions was found to be 0.5 M at pH 7.6. The commercial lipase mixture was found to be acidic due to the lowered pH on the enzyme addition to the reaction flask. Dimethylformamide (DMF) was determined to be a better cosolvent than dimethylsulfoxide (DMSO) as it maintained the reaction pH, with evidence of the latter functioning as an oxidizing agent because of the lowered reaction pH. Lower concentrations of IME and higher stirring rates both led to faster conversions. The minimal amount of lipase needed was determined to be 20 mg/ml buffer, facilitating a much easier workup. Attempts to racemize the (R)-ibuprofen methyl ester with the same reaction conditions as DKR, excluding CRL, led to no racemization, which indicates that enolization and racemization of (R)-IME is catalyzed by CRL enzyme. To our knowledge, no one has reported that the enolization is enzymatic and not purely chemical.

Room 206A

PROFILING ENOXAPARIN SEC FRACTIONS BY PROBING FOR 3-O-SULFO OLIGOSACCHARIDES USING [1H, 15N] HSQC NMR

Consuelo N. Beecher, Derek J. Langeslay, Kemal Solakyildirim, Cynthia K. Larive.

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Heparin is an unbranched, microheterogeneous, anionic polysaccharide comprised of repeating uronic acid-glucosamine disaccharides. Microheterogeneity is introduced during biosynthesis as various patterns of sulfation and uronic acid epimerization. Heparin is used pharmaceutically as an anticoagulant acting through binding of a specific pentasaccharide sequence to the protease inhibitor, antithrombin III (AT-III). An important structural component of this pentasaccharide is the 3-O-sulfated internal glucosamine residue. Deletion of this 3-O-sulfo group reduces affinity to AT-III by 1000-fold. Study of the role of heparin's microstructure in specific protein binding requires isolation and structural characterization of well-defined oligosaccharides. Heparin is depolymerized to generate oligosaccharides of various lengths, which are then separated by size exclusion chromatography (SEC). Typically, the size-uniform fractions obtained by SEC are pooled and separated further by strong anion exchange high performance liquid chromatography (SAX-HPLC). However, it has been demonstrated that the composition of the SEC fractions varies along the size-uniform peak. It is possible that by pooling these fractions, important and rare 3-O-sulfated oligosaccharides are diluted by more abundant oligosaccharides, obscuring their identity in the SAX-HPLC chromatogram. Recent advances in characterizing the structural properties of heparin using [¹H, ¹⁵N] HSQC NMR spectra allow us to probe individual SEC fractions for the presence of 3-O-sulfated *N*-sulfoglucosamine residues and focus our workflow around these samples. This work will demonstrate the use of [¹H, ¹⁵N]HSQC spectra to efficiently identify those SEC fractions containing the rare 3-O-sulfo group, resulting in better resolution SAX-HPLC separations and higher recovery of isolated oligosaccharides for future structural characterization and protein-binding experiments.

EARTH SCIENCES/OTHER PHYSICAL SCIENCES

Room 206B

EFFECTS OF NITROGEN FERTILIZER ON SOIL ORGANIC MATTER POOLS UNDER SWITCHGRASS AGRICULTURE

Zachary Valdez¹, Bill Hockaday², Morgan Gallagher³, Carrie Masiello⁴.

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The cropping of switchgrass (*Panicum virgatum*) for biomass shows potential for high yields in marginal lands with low fertilizer inputs, while the extensive root system can act to improve soil quality and sequester atmospheric carbon dioxide in the soil carbon pool. We are investigating the impact of nitrogen fertilizer inputs on soil organic matter quantity and quality in a biofuels cropping trial in Michigan. Here we test the hypothesis that fertilizer application rate can affect the partitioning of organic matter into different storage pools within the soil: roots, particulate organic matter (density <1.8 g/cm³), and protected organic matter (density > 1.8 g/cm³). Additionally, we use ¹³C nuclear magnetic resonance (NMR) spectroscopy to study the bulk chemistry (carbohydrate, lignin, lipid, and protein) of the roots and particulate soil organic matter. The NMR data also allow us to estimate the relative decomposition of the soil organic matter using a standard decomposition index (alkyl/O-alkyl peak ratio). We use these data to infer the influence of fertilizer management on the mechanisms of soil C storage and decomposition in switchgrass agriculture.

OTHER GEOLOGICAL SCIENCES

Room 206B

DARK ORGANIC MATTER IN PERMANENTLY SHADOWED CRATERS ON MERCURY

Ellen Harju¹, David Paige¹, Matt Sieglar², Mona Delitsky³.

¹*University of California, Los Angeles, Los Angeles, CA*, ²*Jet Propulsion Laboratory, Pasadena, CA*, ³*California Specialty Engineering, Flintridge, CA*.

Data from the Mercury Laser Altimeter (MLA) and neutron spectrometer aboard the MESSENGER spacecraft currently orbiting Mercury have confirmed the presence of water ice in permanently shadowed craters in the north polar region of Mercury. Additional reflectivity data from the MLA shows the existence of an additional low-albedo phase associated with the ice, which is not consistent with Mercury soil or water ice. The purpose of this project was to determine if this dark layer could be an organic-rich layer similar to low albedo materials found on comets, asteroids, meteorites, and other solar system objects. Simple organic molecules (such as methane) are delivered to Mercury by cometary impacts. Although temperatures in the equatorial region of Mercury are too high to retain these organics, they can migrate to the polar region and become cold trapped in permanently shadowed craters with temperatures of approximately 100 K. Mercury has magnetic field lines which concentrate solar wind plasma in the north polar region. Laboratory experiments have shown that, when simple organic molecules are subjected to ultra violet and ion radiation, dehydrogenation can occur, resulting in the loss of molecular hydrogen. This leads to polymerization of the remaining carbon-rich species and the formation of amorphous macromolecular carbonaceous compounds. This process may continue until low-albedo elemental carbon is produced. Based on this evidence, we find that the low-albedo material found in the permanently shadowed craters on Mercury is most likely radiation processed carbon-rich material.

PHYSICS (EXCEPT BIOPHYSICS)

Room 212A

ANALYSIS OF TROPOSPHERIC AEROSOL PROPERTIES USING AERONET AND CALIPSO DATA

Araceli Lopez-Garibay, Patrick Hamill.

San Jose State University, San Jose, CA.

During the last few years, it has become evident that aerosols play an important role in Earth's climate. Consequently, it is important to be able to identify aerosols using instruments in satellites. We use the CALIPSO satellite aerosol data and compare those results with measurements made by AERONET. The CALIPSO instrument is a down-looking

lidar which determines the backscattered laser light from aerosols near the surface. AERONET is a worldwide network of sun photometers that also measures aerosols near the surface, but from the ground. Finding coincidences in location and time between the CALIPSO data and the AERONET data allow us to compare these 2 measurements. Since the type of aerosol observed by AERONET can be determined by methods which we will describe, we can then determine the type of aerosol measured by CALIPSO. We will present tables showing aerosol properties at coincidences as a function of date, time, and location at particular wavelengths (440 nm, 500 nm, 532 nm). We have also generated plots that present altitude vs. extinction (scattering and absorption of solar radiation) of the aerosols in the atmosphere. Moreover, we produced plots that present altitude vs. relative humidity of the marine aerosols in the atmosphere for specific locations such as Lanai. The relative humidity is necessary to determine the index of refraction of the particles. The CALIPSO and AERONET datasets of optical depths at those locations, dates, and times are compared. We will present results showing agreement or discrepancy in the measurements made by the 2 instruments.

Room 212A

HIGH-EFFICIENCY HYBRID SILICON NANOPILLARS-POLYMER SOLAR CELLS

Pushpa Raj Pudasaini, David Elam, Arturo A Ayon.

University of Texas at San Antonio, San Antonio, TX.

Recently, inorganic/organic hybrid solar cells have been studied for low-cost photovoltaic devices because the Schottky junction between inorganic and organic material can be formed by a low-temperature, solution-processable method. We present an efficient hybrid solar cell based on highly ordered silicon nanopillars (SiNPs) and poly (3,4-ethylene-dioxythiophene):polystyrenesulfonate (PEDOT:PSS). The proposed device is formed by spin coating the organic polymer PEDOT:PSS on SiNPs array fabricated by a metal-assisted electroless chemical etching process. The characteristic of the hybrid solar cells are investigated as a function of SiNP heights. A maximum power conversion efficiency (PCE) of 9.65% has been achieved for an optimized SiNPs arrays hybrid solar cell with nanopillar height 400 nm, despite a 12% shadowing loss and the absence of an antireflection coating and the back surface field enhancement. The effect of ultra-thin atomic layer deposition (ALD), grown aluminum oxide (Al_2O_3), as a junction passivation layer has also been studied for the enhanced electrical performance of the device. With the inclusion of the ultra-thin ALD-deposited Al_2O_3 as a interfacial layer between SiNPs array textured surface and PEDOT:PSS layer, the PCE of the fabricated device is increased to 10.92%, which is ~13% greater than the corresponding device without Al_2O_3 layer. The proposed device is promising toward realizing low-cost and high-efficiency inorganic/organic hybrid solar cells.

PSYCHOLOGY & SOCIAL SCIENCES

ANTHROPOLOGY/ARCHEOLOGY

EXPERIMENTAL PSYCHOLOGY

Room 207B

THAT'LL TAKE THEM DOWN A PEG: PERCEIVING HYPOCRISY WHEN THREATENED BY OTHERS

Willie Hale Jr., David Pillow.

University of Texas at San Antonio, San Antonio, TX.

Fiske, in 2002, proposed 5 core social motives (belongingness, understanding, control, self enhancement, and trust) that ostensibly serve to enhance people's survival within groups. We contend that, when these needs are threatened, individuals mitigate said threat by looking for evidence of hypocrisy from the threat's source, simultaneously denigrating or discounting the source while also bolstering and reaffirming their self-concept. Participants considered episodic memories of others' hypocritical behavior and answered items assessing the degree to which the hypocrite's violation of Fiske's five core social needs influenced their perceptions of hypocrisy. A 5-factor model emerged from these items, mirroring Fiske's model. Participants were clustered into groups based on which motive's items exhibited the highest mean rating for that group. Within each group, the items on the highest rated motive were significantly higher than those on each other motive. Additionally, within each group, only the highest rated motive predicted subjective perceptions of hypocrisy, providing evidence that violations of each core social motive uniquely prompted individuals to see hypocrisy in others' behavior. Defensive denigration of those who threaten one's core social needs via identifying hypocrisy is one of many mechanisms that likely evolved to help individuals maintain their place within their social groups. Each core social motive, when violated, provides the impetus for individuals to selectively interpret the behavior of others as hypocritical. (Partially funded by NIGMS MBRS-RISE GM060655.)

LINGUISTICS

Room 207B

AMBIGUITY RESOLUTION: TO BE OR NOT TO BE, THAT IS THE MEANING

Wualú Altamira, Roberto Heredia.

Texas A&M International University, Laredo, TX.

Interlingual homographs are words across languages with competing semantic and overlapping orthographic representations (e.g., CASES = LAW in English and MARRIAGE in Spanish), while cognates are words across languages with equal or similar semantic and orthographic representations (e.g., HOSPITAL). Experiments 1 and 2 explore context effects in reading interlingual homographs and cognates embedded in English sentences. Experiment 3 investigates interlingual homographs embedded in Spanish and bilingual (Spanish/English) sentences. All three experiments address the issue of bilingual lexical access and whether homographs/cognates are activated selectively (i.e., only one meaning is activated) or non-selectively (i.e., both meanings are activated simultaneously). Using the Grammaticality Maze Task, bilinguals read contextually biased English monolingual sentences (experiment 1) as well as contextually unbiased Spanish monolingual sentences or bilingual sentences where the critical target (homograph/control) followed a conjunctive/adverbial modifier in Spanish/English joining two sentences (experiment 3). The Language Maze Task was used for experiment 2 in which bilinguals read English sentences. The preceding contextual information was either high or low towards the English meaning of the critical target (i.e., homographs, cognates, controls). Participants made lexical decisions to word-nonword pairs (e.g., butter vs. reck), and at the same time they had to integrate and understand the presented sentences. Overall, the results were suggestive of non-selectivity, in which control targets were actually faster than the critical homographs (i.e., lexical competition). The results are interpreted in terms of bilingual lexical access models.

OTHER SOCIAL SCIENCES

SOCIAL PSYCHOLOGY

Room 207B

THE RELATIONSHIP BETWEEN INTRINSIC/EXTRINSIC ACADEMIC MOTIVATION AND BURNOUT IN HISPANIC UNDERGRADUATE COLLEGE STUDENTS: A COMPARISON ACROSS CLASSIFICATION

Rebecka English, Monica Munoz.

Texas A&M International University, Laredo, TX.

Burnout is a psychological syndrome based on one's relationship with work, which consists of overwhelming exhaustion, feelings of cynicism and detachment, and a sense of ineffectiveness on the job. Although limited in number, past research studies have suggested fairly high levels of burnout among the general college student population. What is not clear from past studies is whether there are times during a student's college career when burnout is more pronounced, and, given the homogenous nature of past samples, whether ethnic differences exist in the experience of burnout among college students. The current research is aimed at addressing these issues by investigating whether the self-reported experience of burnout differs by classification, transfer status, and ethnic identity in a predominantly Hispanic sample. An additional goal for this study is to explore how well self-reported academic motivational orientation (intrinsic vs. extrinsic) predicts burnout in this sample. Volunteers from the undergraduate student population at Texas A&M International University will complete self-report measures of burnout, academic motivational orientation, ethnic identity, and relevant demographic information. Students who are near the end of their current classification will be asked to complete the same survey once more during the following semester to assess any shift in their responses. Multiple regression analyses will assess the relationships between motivational orientation, ethnic identity, and burnout. Additional analyses will include analysis of variance to assess group differences. Through this, interventions could be developed to reduce the effects of burnout and increase college retention.

TRADITIONAL ECOLOGICAL KNOWLEDGE

Room 214A

CAN CULTURALLY BASED EDUCATION BE INTERMIXED WITH COMPUTING SCIENCES AND INCREASE STUDENT PERFORMANCE

Calvin Pohawpatchoko, Clayton Lewis.

University of Colorado, Boulder, Boulder CO.

It is believed that culturally based education holds an answer to improving student performance, and studies have shown its power. However, can culturally based education be integrated with computing science to improve student performance and bring about a better understanding of historical influences on indigenous identity? This workshop provides a framework built on culturally based education principles. We integrate computing science in a holistic approach for building 21st century skills, understanding historical influence by addressing student's educational needs in an integrated way that opens interest in the power of indigenous computing. This work will help build future intellectual capital to help Native Nations advance in education and sciences in a manner that is culturally appropriate.

Room 214A

TRANSFORMING NATIVE AMERICAN YOUTHS' PERCEPTION OF GEOSCIENCE THROUGH A CONNECTION TO CULTURE, NATURE, AND COMMUNITY

Jamie Ricci¹, Eric Riggs¹, Sara Unsworth².

¹Texas A&M University, College Station, TX, ²University of California, San Diego, La Jolla, CA.

The importance of diverse perspectives in the geosciences has precipitated an active movement to find inclusive educational practices. As Indigenous people and geoscientists increasingly interact, it has become imperative that each gain fluency in both Indigenous knowledge and Western earth sciences. However, few earth science programs consider the cultural milieu from which students approach their studies. Sharing the Land (StL), a program for Native American youth in California, considers geoscience education from a culturally appropriate perspective. Throughout the program, the youth take part in activities that cultivate an understanding of geology, environmental science, and current geoscience issues by embedding each activity in local culture. Activities are guided by members of local Native American communities, professors, and students from various universities, and specialists in certain fields. StL

has been shown to be effective in transforming youths' perceptions of themselves and their culture through science. The aim of this research is to determine which components of StL contribute to this shift. To accomplish this, a series of presurveys and postsurveys are used to explore the youths' relationship with their culture, perception of their future identity, and connections with other people. Three to 4 youth are chosen from each program to participate in semistructured interviews, once before the program began and twice after. By understanding how StL is effective, we may be able to foster similar programs or classroom applications, thereby increasing Native American youths' interest and literacy in science.

Room 214A

INTEGRATING TRADITIONAL ECOLOGICAL KNOWLEDGE INTO MAINSTREAM SCIENCE AND POLICY: INTERNATIONAL HUMAN RIGHTS CONSIDERATIONS

Cynthia Boshell.

University of Tulsa College of Law, Tulsa OK.

Once viewed as folklore by mainstream science practitioners, traditional ecological knowledge (TEK) is increasingly heralded as a key for human populations to adapt and survive in a changing climate, as an alternative frontier of discovery for science research, or as a policy answer to federal land management consultation requirements with Indian Tribes. Such utilitarian approaches to TEK would extract deeply rooted intellectual knowledge from its customary keepers, who are responsible for stewardship of their traditional homelands and attempt to merge TEK into mainstream resource-management programs. This policy-oriented legal research project addresses evolving international human rights dimensions of integrating TEK with science and policy, and proposes alternative approaches for resolving the inevitable conflicts that arise when value systems collide.

Room 214A

POSOH-THE SUSTAINABILITY LEADERSHIP COHORT

Laundi Keepsesagle, Kate Flick.

College of Menominee Nation, Keshena, WI.

POSOH (meaning hello in the Menominee language) is a partnership of University of Wisconsin-Madison researchers, the College of Menominee Nation's Sustainable Development Institute (SDI), and educators in northern Wisconsin. This partnership and project is funded by a \$4.7 million grant from the US Department of Agriculture. The multicultural education model of POSOH will embrace learning both traditional (from Native American collaborators) and scientific ways of understanding sustainability. The goal is to ignite interest and broaden understanding in sustainability through STEM. POSOH's mission is to develop strategies for preparing all learners, including typically underserved youth from nonmainstream cultures and to pursue bioenergy- and sustainability-related studies and careers. This is to be accomplished while simultaneously exploring the contributions of traditional and scientific ways of knowing to our understanding of ecosystems and sustainability. In partnership with POSOH, SDI introduces the Sustainability Leadership Cohort (SLC) to train the next generation of community leaders, especially those of indigenous heritage on or near the Menominee Reservation. The SLC aims to maintain cultural values and encourage holistic thinking. The SLC provides a hands-on non-lecture style environment including trips to other Tribal Nations, film productions, science research retreats, and homework assignments that promote critical thinking and leadership skills. The students will be involved in this new, innovative program from early spring 2013 until late fall 2013. The goal is to empower students so they may one day serve as leaders and change agents in an era of climate change. As POSOH and SLC mature, their multicultural education models and the sustainability research that emerges will be disseminated nationally via presentations, publications, and online forums.

POSTDOCTORAL POSTER ABSTRACTS

BIO/AGR/ENV LIFE SCIENCES

BIOCHEMISTRY/BIOPHYSICS

Ballroom C - 108

A HIGH-THROUGHPUT INHIBITOR SCREEN FOR THE PROTEIN DISAGGREGASE HSP104, A NOVEL THERAPEUTIC TARGET AGAINST FUNGI

Mariana Torrente, James Shorter.

University of Pennsylvania, Perelman School of Medicine, Philadelphia, PA.

Fungi are a growing public health problem. These microorganisms can cause fatal infections in immunocompromised hosts such as transplant patients, AIDS patients, cancer patients, premature babies, and the elderly. Efficacious treatment of these infections is often difficult as medications that eradicate the fungus also harm human cells, becoming toxic to the human host. Thus, more specific antifungals that are able to bypass these problems are needed. Hsp104 is a ring-shaped hexameric yeast AAA+ATPase capable of restoring misfolded and aggregated proteins to their normal structure and function. This protein is essential for cell viability in challenging conditions when proteins tend to aggregate more readily. Interestingly, Hsp104 orthologues are found in all kingdoms of life except animals. Inhibition of Hsp104 would allow for therapies specifically targeted against fungi, which are dependent on Hsp104's activity for survival, while producing little or no side effects. However, only one inhibitor of Hsp104's activity is currently known. Here, by way of a high throughput colorimetric screen including over 16,000 compounds, we identified 20 small-molecule drugs capable of inhibiting Hsp104's activity. These molecules inhibit Hsp104's ATPase activity in a noncompetitive manner. Out of these, we mined molecules that interact with Hsp104 by mechanisms other than nonspecific colloidal effects and inhibit Hsp104 function both *in vitro* and *in vivo*. It is our hope that the results of this study can ultimately open the door to a new, more selective generation of antifungals with fewer side effects.

Ballroom C - 103

INVESTIGATION INTO THE SUBSTRATE SPECIFICITY OF THE HALODURACIN SYNTHETASE HALM2

Gabrielle Thibodeaux,¹ Wilfred van der Donk².

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Lantibiotics are genetically encoded peptides that are produced by Gram-positive bacteria. Efforts to study and understand lantibiotics have been driven in part by a major problem the world is facing today: the emergence of pathogens that are resistant to common antibiotics. There has been an increasing interest in lantibiotic biosynthetic systems because of their potential for engineering peptides that contain enhanced antimicrobial activity and superior pharmacokinetics. A two-component class-II lantibiotic system was discovered in *Bacillus halodurans* C-125. In this organism, two lantibiotic synthetases, HalM1 and HalM2, were found to process two separate peptide substrates, HalA1 and HalA2, into mature lantibiotics. The importance of the core peptide was biochemically characterized by *in vitro* assays, *in vivo* production of chimeric substrates in *E. coli*, and determining the binding constants of HalM2 toward the leader and core independently using fluorescence polarization. Our results have shown HalM2 can process chimeric substrates, which contain HalA1 leader peptide and HalA2 core peptide and HalA2 leader peptide and HalA1 core. Until now, it was believed the leader peptide directed the lanthipeptide synthetase direction and activity, but these results provide evidence that the core peptide is also equally important in the maturation process. The understanding of substrate specificity will enhance our ability to rationally design novel peptides and to generate compounds with improved therapeutic potential. In addition, the unique catalytic properties of lantibiotic synthetases hold great potential for the development of biotechnologies that can potentially impact many areas of basic and applied research.

Ballroom C - 61

SYNTHESIS, CHARACTERIZATION, AND ANALYSIS OF BIOCOMPATIBILITY OF STAR-SHAPED GOLD NANOPARTICLESGermán Plascencia Villa, Daniel Bahena, Arturo Ponce, Miguel José-Yacamán.*University of Texas at San Antonio, San Antonio, TX.*

Engineered nanoparticles have diverse applications in biomedicine as diagnostics, image contrast agents, nanosensors, and drug delivery systems. Anisotropic metallic nanoparticles possess potential applications in cell imaging and therapy+diagnostics (theranostics). However, controlled synthesis and growth of these anisotropic or branched nanostructures have been challenging. Star-shaped, gold nanoparticles were obtained through a seed mediated route using 2-[4-(2-hydroxyethyl)-1-piperazinyl] ethane-sulfonic acid (HEPES) as a precise shape-directing agent. Morphology of gold nanoparticles was obtained by ultra-high resolution FE-SEM (HITACHI S5500) and aberration-corrected atomic resolution TEM/STEM (JEOL ARM-200F) to obtain a detailed characterization of nanostructure and atomic arrangement. Nanoparticles showed absorbance centered in the NIR region (700nm) and dynamic light scattering. The zeta potential showed a narrow size distribution (80 nm), monodispersity, and high colloidal stability. Interaction of star-shaped, gold nanoparticles (35 - 350 µg/ml) with *in vitro* cultured macrophages showed that after 24 h there are no signs of cytotoxicity, as viability remained at $94 \pm 1\%$, even at the highest concentration. FE-SEM imaging techniques helped to analyze adsorption and uptake of gold nanoparticles. Gold nanostars were shown to be biocompatible and efficiently adsorbed and internalized by cells, as revealed by advanced FE-SEM and backscattered electron imaging of complete, unstained, uncoated cells. Additionally, low voltage STEM and X-ray microanalysis revealed the ultrastructural location and stability of nanoparticles after endocytosis with high spatial resolution. Star-shaped gold nanoparticles have demonstrated their applications in biomedicine for SERS applications, thermal ablation, and nanotheranostics.

CELL/MOLECULAR BIOLOGY

Ballroom C - 96

BLOCKADE OF CD47 ENHANCES MACROPHAGE-MEDIATED CANCER CELL CYTOTOXICITY THROUGH THE UPREGULATION OF AUTOPHAGYDavid Soto Pantoja, Gema Martin Manso, David Roberts.*Laboratory of Pathology, National Institute of Health, National Cancer Institute-Center for Cancer Research, Bethesda, MD.*

Over two thirds of cancer patients in the United States will require ionizing radiation (IR) therapy as part of their course of treatment; however, achieving a curative response is limited in part by detrimental side effects on normal cells. We have previously demonstrated that therapeutic targeting of CD47 with antisense morpholinos confers radioprotection on normal tissue while enhancing radiation-induced tumor growth delay in murine models. One possible explanation for this observation is that CD47 blockade protects normal immune cells and preserves antitumor immunity. To test this, wild type or CD47^{-/-} mice were injected with B16 melanoma cells to form subcutaneous tumors and exposed to local IR. Our results demonstrate that tumors on a CD47-deficient microenvironment in combination with IR treatment show reduction in tumor growth when compared to wild type. This was associated with an increase in tumor macrophage infiltrate. Moreover, targeting of CD47-enhanced macrophage mediated killing of melanoma cells and breast cancer cells. CD47 also protects macrophages from death from IR and enhances macrophage differentiation indicating that blockade of CD47 may selectively protect cytotoxic macrophages and increase cytotoxic potential to reduce tumor growth. These effects are associated with upregulation of autophagy related genes *ATG5*, *ATG7* and *LC3*. Therefore, CD47 blockade selectively activates protective autophagy in macrophages that in turn can target irradiated cancer cells and reduce tumor burden. These findings indicate that agents targeting CD47 may allow for more aggressive application of radiation in the treatment of cancer and increase the percentage of curative responses.

Ballroom C - 28

MUTATION IN SPLICEOSOMAL PROTEIN SF3B1 INDUCES ERYTHROID MATURATION ARRESTOscar Ramirez Jr., Manoj Pillai.*University of Colorado, Anschutz Medical Campus, Northglenn, CO.*

Myelodysplastic syndrome (MDS) is a group of clonal hematopoietic disorders characterized by ineffective production of blood cells by the bone marrow and a propensity to transform to acute leukemia. Over 14,000 new cases of MDS are reported each year in the US. Recently, whole-genome sequencing (WGS) of MDS patient samples revealed recurrent mutations in proteins of the splicing machinery. RNA splicing is the molecular process by which introns are removed from pre-mRNA in the nucleus. SF3B1 is the most commonly mutated spliceosomal protein in MDS. SF3B1 is a 155 kilo-Dalton (kD) protein that forms part of the U2 spliceosomal complex. A nonsynonymous mutation (K700E) is the most common SF3B1 mutation in MDS. As MDS patients with SF3B1 mutation have profound anemia, we hypothesized that expression of SF3B1-K700E in normal hematopoietic precursors will result in maturation arrest of the erythroid lineage. Wild type (SF3B1-WT) and mutant (SF3B1-K700E) were expressed in human CD34+ cells by means of retroviral vectors. Erythroid maturation was then effected by culture in two phases: a 7-day culture in hematopoietic cytokines IL3, stem cell factor, FLT3 ligand, IL6, and a subsequent 10-14-day culture in erythropoietin (EPO). Cells were assayed every 3 days for expression of erythroid maturation markers CD71, CD105, and CD235A. At days 7 to 10 of erythroid induction, cells expressing SF3B1-K700E were found to express significantly lower levels of CD71 and CD105 when compared to SF3B1-WT expressing controls. Studies defining the molecular mechanisms of SF3B1-K700E in this maturation arrest are ongoing.

Ballroom C - 20

VOLTAGE-GATED CALCIUM CHANNEL SPLICE VARIANTS IN SYMPATHETIC NEURONSArturo Andrade, Summer Allen, Diane Lipscombe.*Brown University, Providence, RI.*

Voltage-gated calcium 2.2 (CaV2.2) channels control transmitter release at many synapses and in some neurons such as superior cervical ganglia (SCG). A large number of G-protein-coupled receptors inhibit presynaptic CaV2.2 channels. This property is used by neurotransmitters, drugs, and hormones to downregulate transmitter release. The properties of CaV2.2 channels and their inhibition by G proteins vary according to cell type and synapse. Several factors contribute to cell specificity, but we have evidence that cell-specific alternative splicing is critical. *Cacna1b* is the gene that encodes CaV2.2, and it contains several alternatively spliced exons. Here we analyze the actions of an alternatively spliced exon, e18a, which encodes a short, 21-amino-acid sequence in the II-III linker of CaV2.2. E18a is enriched in SCG neurons particularly in adults (90% of the total). To assess the function of e18a, we engineered two lines of mice that either expressed e18a-containing CaV2.2 mRNAs only or that expressed e18a-lacking CaV2.2 mRNAs (D18a) only. The mice were viable and had no gross behavioral differences. CaV2.2 current densities in SCG neurons were approximately 25% larger in +18a compared to D18a mice similar to our analyses of cloned channels expressed in cell lines. Total CaV currents were strongly inhibited by vasoactive intestinal peptide (VIP), and further analyses showed the majority of inhibited currents were CaV2.2. The form of CaV inhibition induced by VIP, membrane delimited or diffusible, was different in neurons of +18a compared to D18a mice, consistent with our studies of cloned channels.

Ballroom C - 53

CADHERIN-11 REGULATES PULMONARY FIBROSIS IN BLEOMYCIN-INDUCED LUNG INJURYMesias Pedroza, Teresa George, Sandeep Agarwal.*Baylor College of Medicine, Houston, TX.*

Idiopathic pulmonary fibrosis (IPF) is a progressive, irreversible pulmonary disorder with no known effective treatments and is generally lethal within five years from the time of diagnosis. Pathologically, IPF is characterized by an aberrant wound-healing mechanism leading to excessive fibroblast proliferation, myofibroblast differentiation, and extensive matrix deposition in the alveolar airways. Epithelial-to-mesenchymal transition (EMT) is the differentiation of fibroblast-like phenotype from epithelial cells that results in myofibroblast accumulation. Cadherin-11 (Cad11) expression on hyperplastic alveolar epithelial cells undergoing EMT is a novel finding in our lab. Hence, we formulated the hypothesis that Cad11 contributes to the development of pulmonary fibrosis through EMT. To test this hypothesis, we proposed the following: determine the contribution of Cad11 deficiency and neutralization in the intraperitoneal bleomycin (IP-BLM) model of pulmonary fibrosis, which better resembles the chronic aspects of IPF; and assess the contribution of Cad-11 in alveolar epithelial cells through EMT. Preliminary findings show that deficiency and

neutralization of Cad11 in the IP-BLM model is associated with attenuated pulmonary fibrosis in conjunction with reduced b-catenin expression. In this model of pulmonary fibrosis, Cad11 deficiency and neutralization revealed restored arterial oxygen saturation, diminished a smooth-muscle actin accumulation, reduced collagen deposition, and decreased TGF- β production. The novelty of this project will be the identification of mechanisms by which Cad11 regulates EMT and TGF β production. This project will support additional translational studies to develop Cad11 as a therapeutic target for pulmonary fibrosis.

Ballroom C - 77

MIF PROMOTES RESISTANCE TO GLUCOCORTICOIDS IN EXPERIMENTAL AUTOIMMUNE ENCEPHALOMYELITIS

Niannian Ji, Thomas Forsthuber.

University of Texas at San Antonio, San Antonio, TX.

Macrophage migration inhibitory factor (MIF) is a proinflammatory cytokine with the unique property of being induced by glucocorticoids (GCs) and the ability to counter regulate their antiinflammatory effects. GCs are the standard treatment for acute attacks of multiple sclerosis (MS); however, they eventually lose efficacy and overall do not prevent progression of the disease. We wanted to determine whether MIF played a role in resistance to GC treatment in experimental autoimmune encephalomyelitis (EAE), an animal model of MS. We induced active EAE in both wild type and MIF knockout (MIF-KO) mice followed by the treatment with dexamethasone (Dex) before or at the onset of disease. Splenocytes and brain mononuclear cells were collected for cytokine ELISPOT assay, flow cytometry analysis, and immunofluorescence staining. Treatment of EAE with Dex in MIF-KO mice was substantially more effective as compared to wild-type mice in terms of delayed EAE onset and decreased disease severity. Dex treatment suppressed inflammatory infiltration in the brains of both wild-type and MIF-KO mice; however, the suppression lasted longer in MIF-KO mice once the treatment was stopped. In contrast, antigen-specific cytokine production by T cells was partially suppressed by Dex and slightly affected by MIF deficiency. Importantly, Dex profoundly inhibited the upregulation of transcription factor T-bet in CD4⁺ T cells from the brains of MIF-KO mice as compared with wild-type mice. Our data suggest that MIF promotes EAE and possibly MS by antagonizing GC effects on T-bet, which implicates the pathogenic, autoreactive T cell in EAE.

Ballroom C - 12

OXIDATIVE-STRESS MEDIATES APOPTOSIS IN A HUMAN MODEL OF DANON DISEASE AND HEART FAILURE

Cynthia Perry¹, Sangyoon Han¹, Stacey Clegg², Kunfu Ouyang¹, Dekker Deacon¹, Ju Chen¹, Qiuming Gong², Zhengfeng Zhou², Neil Chi¹, Eric Adler¹.

¹*University of California, San Diego, La Jolla, CA*, ²*Oregon Health Sciences University, Portland, OR.*

Emerging evidence has highlighted the importance of autophagy, an intracellular recycling pathway, in regulating cardiomyocyte bioenergetics, function, and survival. However, the mechanisms responsible for cellular dysfunction and death in cardiomyocytes with impaired autophagic flux remain unclear. Danon disease is a familial cardiomyopathy associated with impaired autophagy due to mutations in the gene encoding lysosomal-associated membrane protein type 2 (LAMP-2). To investigate the pathogenesis of Danon disease, we created iPS cells from a patient with a mutation in LAMP-2 who expired from heart failure. Danon induced-pluripotent-cells (iPS)-derived cardiomyocytes recapitulated key features of the disease *in vitro*, including impaired autophagic flux, increased cell size, abnormal calcium handling, and increased expression of natriuretic peptides. Danon cells were noted to have significant amounts of mitochondrial oxidative stress and apoptosis, both of which could be abrogated by treatment with the antioxidant N-acetylcysteine. These results implicate mitochondrial oxidative stress and apoptosis in the pathogenesis of Danon disease. They also provide the basis for the use of antioxidants for Danon disease and other autophagy-related human diseases such as heart failure, diabetes, cancer, and neurodegenerative disorders.

Ballroom C - 69

ROLE OF 11-HYDROXYSTEROID DEHYDROGENASE TYPE 1 IN LEUKEMIA CELL LINES

Adaris Rodriguez Cortes, Fatima Rivas, Taotao Ling.

St. Jude Children's Research Hospital, Memphis, TN.

Glucocorticoids (GC) are steroid hormones that regulate physiologic functions such as gluconeogenesis, cell differentiation, and apoptosis in a tissue-specific manner. The prodifferentiation and proapoptotic effects of GCs are central in the treatment of childhood leukemia, particularly in the treatment of the most common childhood cancer, acute lymphoblastic leukemia (ALL). GCs are known to rapidly reduce ALL tumor burden without hindering bone

marrow activity (myelosuppression). The initial response of a tumor to GC treatment is used as a key prognostic indicator. Resistance to GC treatment is observed in 10% to 30% of patients with untreated ALL and in relapse ALL. Multiple factors influence GC resistance, but its etiology and development remain vague. Recently, a clinical study found that mRNA levels of a GC signaling enzyme, 11 β -hydroxysteroid dehydrogenase (11 β -HSD1), differ between GC-sensitive and GC-resistant ALL primary cells. The GC-sensitive cells contained more 11 β -HSD1 mRNA than the GC-resistant cells. This enzyme is bidirectional, with both oxidase and reductase activities, primarily converting cortisone to cortisol and amplifying intracellular GC signaling. The role of 11 β -HSD1 in leukemia cells is still unclear. Our studies aim at exploring the role of 11 β -HSD1 in the development of GC resistance in ALL. Herein, we disclose preliminary data from our studies on the presence and function of 11 β -HSD1 in both B and T leukemia cell lines. We used various molecular techniques, including RT-qPCR, western blots, and drug-induced inhibition studies. Our findings offer a platform to evaluate 11 β -HSD1 as a potential therapeutic target to treat GC resistant ALL. Our current efforts and future studies will be discussed.

ECOLOGY

Ballroom C - 84

NATURAL VARIATION AND COVARIATION IN THE MODEL ALGA *CHLAMYDOMONAS REINHARDTII*

Kyle Hernandez, Jacob Malcom, Tom Juenger, Raquel Likos, Nathan Wisnoski.

The University of Texas at Austin, Austin, TX.

Variation is the lifeblood of ecological and evolutionary dynamics, and wild-type accessions provide a vital resource for studying the causes and consequences of variation. We quantified genome-wide genetic variation, phenotypic variation, and fitness variation and covariation in 40 environments for 18 wild-type *Chlamydomonas reinhardtii* lines and six F₃ crosses between 2 of the wild-type lines. Patterns of genetic variation among polymorphic loci from RAD genotyping reflected the patterns uncovered in a resequencing project with many of these same lines. In addition, we found substantial phenotypic variation in fitness, cell cycle, cell size, and phototaxis among lines. Currently, we are exploring patterns of phenotypic plasticity and genotype-environment interaction in these wild-type lines across environments varying in nutrient availability, trace element concentrations, contaminant concentrations, pH, light, and temperature regimes. The natural variation of *C. reinhardtii* wild-type accessions, ease of crossing, abundance of inexpensive genetic markers, and speed of assays highlight an ideal resource for studying the molecular basis of variation.

ENVIRONMENTAL SCIENCE/STUDIES

Ballroom C - 76

NANOMATERIAL CONTAMINATION IN AGRICULTURAL CROP SPECIES: INTERACTION WITH COEXISTING CHEMICALS AND TROPHIC TRANSFER POTENTIAL

Roberto De La Torre Roche, Joseph Hawthorne, Jason White.

Connecticut Agricultural Experiment Station, Hamden, CT.

Although the use of engineered nanomaterials (NM) has increased, the fate and effects of these substances in the environment are poorly understood. As an emerging class of contaminants, there is significant potential for NM interactions with coexisting chemicals, as well as for bioaccumulation and biomagnification of these materials through food webs. A study currently underway involves corn, soybean, zucchini, and tomato being grown in soil containing weathered pesticides (chlordane and DDE) amended with nanoparticles (NP) of C₆₀ or multiwalled carbon nanotubes (MWCNT). The accumulation of DDE by zucchini, soybean, and tomato grown in C₆₀-amended vermiculite increased by 30-65% compared to controls. However, in a soil containing weathered DDE, C₆₀ coexposure had little impact on DDE accumulation. MWCNT suppressed the pesticide accumulation by 20% to 67%. The finding that engineered nanomaterials can significantly alter the accumulation of pesticides in plants may have significant implications for food safety as well as for the movement of pesticides and other organic contaminants through the environment. To determine NMs' trophic transfer potential, studies have been initiated by exposing zucchini to cerium-amended or control soils. Fresh shoot tissue that had been exposed to 0 - 1000 mg/kg bulk or cerium oxide NPs will be used to feed *Acheta domesticus* (cricket) populations for up to 28 days. Live crickets that had consumed zucchini shoots will

be used to feed predator *Tenodera sinensis* (mantid) populations. The cerium content and nanoparticle translocation in plant and animal populations will be determined.

Ballroom C - 114

HUMAN HEALTH RISK ASSESSMENT OF METALS IN PRIVATE AND PUBLIC GROUNDWATER SUPPLIES IN ARIZONA

Roberto Marrero-Ortiz, Kelley R. Riley, Charles Gerba, Kelly Reynolds.

University of Arizona, Tucson, AZ.

The United States Environmental Protection Agency (USEPA) promulgated the final Groundwater Rule and the revised Arsenic Rule in 2006 to reduce the risk of exposure to contaminants in public groundwater water supplies. The rules however do not regulate chemical contaminants in private, domestic-use wells. Approximately 5% of the Arizona population (300,000 persons) obtains its drinking water from one of 95,000 private household wells. The present study evaluated the occurrence and associated human health risk of arsenic and others metals in 39 private household wells and 10 small public-drinking groundwater supplies in Arizona. The determination of metals present in water samples was carried out by inductively coupled plasma mass spectrometry. Human health impacts related to arsenic and other metal concentrations found in the drinking water supplies were assessed using a quantitative toxic risk assessment approach. In a number of cases, the concentration of metals including As, B, Mo, Mn, Se, and U in groundwater were above the permissible levels for drinking-water quality recommended by the USEPA and WHO. Indeed, 82% of groundwater wells were positive for some level of arsenic with 90% (9/10) of small public systems and 15% (6/39) of private household wells exceeding federal standards for acceptable risk. The results of this study support the need for consumer safety improvements in Arizona groundwater, particularly for private well owners who may be at greater risk of exposure and adverse health outcomes due to a lack of drinking-water monitoring and controls.

MICROBIOLOGY

Ballroom C - 90

ANTIMICROBIAL EFFECTS OF NOVEL NITRO-SUBSTITUTED BENZAZOLO[3,2 A]QUINOLINIUM DRUGS AGAINST MULTI-DRUG-RESISTANT BACTERIAL STRAINS

Gloricelys Rivera, Beatriz Zayas.

Universidad Metropolitana, San Juan, PR.

Benzazoloquinolinium salts (BQs) have shown previously cytotoxic affects in diverse cancer cell lines such as the human epidermoid carcinoma (A431), non-Hodgkin's B cell lymphoma (Toledo), and, more recently, in colorectal adenocarcinoma (Colo 320DM). However, there is no evidence of its potential antimicrobial activity against bacterial strains. To test the antimicrobial potential of these salts, we selected five nitro-substituted benzazolo[3,2-a]quinolinium chlorides that have demonstrated strong activity as anticancer agents: NBQ-2, NBQ-48, NBQ-51, NBQ-95, and NBQ-106. To perform the analysis, we selected five bacterial strains based on the multiple drug-resistant criteria previously published by the Infectious Diseases Society of America (IDSA) and revised literature: *S. aureus*, *K. pneumoniae*, *P. aeruginosa*, *E. coli*, and *S. typhimurium*. Susceptibility tests were examined using the disk-diffusion (Kirby-Bauer) method. Zones of inhibition were compared with the broad-spectrum antibiotic tetracycline. Evaluations of the minimum inhibitory concentration (MIC) of the drugs were performed in triplicate using different concentrations in a 3-microtiter plate of 96 wells. Preliminary screening showed that 4 drugs were effective against all bacterial stains. NBQ-51 exhibited the highest activity with an average of 30 mm diameter of inhibition zone at a 3 mM concentration. Conversely, NBQ-95 at the same concentration did not show any bactericidal activity in the chosen strains. Results of this study exhibited inhibition activity of these compounds and their potential use as antimicrobial agents, especially against multi-drug-resistant bacterial strains. Further analysis of the synergistic effect of NBQs with additional compounds will elucidate the clinical aspect of these drugs.

Ballroom C - 21

EVALUATION OF ANTIGEN-PRESENTING CELLS IN HUMAN, DISTAL COLONIC MUCOSA SUGGESTS A POSSIBLE ROLE FOR RECTAL CD209+ MACROPHAGES AS TARGETS IN HIV INFECTION AND TRANSMISSIONGloria Preza, Karen Tanner, Julie Elliott, Peter Anton, Otto Yang, Maria-Teresa Ochoa.*University of Southern California, Los Angeles, CA.*

The most common route for HIV-1 infection is sexual transmission across colorectal mucosa. It is 20 to 200 times more vulnerable to infection per sex act than that of the female genital tract. Mucosal CD4+ T lymphocytes are believed to be the earliest cells infected, and viral access to activated CD4+ T lymphocytes appears to be a major limiting factor for HIV-1 transmission. However, activation of CD4+ T lymphocytes is dependent on antigen-presenting cells (APCs) such as dendritic cells (DCs) and monocyte/macrophages. Mucosal surfaces are the first line of defense against pathogens but APCs, key regulators of innate immunity and determinants of adaptive immunity, are not well defined in this tissue. We hypothesize that differences in APCs in the mucosa that favor less T lymphocyte activation could contribute to target cell limitation for HIV-1 transmission. Here, we sought to characterize APCs in human colorectal tissue. Using immunohistochemistry, Langerhans cells (LC), which express Langerin, known to bind HIV-1, were detected in the periphery of glands. Unexpectedly, the largest population was a macrophage-like cell expressing CD68 and CD163. Confocal microscopy revealed colocalization of CD209 (DC-SIGN), a DC marker shown to have a role in HIV transmission, with this macrophage-like population. These results demonstrate the unconfirmed presence of LCs in these compartments and a predominance of macrophage-like APCs that express DC-SIGN. This study evaluates the microenvironment in normal human, distal colonic mucosa, describes the potential HIV target cells in these microcompartments, and suggests a possible role for rectal macrophages in early HIV-1 infection and transmission.

NUTRITIONAL SCIENCES

Ballroom C - 5

OBESITY PROMOTES AEROBIC GLYCOLYSIS IN PROSTATE CANCER CELLSDavid Cavazos, Matthew deGraffenried, Laura Bowers, Meredith Marlett, Shruti Apte, Linda deGraffenried.*University of Texas at Austin, Austin, TX.*

Obesity is the leading preventable comorbidity associated with prostate cancer-related recurrence and mortality. As obesity becomes more prevalent, the contribution to prostate cancer progression and mortality is expected to rise. Obesity may promote a worse outcome through the induction of metabolic abnormalities that stimulate cellular proliferation and genotoxic stress. Preclinical and clinical studies indicate that a BMI > 30 is associated with increased oxidative DNA damage and shorter time to PSA failure; however, the mechanisms are multivariate and relatively unresolved. Previous studies in our lab indicate that blood serum derived from obese mice maintained on a 60% calories-from-fat (DIO) diet may promote the proliferative potential of human prostate cancer cell lines *ex vivo*. Further, we have shown that a 1-hour exposure of LNCaP cells to DIO mouse serum enhanced tumor volume and metastasis for up to 12 weeks after xenograft into immunodeficient mice. Here we show that a 1-hour exposure of LNCaP or PacMetUT1 prostate cancer cell lines to 2% DIO mouse serum results in increased aerobic glycolysis relative to those exposed to serum from control-weight mice. This metabolic change was correlated with accumulation of reactive oxygen species (ROS) and increased frequency of DNA double-strand breaks. Interestingly, *N-tert*-butylhydroxylamine, a common food preservative with antioxidant properties, significantly inhibited aerobic glycolysis in the DIO-serum treated cells, suggesting that ROS contributes to a metabolic shift toward glycolysis. Here, we describe one potential mechanism by which obesity contributes to prostate cancer progression and explore the potential role of antioxidants in ameliorating these effects.

PHYSIOLOGY/PATHOLOGY

Ballroom C - 102

SPHINGOLIPID PATHWAY MAPS FROM METABOLIC BIOSIMULATIONS REVEAL INCREASES IN PROGRESSIVE STAGES OF ALZHEIMER'S DISEASEGilbert Centeno Jr., George Perry, Clyde Phelix.*University of Texas at San Antonio, San Antonio, TX.*

Sphingolipid metabolism plays a role in cell death through progressive stages of Alzheimer's disease (AD). In this study, we tested the hypothesis that both levels of metabolites and flux of reactions in the sphingolipid pathway would increase in a simulated hippocampus as AD advanced. We used computational biology on integrated metabolic systems networks to perform predictive biosimulations. Transcriptomes from the human hippocampus (NCBI GEO GSE1297) from subjects of age-matched controls (AMC), incipient, moderate, and severe AD, were used to derive parameters for a deterministic kinetic model of 28 metabolic pathways. Transcriptome-To-Metabolome(TTM)TM biosimulation was performed using COPASI running time-course simulations and reporting metabolite levels and reaction flux values. Percent differences were calculated for gene expression and metabolite levels and reaction flux between each stage of AD versus AMC and each stage versus the prior stage. NodeXL software was used to generate network maps of the sphingolipid pathway where nodes represented metabolites and color and size the percent difference in level. Edges were directional arrows where size represented percent difference in flux and color indicated percent difference in gene expression levels. Results were easily assessed by the sizes and colors of nodes and edges on the network maps. Sphingolipid metabolites increased in AD as reported by others on direct measurements from human brain tissues. These differences were not progressive or linear. Such comprehensive datasets on levels and reactions are not possible with *in vivo* studies. This TTMTM method and pathway mapping will generate new hypotheses on AD pathophysiology.

EDUCATION

EDUCATION RESEARCH/ADMINISTRATION (EXCEPT EDUCATIONAL/SCHOOL PSYCHOLOGY)

Ballroom C - 52

PROMOTING CHANGE IN UNDERGRADUATE BIOLOGY CURRICULA BY INCORPORATING SCIENTIFIC TEACHING TRAINING IN AN IRACDA POSTDOCTORAL PROGRAMDesirée L. Salazar¹, Shannon Seidel², Kelly S. Doran¹, JoAnn Trejo², Ricardo M. Zayas¹, Laurence L. Brunton².¹*San Diego State University, San Diego, CA*, ²*University of California, San Diego, La Jolla, CA*.

The Institutional Research and Academic Career Development Awards (IRACDA) is funded by NIGMS at 19 sites, with the goal of providing mentored postdoctoral training and promoting diversity for the next generation of professors of biomedical sciences. The San Diego IRACDA couples a research-intensive institution, University of California, San Diego (UCSD), with a minority-serving institution, San Diego State University (SDSU). The IRACDA fellows conduct most of their research at UCSD and engage in mentored teaching at SDSU. Here, we discuss recent efforts to incorporate the principles of scientific teaching into the teaching experiences of IRACDA fellows to 1) train future faculty to build student-centered classrooms, 2) help promote a culture of scientific teaching at SDSU, and 3) improve the learning experience for undergraduate students. To provide an opportunity for IRACDA fellows to use scientific teaching skills, we implemented a project to revamp an upper-division cell and molecular biology course at SDSU. We hypothesize that we can improve learning outcomes and decrease the minority/majority achievement gap by incorporating active learning and scientific teaching methods into the course. We created learning outcomes for the course and generated a pre/post-test, which we administered to assess student learning in the current course being offered in traditional lecture format. We will use the same pre/post-test to measure student learning in our revamped course, using student demographic information from the school registrar to assess characteristics of the student

population. We believe that involving our IRACDA fellows in a mentored teaching experience along with training in scientific teaching methods is a unique and effective way to enact change in biology curricula.

OTHER EDUCATION

Ballroom C - 109

SPECTRUM: BUILDING PATHWAYS TO BIOMEDICAL RESEARCH CAREERS FOR GIRLS AND WOMEN OF COLOR

Audrey Parangan-Smith, Rebecca Garcia, Gloriana Trujillo, Kimberly Tanner.
San Francisco State University, San Francisco, CA.

Women of color (WOC) are still largely absent from the biomedical research community. Few materials or models exist that are designed specifically to attract girls of color to these careers. The Science Education Partnership and Assessment Laboratory (SEPAL) in the Biology Department at San Francisco State University (SFSU) has developed the *Spectrum* effort to address the dearth of WOC in biology. Through *Spectrum*, SFSU biomedical scientists who are WOC – including undergraduate and masters students, alumni in local doctoral and biotechnology positions, and biology faculty – with middle and high school teachers, collaborate to engage girls of color in science through 1) co-sponsoring after-school science clubs targeted at girls of color in high-need public schools, 2) developing a mentoring community of WOC biomedical research trainees, and 3) developing video resources highlighting the research programs of WOC biologists. During its initial 4 years, *Spectrum* engaged 456 girls (45% Latina, 13% African American, 22% Asian, 11% unknown, and 7% White) across 9 club sites, including 2 field trips to the laboratories of SFSU WOC biologists. We report an increased number of participating girls who agreed with the following statements: 1) I have heard a woman scientist talk about why she likes science, and 2) I have met a woman scientist who is like me. *Spectrum* has also developed two video resources highlighting WOC, which are available on the SEPAL website and have been distributed nationally. (*Spectrum* is supported by the National Institutes of Health through #1R25RR024307, Supplement #3R25RR024307-05S, and Supplement #3R25RR024307-03S1.)

Ballroom C - 60

TEACHING INTRODUCTORY BIOLOGY TO NON-MAJORS AT A TRIBAL COLLEGE

Olivia George¹, Leyma De Haro¹, Gloriana Trujillo¹, Summer Raines¹, Salina Torres¹, Dorothy Wester², Christopher Harrington², William Adams², Nader Vadiiee².

¹*University of New Mexico, Albuquerque, NM*, ²*Southwestern Indian Polytechnic Institute, Albuquerque, NM*.

Introductory biology for students with little or no background in biology has its challenges in colleges and universities across the country. Instructors teaching biology at tribal colleges face the same challenges as well as additional unique ones. Science education research has suggested that incorporating active learning into the curriculum enhances the student learning experience. As current Institutional Research and Academic Career Development Awards (IRACDA) fellows, we are paired with several minority-serving institutions. One such institution is a national tribal college, Southwestern Indian Polytechnic Institute. Because under-represented minority students tend to leave science, technology, engineering, and math (STEM) disciplines early in their education, we sought to restructure the current biology curriculum at SIPI from traditional lecture into a more active learning environment with more dynamic classes and culturally relevant topics. Our approach was to co-teach the subjects, while keeping the course structure identical for every unit with reading quizzes, clicker questions, and in-class active learning activities. In addition, we also created various low-risk assessments including multiple-choice and group exams, and the students created a final project on a current science topic of their choice instead of having a final exam. We found that students enjoyed working in groups and the incorporation of clickers in class. Our results from surveys and pre- and post-tests on content showed that the incorporation of active learning exercises into the curriculum can indeed increase student learning and retention of the material covered, especially within the Native American student population.

ENGINEERING/BIOENGINEERING/BIOMEDICAL ENGINEERING

Ballroom C - 4

MICROBIAL POLY(GAMMA-GLUTAMIC ACID): PRODUCTION AND BIOMEDICAL APPLICATIONSJose Portilla-Arias¹, Dulce Ma. Barradas-Dermitz², Maria Guadalupe Aguilar Uscanga².¹*Nanomedicine Research Center, Cedars Sinai Medical Center, Los Angeles, CA,* ²*Technological Institute of Veracruz, Veracruz, MX.*

Poly(gamma-glutamic acid) (PGGA) is an edible polypeptide excreted by certain bacteria that is presently accessible on a semi-industrial scale by both chemical synthesis and prepared by biosynthesis in the laboratory in up to 90 g/L yields. Chemically, it is a nylon 4 derivative bearing a carboxylic side group attached to the fourth carbon of the repeating unit. Although this biopolymer is being exploited in the food, agriculture, and cosmetic sectors, its use in massive applications as packaging or coating is still unknown, mainly due to its instability in wet environments and unsuitability to be processed by common techniques. Chemical modification of PGGA involving esterification or amidation of the carboxylic group is the approach explored the most to obtain materials with potential interest as fibers, films, or hydrogels. PGGA is receiving increasing attention in biomedicine because it combines a well-proven nontoxicity with the possibility of conjugating diverse active agents and drugs via the carboxyl side group. Of particular interest is its potential as a drug delivery system due to the capacity of PGGA derivatives to form structured nanoparticles. Partial amidation with hydrophobic amino acids renders stable nanospheres able to efficiently encapsulate proteins that are conveyed by mechanisms appropriate for the design of vaccine delivery systems. Modification by ionic coupling with organic cations constitutes another option to generate PGGA derivatives with new potential applications. Complexes with polycationic polymers such as poly (epsilon-lysine) or chitosan are suitable for building drug and protein carrier systems able to respond intelligently to pH changes.

ENGINEERING SCIENCES/MECHANICS/PHYSICS

Ballroom C - 97

EXPERIMENTAL STUDY OF THE DISCHARGE IN ATMOSPHERIC PRESSURE PLASMA JETS GENERATED IN AR AND AR/O₂ MIXTURECosmina Nicula¹, Magesh Thiyagarajan², Abdollah Sarani¹.¹*College of Science & Engineering, Texas A&M University-Corpus Christi, Corpus Christi, TX,* ²*Plasma Engineering Research Lab (PERL), Texas A&M University-Corpus Christi, Corpus Christi, TX.*

Low temperature atmospheric plasma jets are investigated in argon and argon/oxygen mixtures; the effects of oxygen content in the various plasma emissions have been examined. In order to probe the plasma properties, electrical characterization has been performed. As a result, the electrical properties of the plasma jet show that we have higher peaks in the case of electrical current for Ar/O₂ mixtures compared to pure argon plasma. During the experiment, it can be seen that by adding O₂ to the argon plasma, the system shows a power decrease. The chemical species presented in the plasma jet were identified by optical emission spectroscopy in the spectral range from 200 to 900 nm, and it was found that plasma generated in argon has the highest emission intensity. Space-resolved emission spectroscopy with a resolution of 0.8 nm was performed. Assuming that the rotational temperature of the diatomic molecules is equal to the gas temperature under atmospheric pressure conditions, the rotational and vibrational temperature of the plasma has been determined by fitting the experimental spectra obtained from the spectrometer (with a very high resolution from 306 to 311 nm) with the simulated spectrum achieved from Lifbase software. The interpretation of temperature results show that the increase of oxygen concentration in argon plasma leads to an increase in the gas temperature. Finally, perspectives on using plasma jets in biomedical applications are presented. (Supported by the US Army Medical Research & Materiel Command and the Telemedicine & Advanced Technology Research Center and Texas Research and Development Fund.)

Ballroom C - 91

DEVELOPMENT OF STERILIZATION DEVICE USING NON-THERMAL PLASMA JETS INDUCED BY ATMOSPHERIC PRESSURE DIELECTRIC BARRIER DISCHARGEAbdollah Sarani¹, Magesh Thiyagarajan².¹College of Science & Engineering, Texas A&M University-Corpus Christi, Corpus Christi, TX, ²Plasma Engineering Research Lab (PERL), Texas A&M University-Corpus Christi, Corpus Christi, TX.

Non-thermal atmospheric pressure plasma jets have been verified to be a tremendous source because of their novel applications. In this work, an innovative sterilization device is developed that uses helium, argon, and a helium/argon mixture with an oxygen plasma jet induced by an atmospheric pressure dielectric barrier discharge. Because the sterilization is performed by the plasma reactions of active species at atmospheric pressure, the system does not require any expensive vacuum chambers. To obtain a fundamental understanding of the plasma sterilization process, the reactive plasma species, and the temperature of the plasma jet are investigated. Plasma density has been estimated from current measurement and is in order of 10^{13} cm^{-3} . The gas temperature has been determined by fitting the experimental spectra and using the Boltzmann plot method. The gas temperature is below the temperature required to kill bacteria, e.g., *Streptococcus pneumoniae*. Plasma gas temperature is near room temperature (300 K) in the active zone between the electrodes and was found to increase in the afterglow. In the second part of the work, sterilizations are performed by applying the plasma jet for 15 s to several samples of bacteria. From this test, it is found that complete deactivations of bacteria are obtained by applying the plasma jet for 15 s. Our results show that a non-thermal plasma jet is an efficient source for biomedical applications, where yield of radicals and plume length can be controlled by variation of gas flow rate and discharge parameters.

HEALTH

PUBLIC HEALTH (INCLUDING ENVIRONMENTAL HEALTH/EPIDEMIOLOGY)

Ballroom C - 13

GENETIC POLYMORPHISMS IN *SLC2A4* AND *SCD* ARE ASSOCIATED WITH VARIATION IN OBESITY-RELATED PHENOTYPES IN YUP'IK PEOPLEDominick Lemas¹, Howard Wiener², Diane O'Brien³, Scarlett Hopkins³, Kimber Stanhope⁴, Peter Havel⁴, David Allison², Jose Fernandez², Hemant Tiwari², Bert Boyer³.¹University of Colorado Denver, Aurora, CO, ²University of Alabama at Birmingham, Birmingham, AL, ³Center for Alaska Native Health Research, University of Alaska Fairbanks, Fairbanks, AK, ⁴University of California, Davis, Davis, CA.

Regular consumption of n-3 polyunsaturated fatty acids (n-3 PUFAs) has been associated with protection from obesity-related diseases, in part, by altering the activity of genes involved with lipid and glucose metabolism. Stearoyl CoA desaturase (*SCD*), insulin sensitive glucose transporter (*SLC2A4*), and steroyl regulatory element binding protein (*SREBF1*) are obesity candidate genes that are transcriptionally regulated by n-3 PUFA intake. Although polymorphisms in *SCD*, *SLC2A4*, and *SREBF1* have been associated with obesity-related phenotypes, the extent to which these genetic associations are modified by interactions with n-3 PUFA intake remains unknown. Obesity and lipid-related phenotypes were measured in a cross-sectional sample of Yup'ik individuals (n = 1080) enrolled in the Center of Alaska Native Health Research (CANHR) study. A comprehensive list of 33 single nucleotide polymorphisms within or near *SCD*, *SLC2A4*, and *SREBF1* were tested for association with outcomes of interest in linear models accounting for familial correlations. Dietary intake of n-3 PUFAs was estimated using nitrogen stable isotope ratios ($\delta^{15}\text{N}$) of red blood cells (RBC). *SCD* (rs11190480 and rs2167444) polymorphisms were positively associated with ApoA1 levels (p = 0.006 and p = 0.004, respectively). *SLC2A4* polymorphisms (rs5415 and rs5435) were associated with lower fasting HDL-cholesterol (p = 0.001 and p = 0.003, respectively) as well as increased hip circumference (p = 0.005 and p = 0.027, respectively). Although our results indicate that polymorphisms in *SCD* and *SLC2A4* are associated with obesity-related phenotypes in Yup'ik people, we did not detect significant n-3 PUFA interactions between SNPs in *SCD*, *SLC2A4*, and *SREBF1* that modified genetic associations with obesity phenotypes.

PHYSICAL SCIENCES

ASTRONOMY/ASTROPHYSICS

Ballroom C - 36

MYSTERIES AND DISCOVERIES FROM THE CHANDRA PLANETARY NEBULAE SURVEY (CHANPLANS)Rodolfo Montez Jr.¹, Joel Kastner².¹*Vanderbilt University, Nashville, TN*, ²*Center for Imaging Science, Rochester Institute of Technology, Rochester, NY*.

Planetary nebulae (PNe) are the ejected shells of glowing material formed during the late stages in the evolution of sun-like stars. Observations of PNe taken by NASA's Chandra X-ray satellite observatory have ushered in a new wave of discoveries and mysteries in this class of evolved stars. The X-ray emission detected from PNe comes in 2 flavors: compact sources in the vicinity of the central star and extended sources that fill the nebular cavities. The latter variety, called hot bubbles, are chemically enriched with helium-shell burning products (C, O, and Ne), and their temperatures seem to be regulated by heat conduction across the bubble-nebula interface. Perhaps more exotic are the unexpected compact sources at PNe central stars. Their relatively hard X-ray spectral energy distributions cannot be explained by blackbody-like emission from the hot central stars but, instead, suggest the presence of even hotter thermal plasmas. The origin of this plasma emission may be coronae of binary companions, NLTE photospheric emission from the central proto white dwarfs, low-level accretion, or shocks in the chemically enriched stellar wind. We are uncovering and investigating all of these phenomena via the Chandra planetary nebulae survey (ChanPlaNS), a volume-limited archival and multiyear survey of planetary nebulae in the solar neighborhood. We present the highlights from our analysis and results and the promising prospects afforded by ChanPlaNS.

Ballroom C - 45

HOW DO BLACK HOLES GET THEIR GASJillian Bellovary¹, Alyson Brooks², Fabio Governato³.¹*Vanderbilt University, Nashville, TN*, ²*Rutgers University, Piscataway, NJ*, ³*University of Washington, Seattle, WA*.

Using a set of zoomed-in cosmological simulations of massive high-redshift galaxies, we isolate and trace the history of gas accreted by central, supermassive black holes. We determine the origins of the accreted gas in terms of whether it entered the galaxy during a merger event or was smoothly accreted. Furthermore, we designate whether the smoothly accreted gas is accreted via a cold flow or is shocked on entry into the halo. For moderate-mass (10^6 - 10^7 solar masses), black holes at redshift z_4 , there is a slight preference for accreting cold flow gas over gas of shocked or merger origin. However, this result is a consequence of the fact that the entire galaxy has a higher fraction of gas from cold flows. In general, each black hole tends to accrete the same fractions of smooth- and merger-accreted gas as is contained in its host galaxy, suggesting that once gas enters a halo it becomes well mixed, and its origins are erased. We find that the angular momentum of the gas on halo entry is a more important factor: black holes preferentially accrete low angular momentum gas regardless of whether it was accreted smoothly or through mergers.

CHEMISTRY (EXCEPT BIOCHEMISTRY)

Ballroom C - 29

MONODISPERSE GOLD NANOPARTICLES SUPPORTED BY RICE HUSK SILICA FOR HETEROGENEOUS CATALYSISYan Li, Davontae Habbit, Luyi Sun.*Texas State University-San Marcos, San Marcos, TX*.

Gold nanoparticle (Au NPs)-based catalysts have received more and more attention in the past 2 decades because of unique catalytic properties for many important industrial processes. Both the experimental findings and theoretical predictions demonstrate that the size of Au NPs plays a crucial role in governing the catalytic activity, and the smaller Au NPs exhibit higher catalytic activity. Here, we report an operationally simple method to synthesize Au NP-based heterogeneous catalyst using silica from rice husks (RHs) as a support. Although silica-supported Au NPs have been

extensively studied, the chemical TEOS was usually used as the silica precursor. Notably, in this study, silica from RHs, byproducts from rice production, were first used as the silica source. Silica obtained by calcining HCl-treated RHs was first modified by (3-aminopropyl)triethoxysilane (APTES), which was found to play a dual role: absorb the Au precursor (AuCl_4^-) to the silica surface and stabilize the resultant Au NPs obtained by reducing AuCl_4^- using sodium borohydride (NaBH_4). Characterizations of the nanostructures reveals that Au NPs are formed with a uniform, narrow-size distribution around 1 - 5 nm, which is very critical for essential catalytic activities. The catalyzed reduction of 4-nitrophenol with NaBH_4 was also studied.

PHYSICS (EXCEPT BIOPHYSICS)

Ballroom C- 37

MODELING LASER-TISSUE INTERACTIONS: IMPLEMENTING THE HEAT DIFFUSION EQUATION AND WAVE EQUATION TO SIMULATE THERMAL INTERACTION OF ABSORBER DISTRIBUTIONS IN BIOLOGICAL TISSUES

Frederick Barrera, Elharith Ahmed, Patrick Nash, Dhiraj Sardar.
University of Texas at San Antonio, San Antonio, TX.

The tracking of photons through turbid media (e.g., tissues) has been studied extensively from an experimental vantage point. These turbid media are difficult to characterize since their components are exceedingly variegated and present many challenges to clinicians who require models that precisely predict the location and time evolution of energy deposition. Furthermore, the interaction of the turbid media sample with the source of radiation typically involves many dynamic mechanisms (e.g., photothermal). Using diffuse light transport and an electromagnetic wave approach (i.e., Maxwell's equations), an analysis of thermal energy distribution in tissues is performed. Assuming a highly absorbing chromophore model of melanosomes in tissues, a comparison of the variation of thermal energy by temperature profiles is determined for different collections of melanosome spatial distributions.

Ballroom C - 85

STRUCTURE ANALYSIS OF NATURAL COMPOSITE BIOMATERIALS

Francisco Ruiz Zepeda, Miguel Jose Yacaman.
University of Texas at San Antonio, San Antonio, TX.

Natural self-assembled structures are the inner layer of many species of mollusc shells. The primary purpose is protecting the mollusc's soft bodies from their predators. The structures are made from an arrangement of aragonite crystal platelets separated by an organic matrix. In this work, a characterization of the structure and morphology of seashell samples is done by electron microscopy. The samples are prepared by mechanical polishing and ion milling. The aim of this study is to understand the biomineralization mechanism that nature uses to generate the self-assembled nanocomposite.

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