WELCOME to the 44th Annual West Coast Biological Sciences Undergraduate Research Conference!

April 6th, 2019 • 7:30 a.m. - 5:45 p.m.

University of San Diego

www.sandiego.edu/cas/biology/wcbsur-conference/

The 44th WCBSUR Conference in 2019 will mark the first time the University of San Diego serves as the host. We are proud to join the ranks of the many fine colleges and universities of the western states who have had this honor. Thank you for visiting us in sunny San Diego!

In 1976, Dr. William Eisinger, a professor of biology at Santa Clara University, founded the WCBSUR Conference. The goals of the WCBSUR Conference are as follows:

- **To provide a forum for undergraduate researchers to present original data they have generated in biology and related fields**
- **To foster intercollegiate interactions among students and faculty who share a commitment to undergraduate research in the biological sciences**

This year, more than 200 abstracts were submitted by students across a broad range of disciplines. We encourage you to visit students as they present their research in poster and oral presentations. The research presented today addresses a variety has the potential to make real contributions to knowledge and practice.

Congratulations to all the student presenters and faculty members participating in this year's West Coast Biological Sciences Undergraduate Research Conference. Thank you!

…And in 2020 please join us at Loyola Marymount University for the 45th Annual WCBSUR Conference.

Schedule of Events:

7:30 a.m. – 9:30 a.m.	**Check-In/Registration and Breakfast**
8:15 a.m. – 8:30 a.m.	**Welcome and Announcements**
9 a.m. – 10:30 a.m.	**Oral Presentations I**
11 a.m. – 12 p.m.	**Keynote Address, Dr. Rob Knight (UCSD)** *Our Dynamic Microbiomes and Gut Health*
12:15 p.m. – 1:45 p.m.	**Lunch**
12:15 p.m. – 1:15 p.m.	**Poster Session I (odd-numbered posters)**
1:30 p.m. – 2:30 p.m.	**Poster Session II (even-numbered posters)**
3 p.m. – 4:30 p.m.	**Oral Presentations II**
4:45 p.m. – 5:45 p.m.	**Awards and Closing Remarks**

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Biology Department

Thank you for your interest and support of undergraduate research!

Dr. Rob Knight

Keynote Address: *Our Dynamic Microbiomes and Gut Health*

We are happy to announce that our Keynote Speaker for the WCBSUR Conference will be Dr. Rob Knight. Dr. Rob Knight is the founding Director of the Center for Microbiome Innovation and Professor of Pediatrics, Bioengineering and Computer Science & Engineering at UC San Diego. Before that, he was Professor of Chemistry & Biochemistry and Computer Science in the BioFrontiers Institute of the University of Colorado at Boulder, and an HHMI Early Career Scientist. He is a Fellow of the American Association for the Advancement of Science and of the American Academy of Microbiology. He received the 2017 Massry Prize for his microbiome research. In 2015, he received the Vilceck Prize in Creative Promise for the Life Sciences. He is the author of "Follow Your Gut: The Enormous Impact of Tiny Microbes" (Simon & Schuster, 2015), coauthor of "Dirt is Good: The Advantage of Germs for Your Child's Developing Immune System (St. Martin's Press, 2017) and spoke at TED in 2014. His lab has produced many of the software tools and laboratory techniques that enabled high-throughput microbiome science, including the QIIME pipeline (cited over 12,000 times as of this writing) and UniFrac (cited over 7000 times including its web interface). He is co-founder of the Earth Microbiome Project, the American Gut Project, and the company Biota, Inc., which uses DNA from microbes in the subsurface to guide oilfield decisions. His work has linked microbes to a range of health conditions including obesity and inflammatory bowel disease, has enhanced our understanding of microbes in environments ranging from the oceans to the tundra, and made high-throughput sequencing techniques accessible to thousands of researchers around the world.

ORAL PRESENTATIONS AT-A-GLANCE

(9:30am) COMPUTATIONAL ANALYSIS OF THE RELATIONSHIPS BETWEEN MOBILE GENETIC ELEMENTS, ACCESSORY GENES, AND PLASMID BACKBONE GENES
Mariele Lensink*, Zac Lindsey, (David Cummings and Ryan Botts)

(9:45am) DNA METHYLATION DYNAMICS ACROSS MULTIPLE STEM CELL LINES
Ahmed Adewale Oyetunde, Colin P. Farrell, Cindy Malone, Matteo Pellegrini

(10:00am) MASSIVELY PARALLELED GENOMIC SEQUENCING ON WIDE VARIETY OF CANCERS
Andrew Moradzadeh, Dr. David Berz, Dr. Shirin Birjandi

(10:15am) NUCLEI ISOLATION AND CHROMOSOME CONFORMATION STUDY ON MOUSE CORTEX
Jaanu Gulrajani [1], Jiani Yin [2], Jerry S Huang [2], Cindy S Malone [1], and Daniel H Geschwind [2]

MORNING ORAL PRESENTATIONS, SESSION 5: MICROBIOLOGY
[SCST 130]…… 20

(9:00am) ANAEROBIC MICROBIAL BIOREMEDIATION OF CRUDE OIL
Erin Su*, (Edward Crane, Andre Cavalcanti)

(9:15am) CHARACTERIZATION OF A BACTERIOPHAGE THAT DISPLAYS INFECTIVITY TOWARDS FOUR OF THE FIVE MAJOR DISEASE CAUSING SALMONELLA
Yuendie Guridie*, Victoria Chavez*, Courtney Rundio*, Alexander Earle and Taylor Steele (Michael McConnell and Ryan Botts)

(9:30am) CHARACTERIZATION OF CULTIVATABLE ARSENIC RESISTANT BACTERIA FROM BLACK MOUNTAIN OPEN SPACE PARK.
Elena Bettale*, (Terry Bird)

(9:45am) TESTING THE ROLE OF A CONSENSUS SEQUENCE FOR CHVI-DEPENDENT GENE REGULATION IN THE NITROGEN-FIXING BACTERIUM *SINORHIZOBIUM MELILOTI*
Jesus A. Ortega*, Francesca M. Dela Cruz, and (Esther J. Chen)

(10:00am) TARGETING CLOSELY RELATED STRAINS OF RHODOSPIRILLUM CENTENUM IN RESPONSE TO PREDATORY THREAT
Alexandria Luong*, (James Berleman)

(10:15am) MICROEVOLUTIONARY DEVELOPMENT OF MYXOCOCCUS XANTHUS: AN INVESTIGATION OF PREDATORY PROCESSES
Zlatas Serebnitskiy*, (James Berleman)

MORNING ORAL PRESENTATIONS, SESSION 6: NEUROBIOLOGY AND BEHAVIORAL BIOLOGY I
[SCST 230]…… 22

(9:00am) CYCLIC AMP PROTECTS NEURONAL CELLS FROM BETA-AMYLOID-INDUCED TOXICITY VIA 67 KDA LAMININ RECEPTOR
Charlotte Y.H. Lin*, (Rayudu Gopalakrishna)

(9:15am) EPIGALLOCATECHIN-3-GALLATE PREVENTS BETA-AMYLOID UPTAKE AND NEURONAL CELL DEATH
Seolyn Yang*, Calvin Le, Charlotte Lin, (Rayudu Gopalakrishna)

(9:30am) FUSION BRAIN ORGANOIDS DEMONSTRATE COMPLEX NEURAL NETWORK AND OSCILLATORY ACTIVITIES
Arinnae Kurdian, Osvaldo A. Miranda, Ranmal A. Samarasinghe, Momoko Watanabe, William E. Lowry, Istvan Mody, Cindy Malone, and Bennett G. Novitch

(9:45am) HIGH EXPRESSION OF TFAP2C AND KLF5 PREDICT CEREBRAL ORGANOID DIFFERENTIATION
Felix Turcios, Momoko Watanabe, Cindy Malone, Bennett Novitch

(10:00am) NEW METHODS FOR MODULATING THE SENSITIVITY AND BRIGHTNESS OF VOLTAGE SENSITIVE DYES
Dong Min (Sam) Mun*, Ben Raliski, (Evan W. Miller)

(10:15am) NOVEL PROGENITOR MARKER IMPLICATED IN INTELLECTUAL DISABILITY
Damon Polioudakis, Luis de la Torre-Ubieta, Justin Langerman, Andrew G. Elkins, Xu Shi, Jason L. Stein, Celine K. Vuong, Susanne Nichterwitz, Melinda Gevorgian, CarliK. Opland, Daning Lu, William Connell, ElizabethK. Ruzzo, Jennifer K. Lowe, Tarik Hadzic, Flora I. Hinz, Shan Sabri, William E.Lowry, Mark B. Gerstein, Kathrin Plath, Daniel H. Geschwind

AFTERNOON ORAL PRESENTATIONS, SESSION 7: ANATOMY, PHYSIOLOGY AND DEVELOPMENTAL BIOLOGY II

(3:00pm) THE EFFECT OF PTEROSTILBENE ON G6PD ACTIVITY AND LIPID PEROXIDATION IN THE RED BLOOD CELL
Mariah Richins and Jennifer Meyer

(3:15pm) DETERMINING THE LOWER LIMIT OF SENSITIVITY IN HSV-2 PLAQUE FORMING UNIT ASSAYS
Khadija Shafiq

(3:30pm) DIFFERENTIATION OF hESCs INTO OPCs TO MODEL GBM TUMORS IN VIVO AND STUDY THE EFFECTS OF ROS ON OPC GROWTH
Amir Gerami, Mineli Harteni, Kirsten J. Ludwig, Alvaro G. Alvarado, Michael C. Condro, Steven A. Goldman, Cindy S. Malone, Harley I. Kornblum

(3:45pm) CHANGES IN NOGO-RECEPTOR INTERNALIZATION IN THE PRESENCE OF GREEN TEA POLYPHENOLS (EGCG) AND cAMP
Alexandra Hicks, Rayudu Gopalakrishna , Aubree Mades , Charlotte Lin , Julie Nguyen , Seolyn Yang , William J Mack

(4:00pm) CHARACTERIZATION OF THE POLYMERIC IMMUNOGLOBULIN RECEPTOR IN LEUCORAJA ERINACEA
James Ricketts*, (Valerie Hohman)

(4:15pm) REGULATION OF T CELL RESPONSES TO ZIKA VIRUS INFECTION THROUGH THE TUMOR NECROSIS FACTOR SUPERFAMILY MEMBERS OX40 AND GITR
Rebecca Salgado*1, 2, (Kristopher Koudelka)1 (Sujan Shresta)2, 1

POSTER PRESENTATIONS AT-A-GLANCE

Oral Presentations

Morning Oral Presentations, Session 1: Anatomy, Physiology and Developmental Biology I

[Chair TBD, SCST133]

(9:00am) NUCLEUS ACCUMBENS-PROJECTING MELANIN-CONCENTRATING HORMONE NEURONS PROMOTE PALATABLE FOOD INTAKE

Rae Lan* (Scott E Kanoski)

University of Southern California

Melanin concentrating hormone (MCH) is a neuropeptide that increases feeding, but the mechanisms and sites of action are largely uncharacterized. Here we provide evidence for the nucleus accumbens (ACB) as a downstream target of MCH neurons effects on palatable feeding behavior. Our immunochemistry data reveals the presence of MCH axon terminals in the ACB, while fluorescent in situ hybridization demonstrates ACB MCH1R-expressing neurons that co-express the dopamine receptor D2R. In male rats, activation of the ACB-projecting MCH neurons using a dual viral vector approach increased palatable food intake, but had no effect on bland rodent chow. Furthermore, these effects were sex specific, as activation of ACB-projecting MCH neurons had no effect on intake of either food type in female rats. Overall, our findings elucidate the sex-dependent behavioral actions of a specific projection pathway of MCH neurons on palatable feeding behavior, and implicate a putative interaction with the ACB dopamine system.

(9:15am) TOXIC EFFECTS OF BPA, BPAF, AND ESTRADIOL ON EARLY EMBRYO DEVELOPMENT AND SURVIVAL

Emry R. Cohenour, Anyssa R. Dominguez, M. Schuh

Saint Mary's College of California

Bisphenol A (BPA) is a plasticizer used in the production of plastics. It is an endocrine-disrupter affecting reproductive and developmental processes across species. Next-generation BPA analogs such as bisphenol AF (BPAF), are now being used in “BPA-free” products. We analyzed the dose-dependent effects of BPA, BPAF, and 17b-estradiol on *Xenopus laevis* development and survival. Embryos were exposed to various concentrations of the chemicals or control media for 96 hours. We found BPA and BPAF caused severely disrupted cleavage divisions within the first 1–6 hrs of development. Most BPAF-treated embryos did not survive past 24 hours, with only 0–1% survival at 96 hours. Environmentally relevant doses of BPAF resulted in flexures of the spinal cord, shorter body axis, gut defects, craniofacial malformations, and severe mortality (LC50 = 0.013 mM). BPA induced similar defects, but was less potent and toxic (LC50 = 10.7 mM). Estradiol caused less severe, characteristic defects. Notably, BPAF was 1,000-times more toxic and potent than BPA. These findings underscore the greater toxicity of the replacement chemical BPAF, show that BPA and BPAF act through some but not all estrogenic pathways, and highlight the negative implications these plasticizers may have on human development.

(9:30am) DISEASE MODELING AND THERAPEUTIC APPROACHES FOR CHRONIC INTESTINAL PSEUDO-OBSTRUCTION (CIPO)

Gilbert Mendez, Sergio Solorzano, and Martin G. Martin

University of California, Los Angeles

Chronic Intestinal Pseudo-Obstruction (CIPO) is a rare monogenic disorder that affects the peristaltic movement of luminal content in the gastrointestinal tract (GI), which results in severe life-long disabling condition. Most patients with the monogenic form of CIPO present clinically as neonates severe vomiting, constipation, abdominal distension and pain. Those with the severe form are unable to meet their normal caloric requirements and usually rely on life-long parenteral nutrition. Our laboratory and others have found that the most common gene associated with CIPO is smooth muscle gamma actin, or ACTG2, which is required for normal intestinal peristalsis (muscular contractions and relaxation). We believe that mutations of ACTG2 affect the function of smooth muscle cells (SMCs), resulting in abnormalities of intestinal contractility. Restoration of impaired SMC function is a potential therapy for children with CIPO and it is our long-term goal. The current goal of this study is to use advanced genetic methods to create and rescue human SMCs with ACTG2 mutations in induced pluripotent stem cell (iPSC) lines. To reach this goal, we chose to develop an iPSCs line from a patient containing the ACTG2 p.Arg178Ser mutation due to its unique phenotype – muscularis mass is dramatically thicker than a normal or other CIPO intestine. We have designed several CRISPR gRNAs that target the Arg178Ser variant, which is located in exon 6, and have assessed their cutting efficiency on HEK293T cells. We will then evaluate whether specific mutations of ACTG2 alters the cell cycle including proliferation and survival, and contraction of SMCs following in vivo implantation in NOD-SCID-IL2Rgnull mice. We believe that this approach may improve our understanding the role of ACTG2 in CIPO, and set the foundation for cell-based therapeutics for patients with CIPO.

(9:45am) METASTATIC BREAST CANCER CELLS RELEASE LCN2 TUMOR-SUPPORTIVE PREMETASTATIC LUNG MICROENVIRONMENT

Kayla Meade, Francesca Sanchez, Analine Aguayo*, Nathalie Nadales, Sarkis Hamalian, Toni Uhlendorf, Lisa Banner, (Jonathan A. Kelber)

California State University, Northridge

Cancer metastasis is responsible 95% of cancer-related deaths. Survival and proliferation of cancer cells within distant tissues requires that foreign microenvironments acquire tumor-supportive characteristics through the release of soluble factors and specific cell-cell communications. To further study these complex interactions, we developed a syngeneic murine breast cancer model for elucidating events during premetastatic niche reprogramming. We demonstrate that metastatic mouse PyMT breast cancer cells differentially influence the premetastatic lung and brain, selectively promoting a tumor-supportive lung microenvironment. We also show that metastatic Py230 cells reprogrammed mesenchymal stem cells (MSCs) to selectively increase anti-inflammatory transcripts in monocytes/macrophages. Finally, we demonstrate that immunoneutralization of up-regulated lipocalin 2 (LCN2) in Py230 conditioned media renders it unable to reprogram the premetastatic lung microenvironment toward a tumor-supportive state. These results demonstrate that MSCs can mediate the anti-inflammatory state within the tumor microenvironment and identify LCN2 as an important therapeutic target for blocking breast cancer progression.

(10:00am) CHARACTERIZATION OF A NOVEL MITOCHONDRIAL PROTEIN

Mikayla R. Sweitzer, Danyun Zhang, Deepa Dabir, Carla Koehler

Loyola Marymount University

Mitochondria are multifunctional organelles, key in maintaining cellular homeostasis. Their biogenesis relies on efficient protein import as most mitochondrial proteins are imported via protein import pathways after synthesis in the cytosol. The yeast MIA pathway specifically imports cysteine-rich proteins into the mitochondrial intermembrane space via a series of disulfide reactions that involves electron transfer, key components of which are Erv1 and Mia40. We have recently identified a new mitochondrial protein, Aim32, as an Erv1-interacting protein. The goal of this research project was to characterize Aim32 using varied biochemical and genetic approaches. Multiple protein sequence alignments along with secondary structure prediction tools reveal that Aim32 is likely a thioredoxin-like [2Fe-2S] ferredoxin protein. [2Fe-2S] ferredoxin proteins typically contain two iron ions that are coordinated by key cysteine residues. To address this, we mutated key cysteine residues in Aim32, C213 and 222, and generated E. Coli strains expressing wild type, and mutant Aim32 protein to study its biochemical properties in vitro. We find that Aim32 indeed coordinates iron. Additionally, we have generated a deletion strain of AIM32 to assess its biological function in vivo. We find that deletion of AIM32 confers extreme sensitivity to hydroxyurea (HU)-induced DNA damage that is not rescued by an oxidant, N-acetyl-cysteine (NAC), suggestive of a role in stress response. We conclude that Aim32 is an iron-sulfur (Fe/S) containing protein that has a protective stress response against HU, and may participate in electron transfer shuttling within the MIA pathway.

(10:15am) THE EFFECT OF PHOSPHORYLATION ON THE ONCOGENIC PROPERTIES OF THE PROTEIN E7 FROM HIGH RISK HPV

Madison Malone*, Kayla Mazza, Ryan Orlando, (Ariane L. Jansma)

Point Loma Nazarene University

The Human papillomavirus (HPV) causes tumors by forcing host cells to divide uncontrollably. While there are 200 serotypes of HPV, 15 are classified as “high risk” and have been shown to transform infected cells into tumor cells. The remaining “low risk” result in benign skin legions. In high risk HPV, oncoprotein E7 significantly enhances cell division. High risk E7 is phosphorylated in cells at two conserved serine residues and this phosphorylation increases binding affinity for cellular partners. While low risk E7 possesses these serines, it is phosphorylated in cells to a lesser degree. When this affinity is decreased, these complexes are less likely to form and E7 is less able to hijack the cell cycle. Using mutagenesis combined with NMR spectroscopy and cell based assays, this project investigates the direct effect of E7 phosphorylation efficiency on cell cycle dysregulation. The goal is to understand the mechanistic reason behind why some serotypes of HPV are able to cause tumorigenesis while others are not.

Morning Oral Presentations, Session 2: Biochemistry and Molecular Biology I

[Chair TBD, SCST129]

(9:00am) IDENTIFICATION OF AVASTIN AND TORISEL AS A SYNERGISTIC ANGIOSTATIC COMBINATION TO TREAT CANCER

Bridget Fortin*, Allison Hale*, Connor Lowey, Amy Rausch, Jeffrey Snowbarger (Michael I. Dorrell and Heidi Woelbern)

Point Loma Nazarene University

Tumor angiogenesis is critical for cancer progression, and blocking tumor vascularization is a promising cancer treatment modality with relatively few side effects. However, angiostatic monotherapies have had limited success in the clinic. Past studies in our lab demonstrated the synergistic effects of a specific combination of angiostatic therapies, but the angiostatics used in that study are not FDA approved. Our current studies focus on identifying combinations of clinically-approved angiostatics that synergistically inhibit tumor vascularization. Using the ex ovo chick chorioallantoic membrane (CAM) model, we combined angistatics at doses that were ineffective as monotherapies. Angiogenesis in glioblastoma tumors was significantly reduced using a double combination consisting of Avastin and Torisel; each monotherapy showed little effect. We further demonstrated that both drugs remained effective at 10-fold reduced concentrations in combination. Combining Avastin and Torisel may help overcome the compensatory mechanisms that prevent monotherapy angiostatics from having clinical success in patients.

(9:15am) DETERMINATION OF ZINC BINDING BY *SM*MAK16, A NUCLEOLAR PROTEIN FROM *SCHISTOSOMA MANSONI*

Courtnee Reaves*, (Jon Milhon)

Azusa Pacific University

The human parasite, *Schistosoma mansoni,* is one of the the causative agents of the devastating disease schistosomiasis which affects more than 200 million people worldwide. *S. mansoni* has been found to encode the nucleolar protein *Sm*MAK16 which is involved in the synthesis of 60s ribosomal subunits. The N-terminal end of the *Sm*MAK16 protein contains four uniquely spaced cysteine amino acids which are conserved between all known *Sm*MAK16 homologues. The function of these cysteine residues is currently unknown, but they are reminiscent of a zinc binding domain. Many RNA binding proteins, like those involved in producing ribosomes, are known to fold by binding zinc atoms. Therefore, it is important to determine if *Sm*MAK16 binds zinc. To accomplish this, *Sm*MAK16 was purified as a GST fusion protein using affinity chromatography. Total protein assays and zinc assays were performed on purified GST-*Sm*MAK16 and GST alone in the presence and absence of zinc. It was determined that the purified GST-*Sm*MAK16 bound zinc ions in a one-to-one molar ratio, while the GST alone bound virtually no zinc. It is suspected that the conserved cysteine residues in the N-terminus of *Sm*MAK16 are responsible for the zinc binding by *Sm*MAK16. Additional constructs containing deletions and substitutions of these cysteines will be used to test this hypothesis.

(9:30am) IMPACT OF PROTEIN TYPE AND MAILLARD CONJUGATION ON NANOEMULSION FORMATION AND STABILITY

Sarah Caballero*, (Gabriel Davidov-Pardo)

California State Polytechnic University, Pomona

Nanoemulsions are systems of nanometric oil droplets dispersed in an aqueous phase and are stabilized by emulsifiers such as proteins. While animal-origin proteins are established for this purpose, there is a growing interest in plant-based proteins, due to their sustainability, allergen-free and vegan labels. However, proteins destabilize in acidic conditions (pH~4.6), limiting their food and beverage applications. This study aims to optimize the pH stability of emulsions made with pea protein (PP) by creating Maillard conjugates (MC) with dextran 40 kDa and to determine the impact of ionic strength and temperature on nanoemulsion stability. Caseinate (control) and PP MC hindered destabilization at pH=4.6, with droplet diameters 123±12 nm and 396±15 nm, respectively, while emulsions made with non-MC proteins flocculated. PP MC nanoemulsions were destabilized by calcium ion addition but remained stable for up to 1 week at 37˚C. This study demonstrates the potential of MC of PP to stabilize nanoemulsions.

(9:45am) IN VITRO ASSEMBLY OF BACTERIOPHAGE LAMBDA PROCAPSID TO ENABLE PAYLOAD ENCAPSULATION FOR TARGETED DRUG DELIVERY

Rachel Culver*, Ashley Julio, (Kristopher J. Koudelka)

Point Loma Nazarene University

The ability to structurally engineer viral nanoparticles makes them a useful platform for targeted drug delivery. The procapsid of bacteriophage lambda is one such structure. The hollow icosahedral structure is made up of multiple copies of three major capsid proteins: gpE (structural), gpNu3 (scaffolding), and gpD (stabilizing), and is amenable to payload encapsulation to allow transportation and delivery of therapeutics. An effective method for encapsulation must be found, because expression of capsid proteins in bacterial cells results in self-assembly of the fully-formed procapsid. Therefore, bacteriophage lambda procapsid can be assembled in vitro in order to allow formation around a payload in solution. In this study, we complete the preliminary steps to in vitro assembly by expressing and purifying gpE. Via western blot analysis, we found that gpE can successfully be expressed via induction of an inducible plasmid, and purified via GST-affinity chromatography.

(10:00am) ASSEMBLY AND SURFACE MODIFICATION OF VIRAL NANOPARTICLES FOR CHEMOTHERAPEUTIC DRUG DELIVERY

Daniela Avila*, Gavin Banning*, Tom Roser, Ashley Julio (Kristopher J. Koudelka)

Point Loma Nazarene University

Chemotherapeutics often target all rapidly dividing cells, resulting in a lack of specificity that causes severe side effects. Bacteriophage lambda procapsids are a viral nanoparticle that, once modified, may alleviate the issue. Transferrin ligands can be attached to the procapsid exterior to target cancerous tissue, and the interior can be modified to encapsulate the drug. These modifications increase specificity, consequently decreasing the amount of drug necessary. This hollow complex has multiple proteins: gpE, gpD, gpB and gpNu3. Procapsid proteins were expressed in vivo via BL21 E. coli and by individual subunits in vitro via GST-isolation, both utilizing recombinant expression. They were purified, extracted, and analyzed using SDS-PAGE and size exclusion chromatography. To explore procapsid surface modification, tyrosine-alkyne conjugation and carboxylate (Glu+Asp)-alkyne conjugation labeling were performed. Tyrosine-alkyne conjugation proved most effective.

(10:15am) SINGLE-DNA MOLECULE STUDY OF BARRIER-TO-AUTOINTEGRATION FACTOR (BAF) PROTEIN BY MAGNETIC TWEEZERS

Lindsay Saber

Whitman College

Barrier-to-autointegration factor (BAF) is a small and highly conserved dimer protein found in eukaryotes. It has various binding targets such as double stranded DNA, lamins, histones and transcription factors. BAF also plays a critical role in nuclear assembly, chromatin organization and gene expression. In prior magnetic tweezer studies, BAF has demonstrated DNA condensation by loop formation in a BAF-DNA complex. My research investigates the strength of these BAF-DNA bonds at a range of applied forces using magnetic tweezers. I performed additional experiments with VRK1, a known phosphorylating agent, as well as mutant BAF dimer. My results suggest that BAF binds quickly and strongly to loosely extended DNA. Phosphorylation of the BAF-DNA complex causes binding to weaken, while use of a mutant dimer shows no significant DNA compaction.

Morning Oral Presentations, Session 3: Ecology and Evolution I

[Chair TBD, SCST232]

(9:00am) PREDATOR-PREY RELATIONSHIPS IN HIGH ELEVATION COSTA RICAN ECOSYSTEMS

Amy Eppert*, Abner Rodriguez, Steven Blankenship, Timothy Wiegman, (Ryan Botts, Mike Mooring)

Point Loma Nazarene University

Understanding predatory-prey relationships is critical for understanding the dynamics of ecosystems and implementing effective conservation efforts. This study investigated whether Neotropical mammalian predators select prey based on relative abundance alone, on a subset of known prey species regardless of abundance, or on a combination of both. Data collected from camera traps located in the Talamanca Cordillera of Costa Rica were used to calculate coefficients of overlapping (Δ) for assessing the similarity of activity patterns between predators and their prey. Likelihood ratio tests were used to compare linear models of the three prey selection methods in which the dependent variable was Δ. Additionally, important prey species were identified for each predator using Δ and the regression slope between prey relative abundance index (RAI) and Δ. The results indicated that most predators selected a subset of prey based on relative abundance, thus using a combination of both predictions.

(9:15am) INVESTIGATING THE EFFECTS OF DECREASED PH ON THE INTERTIDAL SHORE CRABS, HEMIGRAPSUS NUDUS AND PACHYGRAPUS CRASSIPES

Davis, A., Chavez, B., Francisco, RJ., Mauricio, C, (Diara Spain)

Dominican University of California

The Bay Area in Northern California is teeming with marine life. Endemic to the intertidal zone are multiple species of crabs. Research studies on commercial crabs suggest that changes in the acidity of the water, ocean acidification, elicits a physiological response adjusting size and weight. To determine whether this finding is accurate in intertidal crabs we collected *Pachygrapsus crassipes* and *Hemigrapsus nudus* from Half Moon Bay, CA. During a 42 day experiment, crabs were maintained in aquaria with chilled seawater, the control was kept at 8.1 pH while the experimental aquaria averaged a pH of 7.5. Crabs were weighed four times over the course of the experiment. Our results show that most control crabs had small increases in weight, while the experimental crabs experienced fluctuations with their final weight falling within the range of the start weight.

(9:30am) PHENOTYPIC EFFECTS OF COMBINED HEAT STRESS AND STARVATION IN THE RED ABALONE HALIOTIS RUFESCENS

Carissa Romero*, Danielle Nestler*, (Lani Gleason)

California State University Sacramento

Warm water El Niño events can cause mortality for temperature-sensitive marine organisms and the food sources they rely on. One species impacted by heat stress and starvation is the commercially important red abalone *Haliotis rufescens*. This project investigates how El Niño events affect mortality and growth in *H. rufescens*. Juveniles were obtained from three California abalone farms and exposed to three conditions: 1) heat stress plus

high food amounts, 2) heat stress plus medium food amounts, and 3) heat stress plus no food. Mortality was checked daily throughout the 24-day experiments and shell length was measured before and after exposure to treatment conditions to assess growth. Although these experiments are currently underway, we expect the highest mortality and lowest growth in the heat stress plus no food conditions. Ultimately, this research can provide crucial information to maintain *H. rufescens'* survival and its economic value in the face of climate change.

(9:45am) REGIONAL AND LIFE-STAGE SPECIFIC RESPONSES TO HEAT STRESS IN THE MARINE SNAIL CHLOROSTOMA FUNEBRALIS

Lourdes Calisa*, (Lani Gleason)

California State University Sacramento

Increasing global temperatures can have population-specific negative effects on intertidal species such as the snail *Chlorostoma funebralis*. In this study, we compared the heat stress tolerance of *C. funebralis* 1) juveniles from northern and southern California geographic sites, and 2) juveniles and adults collected from the same geographic site. The results indicate that juveniles from southern California suffer significantly lower heat stress mortality than juveniles from northern California. In addition, at the southern California site, juveniles showed significantly higher survival than adults; in contrast, at the northern California site, the survival of juveniles and adults was not significantly different. These data suggest that at some geographic sites, heat tolerance is dependent on the life stage of the individual. Ultimately, understanding how warm temperatures affect different life stages of marine organisms can be used to predict survival rates and help protect vulnerable species in the era of climate change.

(10:00am) THE EFFECT OF FIRE ON SOIL MICROBIAL COMMUNITY DIVERSITY

Kyrra Nielson, (Theresa Rogers)

California Lutheran University

Wildfires disrupt soil ecosystems by deteriorating soil structure, decreasing available nutrients, and altering soil microbial communities. Soil microbial communities are essential for ecosystem function. In this study, soil microbial communities from burned and unburned regions of the Ventura Botanical Gardens were monitored 1, 2, 4, and 6 months after the Thomas Wildfire of 2017. Microbial community DNA was extracted from soil samples, the V4 region of 16S rRNA gene amplified by PCR then sequenced using Illumina ® MiSeq. The sequences will be analyzed using Quantitative Insights into Microbial Ecology 2 (QIIME ™ 2). In the early months after the fire we expect lower soil microbial diversity in burned regions relative to unburned regions. Over time the burned region may reach similar levels of microbial diversity. Understanding microbial community changes as soil recovers from wildfires will aid in the design of ecosystem recovery techniques.

(10:15am) NEW CAMERA TRAP SURVEY REVEALS RARE AND ELUSIVE MAMMALS AT LA AMISTAD INTERNATIONAL PARK, COSTA RICA

Steven Blankenship*, Amy Eppert, Abner Rodriguez, Timothy Wiegman, (Ryan Botts, Mike Mooring)

Point Loma Nazarene University

Jaguar (*Panthera onca*) are the largest Neotropical felid and are declining throughout their range due to habitat fragmentation and illegal hunting. Our team has conducted a camera trap survey of elusive mammalian predators and their prey in the Talamanca mountain range of Costa Rica since 2010. These cameras have historically recorded a low density of jaguar in the high elevation cloud forests of the central Pacific slope. In 2017-2018, we

deployed 20 new cameras on two trails in La Amistad International Park (PILA), a vast area near the Panama border that is largely unstudied due to rugged terrain. The photos coming out of PILA indicate the highest density of jaguar recorded by our survey, as well as the first records of bush dog (*Speothos venaticus*), a rare canid that only recently was confirmed in Costa Rica. The survey indicates the critical importance of this park for jaguar conservation.

Morning Oral Presentations, Session 4: Genetics, Genomics and Proteomics I

[Chair TBD, SCST231]

(9:00am) A BIOINFORMATICS-BASED APPROACH TO IDENTIFY MICROTUBULE INNER PROTEINS

Tess Gunnels* (Brian A. Bayless, Justen B. Whittall)

Santa Clara University

Mutations in motile cilia genes can cause devastating human diseases such as juvenile myoclonic epilepsy (JME). Patients with JME commonly have mutations in RIB72, a gene that encodes a motile cilia structural protein. Rib72 protein serves as a scaffold for microtubule inner proteins or MIPs. From a mass spectrometry screen, we identified 34 MIP candidates for further investigation of their structural and functional identities. We then used a bioinformatics-based approach to determine which of these proteins would make strong candidates for further study. Starting with protein sequences from the ciliate model organism, *Tetrahymena thermophila*, we searched the NCBI protein database for homologous proteins across ~30 other model organisms. Using these data, we looked for correlations with proteins found in other cilia-containing organisms and their absence in organisms that lack cilia and flagella. These findings identified specific proteins as candidates for additional research on microtubule inner proteins.

(9:15am) ASSESSING THE DEVELOPMENT OF SPINAL SENSORY INTERNEURONS USING CRISPR/CAS9 MEDIATED GENE EDITING

Brian Chilin*, Armo Derbarsegian, (Sandeep Gupta, Samantha J. Butler)

University of California, Los Angeles

Spinal cord injuries can result in the loss of somatosensation, the ability to experience the environment. This condition has no cure. Somatosensation is mediated by six classes of dorsal spinal interneurons (dI1-dI6). Towards the goal of a cellular replacement therapy, the Butler laboratory defined conditions to direct mouse and human ESCs towards dorsal interneurons. These studies demonstrated that dI1s (proprioceptors) and dI3s (mechanosensors) are dependent on bone morphogenetic protein (BMP) 4, but did not resolve the underlying signaling mechanism. Canonically BMPs activate the Smad complex of intracellular messengers: Smad1, 5, and 8. Smad1 expression is upregulated in differentiating dIs, suggesting it regulates BMP-mediated dI specification. We are using CRISPR/Cas9 methods to delete Smad1 function in ESCs. Guide RNAs were generated to target exon2 of the Smad1 gene and were validated by genotyping. Smad1-null ESC lines will be now be differentiated to assess the requirement for Smad1 in dI1/dI3 fate specification.

(9:30am) COMPUTATIONAL ANALYSIS OF THE RELATIONSHIPS BETWEEN MOBILE GENETIC ELEMENTS, ACCESSORY GENES, AND PLASMID BACKBONE GENES

Mariele Lensink*, Zac Lindsey, (David Cummings and Ryan Botts)

Point Loma Nazarene University

Antibiotic-resistant bacteria are becoming one of the leading public health threats globally. Although, the presence of plasmid-encoded antibiotic resistance has been both extensively researched and well-documented, the relationships between mobile genetic elements (MGEs), antibiotic resistance genes (ARGs), and plasmid backbone structure have not been well documented. Understanding these relationships would provide important insight into the history of how bacterial plasmids have developed and the potential of plasmid backbones to acquire MGEs and ARGs. This research aims to provide a comprehensive analysis of the relationships between ARGs, MGEs, and plasmid backbone structure. By implementing a computational approach to characterize a large sample of plasmids representative of each incompatibility group, we determined what MGEs and ARGs are most frequently associated with given plasmid backbones as well as common insertion patterns.

(9:45am) DNA METHYLATION DYNAMICS ACROSS MULTIPLE STEM CELL LINES

Ahmed Adewale Oyetunde, Colin P. Farrell, Cindy Malone, Matteo Pellegrini

University of California, Los Angeles

DNA methylation is an epigenetic modification that contributes to the multipotency and undifferentiated state of stem cells. How these contributions change across different stem cell lines and how these changes affect stem cells during differentiation is not completely characterized. Here, we aim to profile the methylation state of human stem cell lines using data collected on the Illumina 450K DNA methylation array. To this end, we assembled DNA methylation data, from 30 independent experiments, deposited on Gene Expression Omnibus (GEO). We observe a distinct clustering of precursor cells with their differentiated cell types. With this data set, we aim to analyze differential methylation regions and changes in methylation levels across various stem cell lines and also within each stem cell line as they undergo differentiation.

(10:00am) MASSIVELY PARALLELED GENOMIC SEQUENCING ON WIDE VARIETY OF CANCERS

Andrew Moradzadeh, (Dr. David Berz, Dr. Shirin Birjandi)

University of Southern California

Genomic sequencing has provided an immense amount of information to help medical professionals treat their patients and understand concepts relating to the etiology of diseases. Diseases such as cancer have begun to implement genomic sequencing data to determine the cause of particular malignancies. Our work has examined sequencing data on patients who have been diagnosed with varying types of cancer at different stages. We have used DNA sequencing data gathered via Tempus to elucidate correlations. Current data has determined that 56.5% of patients, who were sequenced and had some form of adenocarcinoma, expressed the TP53 mutation. In correlation to this, all patients in the cohort whom were found to be PD-L1 positive, were expressing the TP-53 mutation. This prospective genomic sequencing study can be useful for understanding why certain populations develop particular malignancies and the underlying mutations behind them. As advancement in cancer research has moved towards individualized therapies, genomic sequencing data paired with patient age, sex, and cancer type can lead to future targeted therapies.

(10:15am) NUCLEI ISOLATION AND CHROMOSOME CONFORMATION STUDY ON MOUSE CORTEX

Jaanu Gulrajani [1], Jiani Yin [2], Jerry S Huang [2], (Cindy S Malone [1], and Daniel H Geschwind [2])

California State University Northridge

The eukaryotic genome is tightly packaged into nucleus of every cell, it's unique 3D spatial organization is closely linked to gene expression and cell state 1. By defining 3D chromatin contacts, Hi-C helps to elucidate the physical interactions between genes, enhancers, and other regulatory elements. We set out to implement a new pipeline for studying chromatin conformation in frozen samples by first, isolating nuclei from a mouse cortex (n=1), followed by fluorescence-activated nuclei-sorting (FANS) to separate neuronal (64%) from non-neuronal nuclei (35%). In situ Hi-C was then performed on the non-neuronal population and the DNA library was sent for paired-end sequencing. We used FastQC for quality assessment of the raw sequencing reads and observed high average quality (Phred) scores across all bases. Juicer was then used for Hi-C data analysis and revealed 17.5% inter-chromosomal, 16.26% short and 35.36% long-range intra-chromosomal interactions, which was similar to a benchmark Hi-C library 4. The successful implementation of nuclei isolation, FANS sorting, and in-situ Hi-C methods allowed for the identification of genome-wide chromosomal interactions in mouse samples. We are interested in further applyingthis pipeline to human samples to better understand disease etiology.

Morning Oral Presentations, Session 5: Microbiology

[Chair TBD, SCST130]

(9:00am) ANAEROBIC MICROBIAL BIOREMEDIATION OF CRUDE OIL

Erin Su*, (Edward Crane, Andre Cavalcanti)

Pomona College

Microbial bioremediation can potentially be used for restoring petroleum-contaminated environments (Varjani and Upasani, 2012). Using microorganisms, the harmful hydrocarbons in petroleum can be degraded into more innocuous compounds (Borah and Yadav, 2016). Most bioremediation research has centered around aerobic environments, but anaerobic remediation should also be explored to allow remediation of other oxygen-deprived environments (Yuniati, 2018). This project therefore focuses on anaerobic culturing of microbes, and selecting for those with the ability to degrade petroleum using a variety of electron acceptors, including sulfur. Microbes from the Salton Sea and the Bernard Field Station's pHake Lake, environments that have and have not, respectively, been exposed to petroleum, were cultured. This project's goals were to compare and contrast these given environments and their potential to naturally overcome petroleum contamination. Through DNA extraction, and subsequent 16s rRNA sequencing and metagenomics, the selected-for microbes and their hydrocarbon degradation pathways, are identified.

(9:15am) CHARACTERIZATION OF A BACTERIOPHAGE THAT DISPLAYS INFECTIVITY TOWARDS FOUR OF THE FIVE MAJOR DISEASE CAUSING SALMONELLA

Yuendie Guridie*, Victoria Chavez*, Courtney Rundio*, Alexander Earle and Taylor Steele (Michael McConnell and Ryan Botts)

Point Loma Nazarene University

In 1972, Myron Levine used chemical mutagenesis to create a derivative of bacteriophage P22 he named P22virB-3. Unlike its parental phage, P22virB-3 infected lysogenic *Salmonella typhimurium* bacteria carrying P22 prophage. Levine showed that this extended host range phenotype was associated with two mutations he called K5 and Vx. We have extended Levine's host range studies by showing that in addition to infecting P22-lysogenized *S. typhimurium* cells belonging to serogroup B, P22virB-3 also infects Salmonella strains belonging to serogroups A, D and E; serogroup C strains are resistant. Sequencing of the P22virB-3 genome has revealed the base pair changes associated with Levine's K5 and Vx mutations and has also uncovered a mutation in the gene coding for P22virB-3's tail fiber protein. We will describe this tail fiber alteration and offer a model for how it enables P22virB-3 to infect strains belonging to four of the five major Salmonella serogroups that cause human illnesses.

(9:30am) CHARACTERIZATION OF CULTIVATABLE ARSENIC RESISTANT BACTERIA FROM BLACK MOUNTAIN OPEN SPACE PARK.

Elena Bettale*, (Terry Bird)

University of San Diego

Arsenic (As) is a ubiquitous naturally occurring element. This metalloid is highly toxic and its dispersal in the environment represents an increasing threat to the organisms living in it. Arsenic-resistant bacteria have developed strategies to resist to the stress of this metal. Arsenic-rich soils were detected in San Diego County at the Black Mountain Open Space Park. This study focuses on the characterization of the cultivable bacteria presenting As resistance properties at this site. It is hypothesized that extreme exposure to an arsenic-rich environment has contributed to the evolution of species that possess favorable traits towards As resistance. Our findings show evolutionary diversity among the isolated species. Some species presented the ability to employ As as a source of energy. Screening for As resistance gene *arsC* was performed and phylogenetic comparison of the 16S rRNA tree with the *arsC* gene tree will allow us to determine HGT occurrence within the microbial community.

(9:45am) TESTING THE ROLE OF A CONSENSUS SEQUENCE FOR CHVI-DEPENDENT GENE REGULATION IN THE NITROGEN-FIXING BACTERIUM *SINORHIZOBIUM MELILOTI*

Jesus A. Ortega*, Francesca M. Dela Cruz, and (Esther J. Chen)

California State University, Fullerton

Sinorhizobium meliloti forms an endosymbiotic relationship with legume plant hosts, providing plants with biologically available nitrogen. The conserved ExoS/ChvI two-component signaling pathway is necessary for gene regulation for transitioning between the symbiotic and free-living states of *S. meliloti*. Previous work in our laboratory identified upstream of ChvI target genes, a 15-bp consensus sequence, hypothesized to be important for gene regulation by ChvI. We tested the importance of this motif for ChvI-dependent gene regulation by using site-directed mutagenesis to make substitution or deletion mutations in the motifs upstream of the *exoY* and SMc00084 genes. GUS fusion constructs harboring the mutated motifs upstream of both genes were introduced into the genome of *S. meliloti*. We observed a large decrease in GUS expression in *S. meliloti* strain mutants. Our findings suggest that the 15-bp consensus sequence is important for regulation of the *exoY* and SMc00084 genes by ExoS/ChvI.

(10:00am) TARGETING CLOSELY RELATED STRAINS OF RHODOSPIRILLUM CENTENUM IN RESPONSE TO PREDATORY THREAT

Alexandria Luong*, (James Berleman)

Saint Mary's College of California

Targeted single gene mutations are valuable research tools, as they reveal the specific impact of a single gene in a process. It is also possible to see the impact of single gene mutants on communities, revealing phenomena such as intercellular communication that signals a warning to the community. *Myxococcus xanthus* and *Rhodospirillum centenum* are model bacterial organisms for cell development research. *M. xanthus* is a predator that can eliminate species such as *E. coli,* but some *R. centenum* cells encyst in response to predation while vegetative cells are lysed. During this process, guanylyl cyclase is activated and R. centenum secretes cGMP to surrounding cells. Guanylyl cyclase mutants are rescued by mixing with exogenous cGMP or cGMP+ strains. This research uses qPCR and predation techniques to observe the impact of intercellular cGMP communication between microbial strains.

(10:15am) MICROEVOLUTIONARY DEVELOPMENT OF MYXOCOCCUS XANTHUS: AN INVESTIGATION OF PREDATORY PROCESSES

Zlatas Serebnitskiy*, (James Berleman)

Saint Mary's College of California

Myxococcus xanthus is a predatory member of the soil microfauna, able to lyse fungi, achaea, and both Gram-positive and Gram-negative bacteria. During predation, *M. xanthus* deploys anti-microbial secondary metabolites and changes cell behavior to form rippling wave structures for effective predation. With the current threat of antibiotic-resistant bacteria, research into antibiotic resistance and susceptibility is needed in order to benefit better health outcomes. Through the propagation of distinct *M. xanthus* lineages within lab-controlled predator-prey environments, lab evolution was observed for the impact on efficiency of predation. Over 2000 generations have passed so far, with dramatic changes in predatory ability as well changes to other phenotypes and behaviors. Further examination of *M. xanthus* optimal predation under certain stressed settings was also done to further improve predation assays. Genomic analyses of evolved strains are projected for later this year.

Morning Oral Presentations, Session 6: Neurobiology and Behavioral Biology I

[Chair TBD, SCST230]

(9:00am) CYCLIC AMP PROTECTS NEURONAL CELLS FROM BETA-AMYLOID-INDUCED TOXICITY VIA 67 KDA LAMININ RECEPTOR

Charlotte Y.H. Lin*, (Rayudu Gopalakrishna)

University of Southern California

Alzheimer's disease (AD) is the most common neurodegenerative disease and is categorized by neuronal cell death. The prevailing hypothesis is that beta-amyloid is internalized by binding to 67kDA Laminin Receptor (67LR) to cause neuronal cell death, thus playing a role in the pathogenesis of AD. Cyclic AMP (cAMP) has been shown to

protect neuronal cells from beta-amyloid-induced cell death; however, its mechanism is unknown. Dibutryl cAMP, a cell-permeable analog of cAMP, causes the internalization of 67LR and prevents beta-amyloid internalization and neurotoxicity. Furthermore forskolin, which activates adenylyl cyclase thus producing cAMP, also protects neuronal cells. Rolipram, which elevates cAMP by inhibiting cyclic nucleotide phosphodiesterase, also decreases beta-amyloid toxicity. cAMP elevating agents are unable to protect neuronal cells from beta-amyloid in protein-kinase A (PKA)-deficient cells, suggesting that PKA plays a role in protecting cells. Therefore, cAMP elevating agents may be useful in the prevention and treatment of AD.

(9:15am) EPIGALLOCATECHIN-3-GALLATE PREVENTS BETA-AMYLOID UPTAKE AND NEURONAL CELL DEATH

Seolyn Yang*, Calvin Le, Charlotte Lin, (Rayudu Gopalakrishna)

University of Southern California

Previous studies show that β-amyloid, a peptide strongly implicated in Alzheimer's disease, enters neuronal cells either through directly binding to a cell surface receptor called 67kDa laminin receptor (67LR), or by associating with prions that bind to 67LR. Furthermore, it is known that epigallocatechin-3-gallate (EGCG), an active ingredient of green tea polyphenol, also binds to 67LR and induces receptor internalization, contrary to its conventionally accepted function as an antioxidant. We hypothesize that EGCG competes with β-amyloid for its binding to 67LR. Due to the EGCG-induced 67LR internalization, both the binding and uptake of β-amyloid are inhibited, thus preventing β-amyloid induced neurotoxicity. Neuroscreen-1 cells treated with low concentrations of EGCG showed a decrease in the cellular uptake of fluorescent-labeled human β-amyloid peptide and, therefore, a greater inhibition of toxicity. We conclude that 67LR is an important neuroprotective receptor that could be targeted in drug development to ultimately protect against Alzheimer's disease.

(9:30am) FUSION BRAIN ORGANOIDS DEMONSTRATE COMPLEX NEURAL NETWORK AND OSCILLATORY ACTIVITIES

Arinnae Kurdian, Osvaldo A. Miranda, Ranmal A. Samarasinghe, Momoko Watanabe, William E. Lowry, Istvan Mody, Cindy Malone, and Bennett G. Novitch

University of California, Los Angeles

Human brain organoids are 3D culture systems created from human embryonic or induced pluripotent stem cells. This new platform recapitulates unique aspects of human brain development; providing novel insights into human neurological diseases. However, much of the current literature on brain organoids has focused on identifying pathological changes in organoid structure as a means to model developmental brain disorders There has been less focus on organoid physiological activity or network architecture. Using two photon based calcium imaging and extracellular recording of local field potentials, we show that cortex-ganglionic eminence "fusion" organoids, in which the excitatory and inhibitory neurons integrate, have unique patterns of calcium network activation and sustained low frequency oscillations. Together, these data suggest that excitatory-inhibitory fusion organoids have unique and complex neural circuit activities. Further understanding of the underlying mechanism of these physiological activities allow fusion organoids to provide novel insights into human brain disease.

(9:45am) HIGH EXPRESSION OF TFAP2C AND KLF5 PREDICT CEREBRAL ORGANOID DIFFERENTIATION

Felix Turcios, Momoko Watanabe, Cindy Malone, Bennett Novitch

California State University, Northridge

Defects in brain development underlie neurological diseases; yet, the critical mechanisms are not understood. Efforts to investigate these mechanisms utilize animal models. However, the human brain has distinct features from other species. Evidence suggests that these human-specific features may be impacted, illustrating the need for human-specific models. One model involves directing human pluripotent stem cells (hPSCs) to form structures termed organoids. Cerebral organoids recapitulate aspects of human fetal brains. Our lab previously developed a reproducible and efficient protocol to generate cerebral organoids. The success of cerebral organoid differentiation is influenced by the maintenance of hPSCs. We seek to identify the key factors that impact neural differentiation to improve outcomes. Transcriptional analyses showed that hPSCs yielding the best organoids displayed elevated expression of TGF-beta superfamily signaling molecules and genes associated with naïve pluripotency. Identifying these molecules will yield effective protocols for optimizing cerebral organoids to elucidate human neurological disease mechanisms and accelerate drug discovery.

(10:00am) NEW METHODS FOR MODULATING THE SENSITIVITY AND BRIGHTNESS OF VOLTAGE SENSITIVE DYES

Dong Min (Sam) Mun*, Ben Raliski, (Evan W. Miller)

University of California, Berkeley

All cells within the human body maintain a resting membrane potential that arises from a gradient of sodium and potassium ions. We are developing voltage-sensitive fluorophores, or VoltageFluors (VF dyes) that provide a fast and sensitive optical read-out of membrane voltage. In this work, we synthesize and characterize new VF dyes based on the central principle of modulating conformational flexibility within the dye. The donor moiety of the dye was synthetically modified to yield compounds with differing levels of planarity and flexibility. Patch clamp electrophysiology and optical characterization reveal differences in voltage sensitivity correlated with conformational flexibility of the modified donor, which is further validated by computational calculations. These efforts may represent a new paradigm for improving VoltageFluor dyes.

(10:15am) NOVEL PROGENITOR MARKER IMPLICATED IN INTELLECTUAL DISABILITY

Damon Polioudakis, Luis de la Torre-Ubieta, Justin Langerman, Andrew G. Elkins, Xu Shi, Jason L. Stein, Celine K. Vuong, Susanne Nichterwitz, Melinda Gevorgian, CarliK. Opland, Daning Lu, William Connell, ElizabethK. Ruzzo, Jennifer K. Lowe,Tarik Hadzic, Flora I. Hinz, Shan Sabri, William E.Lowry, Mark B. Gerstein, Kathrin Plath, Daniel H. Geschwind

University of California, Los Angeles

The human neocortex is made up of a myriad of cells. While the major cell types are known, the molecular mechanisms and transition states giving rise to these cells are not well understood. In previous work, using single-cell RNA sequencing, we have developed a catalogue of cell types in developing human neocortex, including neural progenitor cells (NPCs) and their neuronal progeny. We identified 1) transition states from NPCs to neurons, and 2) transcription factors enriched in specific cell types (including ZFHX4) which may act as drivers of those fates. Here, I found that 5-13% of the S-phase cells in the progenitor laminae express markers of both radial glia and neurons, supporting a model where a neurogenic program is induced before cell division. These findings, including my current work characterizing ZFHX4, validate the sequencing results and bring insight into mechanisms of normal brain development and neuropsychiatric disease.

Afternoon Oral Presentations, Session 7: Anatomy, Physiology and Developmental Biology II

[Chair TBD, SCST133]

(3:00pm) THE EFFECT OF PTEROSTILBENE ON G6PD ACTIVITY AND LIPID PEROXIDATION IN THE RED BLOOD CELL

Mariah Richins and Jennifer Meyer

Dixie State University

Diabetes is a growing epidemic and is characterized by hyperglycemia. Moreover, patients with hyperglycemia have reduced glucose-6-phosphate dehydrogenase (G6PD) levels and increased lipid peroxidation in various cell types due to increased levels of reactive oxygen species (ROS). Pterostilbene, a more cell permeable variation of the antioxidant resveratrol, has been shown to be effective in maintaining glucose levels, reducing ROS, and affecting G6PD in liver cells; indicating pterostilbene could be a formidable therapy for the treatment for individuals with hyperglycemia. Data obtained in this study determined the effect of pterostilbene on G6PD activity and lipid peroxidation levels in red blood cells treated in normal and hyperglycemic conditions. It was determined that pterostilbene has the ability to increase G6PD activity and ameliorate lipid peroxidation levels in hyperglycemic red blood cells.

(3:15pm) DETERMINING THE LOWER LIMIT OF SENSITIVITY IN HSV-2 PLAQUE FORMING UNIT ASSAYS

Khadija Shafiq

California State Polytechnic University, Pomona

HSV-2 causes 50% of genital Herpes infections in the United States. To determine the efficacy of HSV-2 treatments, our laboratory uses the Plaque Forming Unit (PFU) Assay to assess viral burden in spinal cord and brain of HSV-2 infected mice because the virus localizes in these tissues post-challenge. In this study, known concentrations of HSV-2 were added to uninfected spinal cords and brains of mice, then analyzed by the PFU assay. The PFU assay was conducted on multiple days on different tissue samples to determine interday variability of quantified viral plaques and the reproducibility of this assay. The sensitivity was assessed by evaluating the lowest amount of virus that could produce plaques in a tissue. We obtained statistically identical PFU results from one day to the next. This data corroborates the PFU assay as a valuable way to measure the degree of infection when comparing different antiviral treatments.

(3:30pm) DIFFERENTIATION OF hESCs INTO OPCs TO MODEL GBM TUMORS IN VIVO AND STUDY THE EFFECTS OF ROS ON OPC GROWTH

Amir Gerami, Mineli Harteni, Kirsten J. Ludwig, Alvaro G. Alvarado, Michael C. Condro, Steven A. Goldman, Cindy S. Malone, Harley I. Kornblum

University of California Los Angeles

Human oligodendrocyte progenitor cells (OPCs) can give rise to different glial cell types such as astrocytes and oligodendrocytes. OPCs can be used to create a humanized glial microenvironment in mice to model brain tumors and responsive human glia to neurological diseases. Recently, we have successfully generated human OPCs from

iPSC and ESC cultures. However, one disadvantage of using human OPCs to model brain tumors is their slow rate of differentiation and proliferation. It has been shown that environmental factors and intracellular signaling pathways may play key roles in neural stem cell (NSC) proliferation and self-renewal. Recent studies have suggested that hypoxia can increase the endogenous reactive oxygen species (ROS) levels by activating the NOX pathway in NSCs. Additionally, ROS can play roles as second messengers, and activate cellular processes such as the PI3K/Akt/mTOR pathway via reversible inactivation of the PTEN protein. In this study, we sought to determine whether altering ROS levels in OPCs affects cell proliferation and survival rate. Thus, we tested this hypothesis by targeting the NOX pathway via culturing the OPCs in hypoxia and by administering Apocynin as a NOX inhibitor. Lastly, we have genetically altered OPCs by introducing PTEN and/or TP53 mutations to examine whether loss-of-function in tumor suppressor genes affect OPC proliferation.

(3:45pm) CHANGES IN NOGO-RECEPTOR INTERNALIZATION IN THE PRESENCE OF GREEN TEA POLYPHENOLS (EGCG) AND cAMP

Alexandra Hicks, Rayudu Gopalakrishna , Aubree Mades , Charlotte Lin , Julie Nguyen , Seolyn Yang , William J Mack

University of Southern California

Nogo-A is a known axonal growth inhibitor and binds to NgR1, a receptor used by multiple growth inhibitors, which all act to inhibit recovery after a neuronal event such as a stroke. Current studies have looked at EGCG, a green tea polyphenol as an inexpensive product that can block NgR1 as well as it's downstream signaling. Green tea polyphenols have been shown to induce endocytosis of NgR1 and prevent its effects. Binding of EGCG to its high affinity receptor caused an increase in intracellular cAMP and ultimately caused the endocytosis of NgR1. Addition of agents like Forskolin, an adenylyl cyclase activator, increase intracellular cAMP levels and thus aid in endocytosis of NgR1. NgR1 internalization was also noted to be absent in N6-benzoyl cAMP, a PKA activator. However, both EGCG and cAMP induced endocytosis of NgR1 in cells where PKA was absent, indicating that PKA is not essential to the process. Understanding the process by which these factors help to inhibit and degrade NgR1 in neuronal cells can be used to develop drugs to enhance recovery after a neuronal event.

(4:00pm) CHARACTERIZATION OF THE POLYMERIC IMMUNOGLOBULIN RECEPTOR IN LEUCORAJA ERINACEA

James Ricketts*, (Valerie Hohman)

University of San Diego

The protection of mucosal surfaces against pathogens is mediated in part by antibodies of the secretory immune system. The polymeric immunoglobulin receptor (pIgR) has a key role in this defense against unwanted invaders, by transferring antibodies across epithelial cells and into mucosal secretions. PIgR has been identified in many different vertebrate classes, including mammalian, avian and reptilian, amphibian, and teleost species, but not in cartilaginous fish. Antibody secretions have been identified in various organs in cartilaginous fish, however, the proteins mediating this transport have yet to be identified. In this study, we have isolated a partial gene sequence from *Leucoraja erinacea*, a cartilaginous fish, that demonstrates homology to other pIgR sequences from various vertebrate species. This novel discovery in a Chondrichthyes species may provide insight into the characteristics of the primordial adaptive immune system and how defenses against pathogens at mucosal surfaces first occurred in lower vertebrates

(4:15pm) REGULATION OF T CELL RESPONSES TO ZIKA VIRUS INFECTION THROUGH THE TUMOR NECROSIS FACTOR SUPERFAMILY MEMBERS OX40 AND GITR

Rebecca Salgado*1, 2, (Kristopher Koudelka)1 (Sujan Shresta)2, 1

Point Loma Nazarene University

Zika virus (ZIKV) is a flavivirus carried by the *Aedes egypti* mosquito and is a global health crisis, with no vaccines or anti-viral therapies available. ZIKV has major neurological implications, seen in the rising number of cases of microcephaly and ZIKV-associated Guillain-Barré syndrome. A prominent area of ZIKV research includes studying the primary T cell response to infection. The tumor necrosis factor superfamily members (TNFs) play an important role in T cell co-stimulation, proliferation, and survival. In this study, wild-type mice were treated with an IFN Type I blocking antibody and subsequently infected with a clinically-isolated strain of ZIKV. Expression patterns of multiple TNFs in naïve and antigen-specific T cells were analyzed at varying timepoints, with OX40 and GITR showing high shifts in expression. Antibody treatments of both OX40 and GITR were given to Ifnar -/- mice after ZIKV infection; clinical scores, weight loss, and survival were recorded.

Afternoon Oral Presentations, Session 8: Biochemistry and Molecular Biology II

[Chair TBD, SCST129]

(3:00pm) ASSEMBLY AND SURFACE MODIFICATION OF VIRAL NANOPARTICLES FOR CHEMOTHERAPEUTIC DRUG DELIVERY

Daniela Avila*, Gavin Banning*, Tom Roser, Ashley Julio (Kristopher J. Koudelka)

Point Loma Nazarene University

Chemotherapeutics often target all rapidly dividing cells, resulting in a lack of specificity that causes severe side effects. Bacteriophage lambda procapsids are a viral nanoparticle that, once modified, may alleviate the issue. Transferrin ligands can be attached to the procapsid exterior to target cancerous tissue, and the interior can be modified to encapsulate the drug. These modifications increase specificity, consequently decreasing the amount of drug necessary. This hollow complex has multiple proteins: gpE, gpD, gpB and gpNu3. Procapsid proteins were expressed in vivo via BL21 E. coli and by individual subunits in vitro via GST-isolation, both utilizing recombinant expression. They were purified, extracted, and analyzed using SDS-PAGE and size exclusion chromatography. To explore procapsid surface modification, tyrosine-alkyne conjugation and carboxylate (Glu+Asp)-alkyne conjugation labeling were performed. Tyrosine-alkyne conjugation proved most effective.

(3:15pm) HIGH-THROUGHPUT CHARACTERIZATION OF INDUCIBLE PROMOTER ARCHITECTURES IN ESCHERICHIA COLI

Timothy Yu*, Grace Bower*, Winnie Liu, Jeremy Shek, Guillaume Urtecho, Jessica Davis, (Sriram Kosuri)

University of California, Los Angeles

Current inducible promoters are often leaky and limited in their individual ranges of expression, hindering exploration of protein function, metabolic pathway optimization, and ordered gene expression. This shortcoming stems from our incomplete understanding of the exact relationship between the architecture of an inducible system and its corresponding expression level. Here, we employed a massively parallel reporter assay (MPRA) to

simultaneously quantify the expression levels of a library of ~8000 unique promoter architectures based on the lacUV5 background. These variants contain different combinations of -10 elements, -35 elements, and lac operator site arrangements. We find that our "bottom-up" approach yields novel architectures that have lower uninduced expression and higher dynamic range relative to that of the canonical lacUV5 architecture. Furthermore, we present statistical models that can provide modest prediction of repression in the canonical lacUV5 architecture based on the identities of the -10 elements, -35 elements, and lac operator sites.

(3:30pm) HUMAN SCENT, THE FORGOTTEN EVIDENCE IN ARSON INVESTIGATIONS

Thea McCleign*, Alex Menjivar*, Kerstin Saruwatari*, (Lisa Harvey)

Victor Valley College

Anecdotal evidence suggests that a burned article found at an arson crime scene can be used for scent by a bloodhound to trail and find a fleeing arsonist. Scent left behind on an article is thought to be regulated by the Major Histocompatibility Complex, a polymorphic region found on chromosome 6 producing proteins located on the outside of nucleated cells. In the present study, participants held an article, either newspaper or wood, which was burned with or without accelerant to determine the viability of scent. Bloodhounds were used to trail the person who touched the article. When newspaper or wood was burned without accelerant, the bloodhounds correctly identified trail-layers 95.7% and 92.3% of the time, respectively. When accelerant was added, the find rate significantly decreased. These results show that scent can survive temperatures of at least 233˚C, but not greater than 2820˚C. This information is invaluable for arson investigations.

(3:45pm) MOLECULAR DYNAMICS SIMULATIONS REVEAL DETERMINANTS OF THERMOSTABILITY IN DESIGNED GLOBULAR PROTEINS

Matthew Gill*, (Michelle E. McCully)

Santa Clara University

Designing functional proteins that withstand extreme heat is necessary for industrial use and for certain protein therapeutics. Thus, elucidating the atomic-level determinants of thermostability is a major interest for rational protein design, and a frequent subject of molecular dynamics simulations. We compared a 70-residue domain of procarboxypeptidase A2 (1AYE) to its computationally-designed, thermostable variant (2GJF) with 70% sequence identity. Its residues are thought to stabilize the protein via increased hydrophobic core packing and inter-secondary-structure interactions. To evaluate stability at the molecular level, we simulated the dynamics of 1AYE, 2GJF, and four minimally-modified variants at 25°C and 100°C, using all-atom, molecular dynamics simulations. The ilmm simulation analysis software was used to compare structural dynamics data and to confirm relative degrees of unfolding at 100°C. Secondary structure determination and contact analysis provided insights into individual residues' contributions to stability. We used these data to design additional variants with mutations expected to stabilize the most dynamic regions.

(4:00pm) NMR SPECTROSCOPY TO EVALUATE THE PHOSPHORYLATION STATE OF THE ONCOGENIC PROTEIN E7 FROM A HYPER-VIRULENT FORM OF HPV

Ryan Orlando*, Kayla Mazza, Madison Malone, (Ariane L. Jansma)

Point Loma Nazarene University

The Human papillomavirus (HPV) causes tumors by forcing host cells to divide uncontrollably. In high risk HPV16, oncoprotein E7 significantly enhances cell division. High risk E7 from HPV16 is phosphorylated in cells by Casein

Kinase 2 (CK2) at two conserved serine residues and this phosphorylation event has been shown to increase binding affinity for cellular partners. This project focuses on the phosphorylation state of a naturally occurring hyper-virulent form of HPV16 isolated in Africa, which possesses an additional serine residue. This point mutation was engineered into the disordered domain of HPV16 E7 in order to evaluate the phosphorylation state in real time. The results demonstrate that this third serine residue is phosphorylated to the same extend and on the same time scale as the existing serines. This provides mechanistic details in terms of the CK2 recognition sequence, as well as additional information regarding the functional relevance of high risk HPV E7 phosphorylation.

(4:15pm) EXPRESSION AND PURIFICATION OF THE DISORDERED PDZ BINDING DOMAIN OF THE NS5 PROTEIN FROM TICK-BORNE ENCEPHALITIS VIRUS

Cecelia Lambie*, Jeremy Wright, (Ariane L. Jansma)

Point Loma Nazarene University

Members of the PDZ family of proteins play a key role in the development of multicellular organisms. Viruses such as Tick-Borne Encephalitis Virus (TBEV) will therefore target these proteins to hijack their host cells as a means to enhance replication as well as transmit to new hosts. These viral proteins interact with host cell PDZ domains through a short disordered region known as a PDZ binding motif (PBM). Nuclear Magnetic Resonance (NMR) spectroscopy is an ideal technique to obtain atomic level information regarding the interactions of these small disordered regions with their cellular PDZ partners. However, this requires highly pure isotopically labeled protein at relatively large amounts, which is difficult for such a small disordered peptide. This project seeks to optimize recombinant bacterial expression and subsequent purification of a 5 kDa peptide incorporating the PBM of the NS5 protein from TBEV.

Afternoon Oral Presentations, Session 9: Ecology and Evolution II

[Chair TBD, SCST232]

(3:00pm) A STUDY OF PENCIL URCHIN POPULATION GENETICS AT HANNIBAL BANK

Hannah Lee*, (Walter Cho)

Point Loma Nazarene University

Hannibal Bank is a seamount-like feature known for its high productivity and biodiversity that is located in an UNESCO World Heritage Site off the Pacific coast of Panama. The biodiversity and biogeography of two species of pencil urchins at Hannibal Bank were studied using genetic analysis and geographical imaging systems. DNA barcoding of the COI mitochondrial gene identified gene sequences for 80 samples of two species of pencil urchins (Genus *Hesperocidaris*). Analyses of the geography and bathymetry of the bank indicated that both pencil urchin species demonstrated high gene flow and no significant genetic population structure. Samples of species 1 were distributed primarily on the northern and southern flanks of the bank with some near the peaks with recent population expansion indicated by haplotypes. Samples of species 2 were distributed intermittently along the flank of the bank's perimeter and the haplotype network indicated that it is an evolutionary stable population.

(3:15pm) EGG SIZE DETERMINES FRY SIZE IN SUBSTRATE-SPAWNING CICHLID FISHES

Leigh Sanders*, (Ronald Coleman, PhD)

California State University Sacramento

Egg production is energetically costly and understanding why organisms lay eggs of a certain size allows us to understand their ecology, behavior, and physiology. However, the number of eggs that an organism can produce is limited by the energy it expends on each offspring. This research examined 33 species of substrate spawning cichlids across 23 genera. Eggs and free-swimming fry were sampled from each spawning female. To compare eggs across the different species, the length of the egg axes were measured to calculate an effective egg diameter. Similarly, fry length was measured for each sample. Regression analysis showed a significant positive relationship between effective egg diameter and fry length throughout multiple species of substrate-spawning cichlids across many genera. That is, egg size plays a critical role in determining fry size for substrate-spawning cichlids.

(3:30pm) DOES PARASITISM AFFECT THE FECUNDITY OF THE PACIFIC MOLE CRAB, EMERITA ANALOGA?

Victoria Coffey, Ana Ibarra Sotelo, Silvia Arredondo, and Ritin Bhaduri

California State University Stanislaus

Parasites are known to influence their hosts in several different ways including physiological changes and behavioral modifications to altering life history traits, such as fecundity, in the hosts populations. The acanthocephalan parasite, *Profilicollis altmani*, commonly infects the Pacific mole crab, *Emerita analoga*; yet this parasites effect on the crab's fecundity is unknown. Consequently, we examined the effects of the acanthocephalan parasitism on various aspects of the fecundity of this crab species. Crabs were collected from the swash intertidal zone of Monterey Bay, California in September 2017 and again in August 2018. We recorded the crab's body size, egg-bearing status, egg developmental stage, parasite prevalence and infection intensity, parasite volume, and crab dry mass. To quantify fecundity, eggs from gravid crabs were carefully removed, counted and weighed. Of the 295 crabs examined, 249 (84.4%) were gravid and 46 (15.6%) were non-gravid. Parasite prevalence was 87.9% in gravid and 80.4% in non-gravid. There is a significant positive relationship between parasite intensity and host body size, indicating that the acanthocephalan did not affect growth or survival of their crab host. Egg mass was unaffected by both infection intensity and mean cystacanth volume. No significant differences were noted when egg mass between uninfected and infected crabs were compared. Additionally, no significant difference was documented between different developmental stages in uninfected and infected gravid crabs. Our study suggests that the fecundity of *E. analoga* remains mostly unaffected by *P. altmani*.

(3:45pm) THE RICH TAPHONOMIC HISTORY OF THE LATE PLEISTOCENE FROM RANCHO LA BREA

Ellie Pitcher, Nicolas Noriega, Dr. Joshua Cohen, and (Dr. Wendy Binder)

Loyola Marymount University

The Rancho La Brea tar pits represent a unique window into the environment leading up to the end-Pleistocene megafaunal extinction. It is one of the most fossiliferous sites in North America, preserving thousands of specimens, and presents an opportunity to observe the paleoecology of the Late Pleistocene. At the tar pits, there are two major collections: the original Hancock collection and the modern Pit 91 collection. The Hancock collection focused on large, museum-worthy specimens, often excluding smaller and heavily damaged fossils. In contrast, the modern Pit 91 collection records and collects all specimens using modern excavation techniques, so it is imperative to understand any collecting biases between these collections. Taphonomy, the process that an organism undergoes from death to discovery, is important to understand because it provides insight into the local

environment at the time of death. By determining the taphonomic processes of the Hancock collection and Pit 91 collection, collecting bias can be quantified to better understand biological differences between these collections. This study compared taphonomic features including abrasion, pit wear, weathering stages, and census data in the sabertooth cat, *Smilodon fatalis*, and the bison, *Bison antiquus*, from Pit 61/67 of the Hancock collection and from the Pit 91 collection. Taphonomic features were similar in both collections, indicating that differences in census data can be attributed to collecting bias. With this data, the collecting bias was quantified between the Hancock collection and Pit 91, which will allow for more meaningful paleoecological comparisons between the two collections in the future.

(4:00pm) ACYL-HOMOSERINE LACTONE SYNTHESIS IN ARTHROBOTRYS OLIGOSPORA AS A BIOLOGICAL CONTROL AGENT FOR PARAS

Brianna Frawley and Alexa Ramirez

Vanguard University of Southern California

Every year, over a billion pounds of pesticides are used in the U.S., and nearly 5.6 billion pounds are used worldwide (Alavanja, 2009). There is a need to investigate alternative methods to combat crop-damaging pests, such as the nematode. The nematophagous fungus, *Arthrobotrys oligospora*, has been studied for its potential for nematode control. However, the mechanism of interaction between carnivorous fungus and parasitic nematodes remains unknown. We hypothesize that quorum sensing is the key to understanding how *A. oligospora* tracks and lures its prey. Acyl-homoserine lactone (AHL) is a molecule commonly used by bacterial species for this mechanism (Werner et al., 2014). Preliminary data demonstrates the presence of AHL in the supernatant of *A. oligospora* exposed to nematodes, suggesting that AHL plays a role in microbial predator-prey interaction. Our studies suggest that worms prefer *A. oligospora* over a neutral attractant. This information may contribute to a safer alternative to pesticides.

(4:15pm) CASE STUDY USED TO COMMUNICATE OCEAN ACIDIFICATION TO AN ENVIRONMENTAL SCIENCE STUDENTS

B. Chavez, S. Herrera, T. Wells, (Diara Spain)

Dominican University of California

Often a science course involves students taking notes while a professor talks. While this is the fastest method to cover material, this is not ideal for keeping the attention of students. Case studies are an alternative teaching method for communicating information through peer interactions, clever storylines, and discussions. A multi-part ocean acidification case study was used to teach environmental science students. They read articles, reviewed data, and used critical thinking to answer questions. Students were later asked to complete a short survey about the content of the case and their opinion on its effectiveness. The results indicated that this case study was successful in communicating the concepts of ocean acidification. All were able to identify the correct answer about the relationship between the Keeling curve and carbon dioxide emissions, and 82% gave a precise definition for ocean acidification. The case was rated very or extremely effective by 90% of students.

Afternoon Oral Presentations, Session 10: Genetics, Genomics and Proteomics II

[Chair TBD, SCST231]

(3:00pm) EXAMINATION OF ORNITHINE DECARBOXYLASE ANTIZYME RNA STRUCTURE AND FUNCTION

Zach Frevert, Korey Krutsinger, and Julie Soukup

Creighton University

Riboswitches are non-coding sequences in messenger RNA that directly bind to cellular metabolites and affect gene expression through feedback regulation. Riboswitches are widely found in bacteria, with one class in fungi and plants, and none previously found in animals. We propose riboswitch functionality of a translational frame-shift stimulatory pseudoknot RNA (PK RNA) that is highly conserved among vertebrate ornithine decarboxylase antizyme (OAZ) genes that are involved in polyamine biosynthesis regulation. Apparent binding affinity and specificity for polyamines were determined using in-line probing and equilibrium dialysis. Mouse OAZ1-PK RNA binds to spermine with greater affinity than other polyamines. Spermine binding to OAZ1-PK RNA causes conformational change, a characteristic property of riboswitches. Spermine analogs (with equal or greater net positive charge) have lower affinity and specificity for the OAZ1-PK RNA. We next used isothermal titration calorimetry to determine binding affinities. Results indicate that the Kd (binding affinity) of OAZ1-PK RNA for spermine (the natural ligand) is ~275 µM. Further experiments on natural spermine analogs have shown Kd¬ values up to ~5 mM, and at least one synthetic analog with a Kd value of ~20 µM. Future experiments will focus on X-ray crystallography of this RNA. Our results suggest that translational frame-shifting in OAZ expression evolved for spermine-dependent regulation of the OAZ protein. Thus, the OAZ1-PK RNA may function as a spermine sensor and mammalian riboswitch, indicating a wider expression of riboswitches amongst eukaryotes and offering a novel mechanism for affecting metabolic processes in cancer and other diseases.

(3:15pm) USING RNA-SEQUENCING TO INVESTIGATE HEAT STRESS RECOVERY IN THE MARINE SNAIL CHLOROSTOMA FUNEBRALIS

Amanda Bedolla*, Lizvette Ayala-Valdez*, (Lani Gleason)

California State University Sacramento

Southern California populations of the intertidal marine snail *Chlorostoma funebralis* show higher survival and faster recovery after heat stress compared to northern California populations. However, the genes that are involved in facilitating recovery from thermal stress have not yet been identified. To examine this, we 1) exposed northern and southern California individuals to thermal stress, 2) allowed these individuals a recovery period, and then 3) extracted RNA for whole transcriptome RNA-sequencing. We expect that treated individuals from southern California will have similar expression levels of stress-induced genes as the control individuals that were not exposed to thermal stress. In contrast, we expect upregulation of stress response genes, such as heat shock proteins, in northern California individuals. This would indicate a decreased ability to repair damage after exposure to stressful conditions. Ultimately, identifying genes that facilitate heat stress recovery can help us predict how this species might respond to global warming.

(3:30pm) CREATION OF NOVEL LENTIVIRAL VECTORS TO EXPRESS ß-GLOBIN

Jason Quintos, Richard Morgan, Roger Hollis, Cindy Malone, Donald Kohn

California State University, Northridge

Sickle cell disease (SCD) is an inherited blood disorder caused by a single point mutation in the β-globin gene. SCD can be treated by gene therapy combined with autologous hematopoietic stem cell transplantation. The current challenges facing globin gene therapy vectors are titer and efficient gene transfer to CD34+ cells (which contain the hematopoietic stem cell population). Ideally vectors need to be designed that increases titer and gene transfer without overtly reducing the robust β-globin expression in red blood cells that is achieved with existing vectors. In our study, we plan to create modifications to our clinical globin vector that include either using minimal CORE regions to reduce overall vector size or 21 bp deletions to remove self-regulatory L-RNA regions in the hypersensitive site 2 and the intervening sequence 2. A reduction in vector size is expected to greatly improve titer and gene transfer, since it is well known that larger vectors have lower titers. Removal of L-RNA self-regulation should improve the ratio of vector-derived beta globin compared to endogenous globin expression (as the endogenous allele will still be subject to self-regulation). Vectors will be analyzed in HUDEP-2 cells to measure and compare vector to endogenous β-globin expression.

(3:45pm) PLASMID GENOMES FROM VANCOMYCIN-RESISTANT ENTEROCOCCI ISOLATED FROM A WASTEWATER TREATMENT PLANT IN SAN DIEGO COUNTY

Joseph Bravo*, Gabrielle Hovis, Taryn Kucey, Gillian Yap (Ryan Botts, David Cummings, Dawne Page)

Point Loma Nazarene University

Antibiotic resistance among Gram-positive bacteria is a serious global health threat. Vancomycin-resistant enterococci (VRE) are especially concerning since they are susceptible to few if any antibiotics, and can serve as a reservoir for mobile genetic elements containing diverse resistance genes that could potentially be transmitted to other Gram-positive bacteria. The plasmids that confer resistance in Gram-positive bacteria, however, are poorly understood. In this project, a set of eight VRE strain were isolated from the influent of a wastewater treatment plant in San Diego County. Antibiotic susceptibilities were determined by disc diffusion methods, revealing resistance most commonly to vancomycin, penicillin, linezolid, and erythromycin. Plasmids were isolated from the strains, and the complete nucleotide sequences were determined by MinION sequencing technology. Known resistance genes *vanA*, *vanH*, *vanX*, and *ermB* were identified in the plasmid genomes.

(4:00pm) PROTEIN RECRUITMENT TO AN INDUCED DOUBLE STRAND BREAK (DSB) IN YEAST

Ana Garcia Castineiras*, Luis Diaz, Robert Buxton, (M. Cristina Negritto)

Pomona College

Homologous recombination is a DSB repair pathway in which a donor DNA, that shares a region of homology with the damaged DNA, serves as a template for its repair. The Mre11-Rad50-Xrs2 (MRX) and TFIIH complexes have been shown to play an essential role in DNA end degradation to create 3' overhangs that can be used for homology search. TFIIH is also a complex known to participate in nucleotide excision repair (NER), where its recruitment to UV lesions is mediated by Rad4. To determine if Rad4 could have an analogous role in homologous recombination, we examined the functional dependency between TFIIH, Rad50 and Rad4 at a double strand break in different genetic backgrounds. Using chromatin immunoprecipitation assays, we determined that recruitment of TFIIH and Rad50 to DSBs is reduced in Drad4 mutants, which suggests a function of Rad4 in homologous recombination that is upstream of the degradation step.

(4:15) THE ROLE OF THE OAZ1 RNA IN CONTROLLING GENE EXPRESSION

Logan P. Baumberger*, Taylor L. Burke, (Garrett A. Soukup and Juliane K. Soukup)

Creighton University

Riboswitches are segments of messenger RNA (mRNA) that bind to specific cellular metabolites and regulate gene expression. Riboswitches are defined based on the following criteria: the RNA binds specifically to one metabolite, exhibits conformational changes induced by metabolite binding, and influences gene expression in a metabolite-dependent manner. Although nearly all discovered riboswitches are in bacteria, fungi, and plants; we have identified a putative mammalian riboswitch. The mouse Ornithine Decarboxylase Antizyme 1 (Oaz1)-pseudoknot (PK) RNA appears to bind specifically to spermine, exhibits spermine-dependent conformational changes, and influences spermine-dependent expression of Oaz1, an inhibitor of spermine biosynthesis. This work aims to investigate the role of the Oaz1-PK RNA in controlling gene expression in the presence of various polyamines. The function of Oaz1-PK RNA as a spermine-dependent riboswitch regulating expression of Oaz1 provides a potential target for affecting a metabolic process key to cancer cell growth and proliferation.

Afternoon Oral Presentations, Session 11: Neurobiology and Behavioral Biology II

[Chair TBD, SCST230]

(3:00pm) DEVELOPING A NOVEL HUMANIZED MOUSE MODEL WITH TRANSPLANTED HIPSC-GLIAL ENRICHED PROGENITOR CELLS/HESC-OLIGODENDROCYTE PROGENITOR CELLS

Emily Hatanaka*, Michael Meadow, Kaitlin Ryan, Cindy S. Malone, William E. Lowry, S. Thomas Carmichael and Irene L. Llorente.

University of California, Los Angeles

White matter stroke (WMS) accounts for 30% of all stroke events and is caused by the development of ischemic lesions in the connecting regions of the brain, termed the white matter tracts. A key aspect to WMS is the damage to glial cells (astrocytes and oligodendrocytes) and the loss of myelin. These glial cells are vital in maintaining the central nervous system and without them deficits occur. To develop new treatments for this disease, it is important to determine how these human glial cells react to WMS. We first developed a mouse model with human astrocytes and oligodendrocytes. This was done by deriving glial enriched progenitor cells from human iPSCs and oligodendrocyte progenitor cells from human ESCs. The cultured GEPs and OPCs were then transplanted into mouse pups. Data indicate that the transplanted cells populate the mouse brain and create a humanized environment. This can serve to better study human glial cells in a humanized animal model and in the future, be used as a cell based therapy for white matter stroke.

(3:15pm) SOCIAL INTERACTION IN MICE MITIGATES CHRONIC STRESS-INUCED ERRATICISM IN DECISION-MAKING

Arish Mudra Rakshasa and Dr. Michelle T. Tong

Earlham College

Chronic stress can significantly impact cognitive processes, including decision-making. Studies using mouse models have demonstrated that chronic stress can lead to increased risk-taking; however, methods for counteracting these stress effects are underexplored. In the current study, we investigated the role of social interaction in attenuating stress-induced aberrant decision-making. To test decision-making, mice were trained to perform a Cost-Benefit Conflict (CBC) task on a T-maze, in which they could choose between a high-benefit, high-cost alternative and a low-benefit, lost-cost alternative. Mice were either housed in groups or alone throughout the experiment. Both groups of mice underwent a seven-day period of repeated immobilisation to induce chronic stress. Stress levels were confirmed using behavioural (open field test) and physiological (urine corticosterone ELISA) measures. We found a significant increase in frequency of high-risk decisions after exposure to chronic stress among both socially- and individually-housed mice. Crucially, socially-housed mice showed a significantly smaller increase in high-risk decision-making compared to singly-housed mice. These findings suggest that although chronic stress leads to risky decision-making in mice, access to social interaction may be a potent factor for mitigating this stress effect. Therefore, using a mouse model, we reveal a complex relationship between chronic stress, social isolation, and decision-making. Further exploration of this relationship among human participants may help determine effective ways of mitigating chronic stress effects.

(3:30pm) THE AUTISM-ASSOCIATED CHROMATIN MODIFIER, CHD8, AFFECTS NEURONAL PHENOTYPES IN DROSOPHILA

Chloe Welch*, Alain Hu, Lillian Murphy, Any Ardon-Castro, Darren Nguyen, Amy Lew (Kimberly Mulligan)

California State University Sacramento

Autism spectrum disorder (ASD) refers to a group of heterogeneous neurodevelopmental disorders that afflict 1 in 59 children in the United States. Chromodomain Helicase DNA Binding Protein 8 (CHD8) is a chromatin modifier that defines a common ASD subtype characterized by macrocephaly and gastrointestinal (GI) problems. Our research is aimed at examining neural and GI phenotypes in Drosophila melanogaster to elucidate how CHD8 impairs neural development. The assays described here will ultimately be used to study connections between gut microbiota and neural phenotypes in Drosophila with this ASD risk gene. We used immunohistochemistry and confocal microscopy to show that heterozygous loss of the Drosophila CHD8 ortholog, kismet (kis) causes disrupted axon guidance in adult brains, a common cellular ASD phenotype. We also used the courtship assay to show that heterozygous kis mutants exhibit a significantly reduced courtship index. These results reiterate the important role kis plays during neural development.

(3:45pm) THE MISSING PUZZLE PIECE AND THE MAJOR HISTOCOMPATIBILITY COMPLEX (MHC)

Megan Rodriguez*, Alicia Verley*, Isabelle Pittet*, Kaitlin Magner*, (Lisa Harvey)

Victor Valley College

Studies have demonstrated that the Major Histocompatibility Complex (MHC) controls human scent. Research has also shown that MHC is altered in individuals with Autism Spectrum Disorders (ASD). This change in MHC would suggest that scent in an individual with ASD may be altered. In the present study, bloodhounds were used to trail individuals with ASD in order to determine if there were differences in the find rate of ASD and Non-ASD individuals. When bloodhounds were presented with the scent of a person diagnosed with ASD the dogs were able to correctly identify the individual 33% of the time. In comparison, the Non-ASD participants were correctly identified 90% of the time. Additionally, the ASD participants taking medication were identified only 7.7% of the time. These data support the existing theory that MHC is a major regulator of human scent.

(4:00pm) EXAMINING THE IMPACT OF MEDICATION BELIEFS ON MEDICATION ADHERENCE AMONG HYPERTENSIVE PATIENTS

Elizabeth Ordonez, Justin Cha, Michael Xu, John Billimek

University of California, Irvine

Uncontrolled hypertension continues to disproportionately affect Hispanic/Latino patients. Understanding how medication nonadherence is associated with beliefs about medications may lead to reduced disparities and improved health outcomes. A Beliefs about Medications questionnaire (BMQ) was used to identify perceptions on medication overuse, harm and general concerns. The BMQ was distributed to 38 patients with uncontrolled hypertension (BP>140/190). On average, patients were 62.4 ± 11.02 years old, 68.4% female, 36.8% had beyond a high school diploma, and 76.3% identified as Hispanic. Using a Chi-sqare test, data suggests that negative beliefs about medication are associated with intentional nonadherence (e.g.; choosing not to take medications; 67% vs. 10%, p=0.001) but not unintentional nonadherence (e.g. forgetting; 44% vs. 20%, p=0.16). New interventions should be introduced to improve medication adherence among individuals with negative beliefs about medication to reduce overall health disparities.

(4:15) SCREENING FOR E-CADHERIN INTERACTING PROTEINS IN DROSOPHILA MELANOGASTER LARVAL BRAINS

Karol Canales

Vanguard University of Southern California

The cadherins superfamily is one of the most important molecules involved in cell-cell adhesion. E-cadherin is a calcium-dependent protein needed for the formation and maintenance of epithelial cell-cell contact. A common model organism that is used to study E-cadherin is Drosophila melanogaster. Although D. melanogaster has helped to confirm that E-cadherin interacts with other proteins that are needed for cell-cell interactions such as Catenin, the mechanism of E-cadherin's function in the nervous system is remain to be elucidated. E-cadherin is expressed in the neurons and axons of the Drosophila larval brain. Axons without E-cadherin had more branches and trajected differently than the wild type axons. The purpose of this study is to test for the possible interaction between AJUBA-LIM protein and E-cadherin using Co-immunoprecipitation (Co-IP) and Western Blot (WB). Successful isolating E-cadherin's interacting protein will help discover the mechanism of axon branching and trajecting in the nervous system.

Poster Presentations

Biochemistry

1. A 44KD αβ HETERODIMER OF TDT EXHBITS ACTIVITIES THAT THE 58KD MONOMER DOES NOT

Alisa Kinzel*, Joshua Garcia, Jonathan Kugler, Rebekah Leigh, Grace Gooneratne, (Ross S. Anderson)

The Master's University

Recombinant Terminal deoxynucleotidyl transferase (rTdT) as purified from E.coli is a 58KD monomeric protein. The same protein purified from calf thymus is a 44KD αβ heterodimer. When the gene was cloned and found to encode the monomeric form, it was then thought that the heterodimeric form was a purification artifact. Preliminary studies have revealed that both the rTdT and the αβ heterodimer can polymerize single-stranded DNA (ssDNA), however, the rTdT cannot engage in two additional catalytic activities that the αβ heterodimer can: addition of a phosphoryl group onto the 3'-end of ssDNA, and pyrophosphorolysis. This suggests a significant structural change occurs upon proteolytic cleavage of the 58KD monomer which retains the polymerizing ability, but also imparts the two additional activities. The question then, is the αβ heterodimer simply an artifact of purification, or is it the true functional enzyme in the calf thymus?

2. ALCANIVORAX BORKUMENSIS AND THE SURFACTANT MIX LECITHIN AND TWEEN 80 ON THE DEGRADATION OF OIL

Eve Groharing, Scott Gaines

Concordia University Irvine

A high demand for crude oil production leads to increased risk of spills and a need for effective and environmentally friendly methods of remediation. One such lengthy method is bioremediation using Alcanivorax borkumensis, a hydrocarbonoclastic bacteria. The goal of this study was to introduce a nonvolatile surfactant made from a mix of Soy Lecithin and Tween 80 to emulsify the oil, increasing surface area to aid the bacteria in degradation. This was completed by measuring bacterial concentration and mm of oil remaining in two treatment

groups both containing mineral oil and bacteria in marine broth with one group also containing the Lecithin/Tween 80 surfactant. A. borkumensis' concentration increased with time in both treatments, but the inclusion of the surfactant did not lead to a significant difference in the rate of oil consumption. With increased study time and exploration in measurement techniques, future research is promising for this coupled bioremediation process.

3. APPLICATION OF PORTABLE SPECTROMETER FOR COLORMETRIC TEST.

Maria Vidaca *, (Karno Ng)

California State University San Marcos

The aim of this project is to develop the optimal conditions for a color test that was used for the detection of Gamma-hydroxybutyrate (GHB) and measured the absorbance of the developed color. Calibration curve was prepared from five GHB standard solutions with a concentration range from 1 mg/mL to 5 mg/mL. Color test was developed for each GHB standard solutions and the absorbance of the developed color was measured at maximum wavelength 500 nm. The r^2 value was found to be 0.7681. Reproducibility of the study was evaluated by performing the calibration study in 3 different days and RSD was found to be 5.94%. The long-term goal of this project is to use a wireless spectrometer in this study which would be beneficial to the medical field. Performance of a PASCO wireless spectrometer was evaluated with a color-dye and the results showed the performance is comparable to the UV/VIS instrument.

4. CHARACTERIZING THE IMPACT OF EXTRACELLULAR DNA ON BIOFILM FORMATION.

Hector Herrada*, (Dr. Anthony Bell)

University of San Diego

Biofilms are biomolecular matrices which consist of polysaccharides, proteins and amphipathic peptides, and extracellular DNA (eDNA). On the molecular level, biofilms adhere onto cell membranes in a configuration which allows any bacteria in close proximity to position itself between the biofilm and the membrane of a cell. This harboring effect causes biofilm formation to be directly responsible for pathogen resistance to antimicrobial and host cell immune response(s). Previous studies indicate that eDNA sequesters host cell factors such as metal cations and abundant endogenous proteins to promote the attachment and proliferation of biofilms. My research focuses on characterizing the binding affinity properties Methicillin-resistant Staphylococcus aureus (MRSA) eDNA has toward divalent cations, proteins and heme.

5. DETERMINING SMMAK-16-α-IMPORTING BINDING WITH PROTEIN CO-PRECIPITATION

Ben Hull*, (Jon Milhon)

Azusa Pacific University

SmMAK16 is a nucleolar protein from the trematode Schistosoma mansoni that contains a C-terminal monopartite and an upstream bipartite nuclear localization signal (NLS). In order to be translocated through the nuclear pore complex, nuclear proteins often bind to a chaperone protein. Since SmMAK16 localizes to the nucleus, it may bind to the chaperone α-importin, however, this has not been demonstrated. Therefore, to better understand the function of SmMAK16, it is important to determine whether the protein binds with α-importin. The two proteins have been cloned into expression vectors. SmMAK16 has been cloned into pGEX-4t-1 and is expressed as a fusion protein with Glutathione-S-Transferase; α-importin has been cloned into pRSET, which expresses the protein with a 6X Histidine Tag. SmMAK16 has successfully been purified with fast protein liquid chromatography (FPLC) on a GSH affinity column, concentrated by centrifugal filtration, and pulled down with glutathione agarose. The next steps are to purify and concentrate α-importin, and then determine if SmMAK16 and α-importin co-precipitate.

6. DETERMINING THE OPTIMAL CONDITIONS FOR SYNTHESIS OF ACID-TRANSFORMING CHITOSAN FOR USE AS A NANOANT

Nathalie Iribe*, (Julius A. Edson, Young J. Kwon)

University of San Diego

Conventional antibiotics are commonly derived from other organisms, making it is easy for the bacteria to develop a contradicting mechanism and develop resistance. The goal of my project is to investigate the optimal conditions for the synthesis of an aqueous form of the polymer chitosan, or Acid-Transforming Chitosan (ATC). This is a deacetylated form of chitin, with increased antimicrobial properties that work to kill an organism or inhibit its growth, through various physical mechanisms. The hypothesis of this study is that if an optimal synthesis for the ATC is found, ATC with higher antimicrobial activity and minimal toxicity could be feasible to produce at higher yields on a large scale. Varying molecular weights will be analyzed using proton NMR to check its conjugation efficiency of the ketal functionality, a major contributor of ATC's antimicrobial properties. Different reaction times will be tested for optimal yield, and purification methods will be investigated.

7. DEVELOPMENT OF A SIMPLE EXTRACTION METHOD FOR TETRACYCLINE ANALOGUES FROM MILK WITH UV DETECTION

Thien Le, Oscar Cordova

California State University San Marcos

Tetracycline and analogues are among the most used antibiotics in the dairy industry leading to their presence in commercial milk. The purpose of this study is to develop a quick extraction method for the tetracycline analogues from milk with triofluoroacetic acid and the results are compared with the SPE extraction. Tetracycline analogues from the extracted samples were separated and detected by an HPLC-UV system with maximum absorbance wavelength = 355 nm. Calibration curves for tetracycline analogues (MC, TC, DEM, CTC and DC) were prepared from standard solutions with concentration range from 0.0320 mg/mL to 2.034 mg/mL Good linearity was shown for each analogue (r^2 value range from 0.9905-0.9967). Percent recovery for MC, TC, DEM, CTC and DC was: 80.67%, 48.82%, ~90%, 78.54% and 86.3% respectively. The results are comparable with the SPE extraction except for TC due to the interference from the milk matrix.

8. GENETICALLY ENGINEERING MICROBIAL FACTORIES TO PRODUCE NOVEL COMBINATIONS OF ENTOMOTOXINS

Nayeli Fernandez*, Michelle Zuniga*, Katherine Hernandez, Sarah E. Bryant*, Hyun-Woo Park, Brian A. Federici, (Dennis K. Bideshi)

California Baptist University

Commercial formulations of Bacillus thuringiensis subsp. israelensis (Bti) and Lysinibacillus sphaericus (Ls) are used worldwide to control mosquitoes that transmit viruses and parasites responsible for >500,000,000 cases of morbidity and mortality annually. Bti's efficacy is due to synergistic interactions among four proteins (Cry4Aa, Cry4Ba, Cry11Aa, and Cyt1Aa), whereas Ls's activity is elicted by BinA/B. Lipophilic Cyt1Aa synergizes the toxicity of Cry and BinA/B proteins by increasing midgut-receptor binding and/or intracellular entry of these toxins. Previously, we fused Cyt1Aa to BinA yielding a highly toxic broad-spectrum protein chimera. To produce more robust microbial factories with effective combinations of proteinaceous toxins packaged in a composite inclusion for ingestion by mosquito larvae, we transformed Bti 4Q5 lacking Cry4Aa (Bti-ΔCry4Aa) or Cyt1Aa (Bti-ΔCyt1Aa) with a plasmid harboring the cyt1Aa:binA chimeric gene (pBU-BtIII-cyt1Aa:binA). The ability of these recombinants to produce composite multi-toxin paracrystalline inclusions and their mosquito larvicid activities were examined in this study.

9. HUMAN CYTOMEGALOVIRUS INTERLEUKIN 10 (CMVIL-10) ENHANCES HOST CXCR4 SIGNALING.

Maggie Chen*, (Juliet V Spencer)

University of San Francisco

Human Cytomegalovirus (HCMV) is a herpesvirus that establishes lifelong latency. HCMV manipulates host immune responses by hijacking cytokine and chemokine signaling pathways. The UL111A gene encodes cmvIL-10, a potent immune suppressive cytokine and ortholog of human interleukin 10. Despite low sequence homology, cmvIL-10 binds to the cellular IL-10 receptor (IL-10R) and induces activation of Stat3, a transcription factor that translocates to the nucleus to promote expression of target genes. We found cmvIL-10 enhances signaling outcomes when chemokine CXCL12 bound its native receptor, CXCR4, enhancing calcium flux in a Stat3-dependent manner. We found that in cells treated with both cmvIL-10 and CXCL12, Stat3 co-localized with calcium transporters in mitochondria. In conclusion, cmvIL-10 triggers Stat3 activation resulting broad effects on host cells that include both transcriptional activation and enhanced calcium transport through the CXCL12/CXCR4 pathway. The results of this project will advance our understanding of how HCMV modulates host cell signaling.

10. SYNTHETIC BIOLOGY IN METHANOCOCCUS MARIPALUDIS

Freeman Cherng

University of California, Berkeley

The combination of increased global plastic demand with concerns over climate change have resulted in an urgent need to discover sustainable methods for the production of desired biochemicals. Methanococcus maripaludis is reliant on H2 and CO2 for ATP and biomass production, so its rapid autotropic growth makes it a viable model organism that can be genetically harnessed for the engineering of useful products. Using synthetic biology methods, enzymes can be taken from a variety of organisms and combined into a host: in this case, the gram-negative methanogen Methanoccocus maripaludis. This project explores the combination and optimization of two enzymatic pathways to increase the intracellular NAD+ concentration within the organism, namely the PhaABC and NadMV pathways. By increasing the rate-limiting NAD+ in the biosynthesis of polymers (e.g. polyhydroxybutyrate), Methanoccocus maripaludis can be utilized as a “workhorse” similar to Escherichia coli and S. cerevisiae for the sustainable production of plastics.41

11. THE ROLE OF COMPUTER SCIENCE IN BIOLOGY AND MEDICINE: GENERATION OF AN ANTI INFLAMMATORY PEPTIDE

Keyan Kazemian, Rambod Meshki, Greg Hough, Parastoo Ali Pour, Paria Alipour, Mahsa Mahmoudi, Sofia Mahmoudi, Homa Mahdavi MD

Irvine Valley College

It is known that oxidized lipids can trigger systemic inflammation which in turn can affect the structure and function of cardiovascular system. Our group discovered in the 1990 that the structure and function of high density lipoprotein (HDL) or the so called good cholesterol is as important as its circulating levels. In many disorders the structure and function of HDL are abnormal and the HDL is dysfunctional not being able to prevent lipid oxidation and inflammation. Our group therefore developed an assay to determine the protective capacity of HDL and formulated a peptide that rescued HDL by sequestering the oxidized lipids in patient HDL. For designing the peptide collaborators at the University of Alabama used computer modeling and calculations to generate such peptide. Computer analyses showed that it was necessary to have 4 phenyl alanine groups (with its chemical symbol being F) in the peptide and therefore it was termed 4F peptide. Studies in laboratory animal models showed that the peptide was safe and efficacious. It did not generate any adverse effects and it converted dysfunctional HDL from patients with atherosclerosis into an HDL that was able to prevent LDL oxidation and to systemic inflammation as determined by the reduction of the level of the proinflammatory molecule serum amyloid A. The peptide is under various studies determining its usefulness in preventing metabolic disorders in humans in the future.

12. UNDERSTANDING MACROPHAGE POLARIZATION BY TUMORS

Audrianna Alonso*, Bridget Fortin, Jeffrey Snowbarger, (Michael I. Dorrell, Heidi Woelbern)

Point Loma Nazarene University

Cancer cells manipulate their microenvironment to maximize growth and minimize immune system recognition and elimination. Macrophages can either polarize to the pro-inflammatory M1 phenotype to eliminate foreign microbes and abnormal cells, or alternately towards the M2 phenotype, which inhibits the inflammatory response and is associated with wound healing and tissue repair. Aggressive tumor cells can prevent M1 macrophage activity and promote activation towards the M2 phenotype, developing tumor associated macrophages (TAMs) that promote growth and prevent immune attack. We are using TAMs as a target for delivering and activating chemotherapy agents using antibody-derived enzyme pro-drug therapy (ADEPT). Our ADEPT strategy, identification of the mannose macrophage receptor (MMR) as a target for ADEPT, as well as current in vitro efforts to use tumor-conditioned media to differentiate macrophages towards an M2 phenotype, will be discussed. Activation of M2-specific genes,

including MMR, CASC9, arginase, and the scavenger receptor (CD163), demonstrate our ability to cause M2 macrophage activation in vitro.

Cell Physiology

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13. GLUTAREDOXINS REGULATE PLANT GROWTH AND ROOT SYSTEM ARCHITECTURE.

Sophia Carpinelli*, Craig Cowling, Miguel Rosas, (Matthew Escobar)

Pomona College

Glutaredoxins (GRXs) are small enzymes that reduce disulfide bonds in target proteins. The model plant Arabidopsis thaliana has 31 GRX genes. We previously found that a group of Arabidopsis GRX genes is transcriptionally activated by nitrate. To characterize the function of one of these nitrate-regulated GRXs, AtGRX660, we generated transgenic Arabidopsis plants that overexpress the AtGRX660 gene. We isolated total RNA from the transgenic lines and quantified AtGRX660 mRNA levels via qRT-PCR. All AtGRX660-overexpression lines displayed a dwarf shoot phenotype, with reductions in shoot biomass and total leaf area compared to wild-type plants. While primary root growth was normal in the transgenic plant lines, lateral roots were almost absent. Phase contrast microscopy demonstrated that lateral root primordia develop in the transgenic lines, but the primordia do not emerge from the primary root. These results suggest that AtGRX660 acts as a negative regulator of shoot development and inhibits lateral root elongation.

14. ANALYSES OF TRACE ELEMENT COMPOSITION IN A METASTATIC BREAST CANCER MODEL USING X-RAY FLUORESCENCE

Sagar Pyreddy*, Jayasuriya Senthilvelan*, (Mihai Gherase, Jason Bush)

California State University, Fresno

Previous studies have demonstrated the utility of trace element analyses as an accurate indicator of cancer cell proliferation. To test the relationship between differences in trace element composition and metastatic behavior for breast cancer cells, we utilized X-ray Fluorescence (XRF). Metastatic variants of the common breast cancer cell line, MDA-MB-231, were used in a 3D culture system as a surrogate environment for in vivo growth. XRF spectra were analyzed with MATLAB and a combination of operations were performed including low pass Butterworth filter, Gaussian models fit to each elemental peak, Bremsstrahlung intensity

corrections, and two sample Student t-tests to calculate statistical significance. All trials found that the osteotropic (bone-metastatic) variant cells consistently accumulated more iron (Fe) and lead (Pb) (p-value of < 0.0001) relative to the parental cell line. This proof-of-concept approach demonstrates that XRF is quantitatively objective, relatively inexpensive, and extremely fast for identifying potential differences among cancer cells.

15. CHANGES IN ASTROCYTE CELL-SURFACE PROTEIN EXPRESSION FOLLOWING OGD AND LPS

Robert O'Dell, Kathleen G. Tallman

Loyola Marymount University

Astrocytes, pericytes, and endothelial cells compose the blood-brain barrier (BBB). Previous studies investigated these cells during stroke-like and inflammatory conditions. This study investigates astrocytes under these conditions. Human astrocytes (ScienCell) were exposed to LPS or OGD for 5 hours. Flow cytometry was used eighteen hours later to assess the percentage of cells positive for the surface proteins PDGFRβ, NG2, CD13, or CD11b and their mean fluorescence intensity. Previous data from this lab showed a small, but discrete population of CD11b positive cells endothelial cells and pericytes that decreased significantly after OGD and LPS. This population was absent in astrocytes, suggesting that only pericytes and endothelial cells are positioned to attract immune cells to the brain. Finally, although it was not statistically significant, NG2 expression increased after OGD and LPS treatment in astrocytes suggesting that astrocytes may attach more firmly to the basement membrane during stroke-like and inflammatory conditions.

16. DOXORUBICIN CAUSES DOSE-DEPENDENT CELL DEATH IN THE GLIOMA CELLS

Amber M Tavener, Richard L Daniels

The College of Idaho

Glioblastoma is a uniformly lethal astrocyte-derived tumor that is resistant to many anti-cancer drugs. We investigated whether doxorubicin, a topoisomerase II inhibitor traditionally used in many different cancer treatments, causes cell death in a murine-derived model system of glioblastoma (GL261 cells). We specifically hypothesize that the cell death will be dose-dependent. To test this, we treated cells with various concentrations of doxorubicin. We quantified apoptosis (comet assay) and cell viability (MTT assay) and found a dose-dependent response in both assays. To test whether membrane efflux pumps protect GL261 cells from drug-induced cell death, we treated cells with an efflux pump inhibitor prior to doxorubicin application. With this co-treatment we found fewer apoptotic cells. Contrastingly, the MTT co-treatments showed a decrease in cell viability. Future research will elucidate the cellular

mechanisms that lead to doxorubicin-induced cell death and the role of efflux pump inhibitors in GL261 cells and glioblastoma treatment.

17. EXAMINING HOW SIRT3 PREVENTS AGING IN HEMATOPOIETIC STEM CELLS

Andrew Widjaja, Dorothy Li*, (Danica Chen)

University of California - Berkeley

Aging impairs the self-renewal and differentiation potential of adult stem cells, which exist throughout the lifespan of an organism to repair and maintain tissues. SIRT3, a mitochondrial sirtuin that reduces reactive oxygen species levels, has been shown to play a role in maintaining hematopoietic stem cell (HSC) homeostasis with age. Although SIRT3 upregulation was found to improve the reconstitution capacity of aged HSCs, it is still unknown whether the restoration of SIRT3 at an old age will reverse or prevent further aging-associated phenotypes, such as myeloid bias. Overproduction of myeloid cells can lead to pathologies such as clonal hematopoiesis and myeloid leukemias. We report here an animal model of inducible Sirt3 overexpression in the hematopoietic compartment that leads to decreased aging phenotypes in vivo as assessed by peripheral blood analyses. Sirt3 overexpressed at an old age leads to the reversal of myeloid bias, suggesting a potential point of therapeutic intervention.

18. LAMININ-1 INDUCES ENDOCYTOSIS OF 67KDA LAMININ RECEPTOR AND PROTECTS NS-1 CELLS FROM CELL DEATH

Rayudu Gopalakdrishna

University of Southern California

As Laminin-1 has neuroprotective capabilities, this experiment focused on whether soluble laminin-1 could induce signaling for neuroprotection via the 67KDa laminin-1 receptor (67LR). Neuroscreen-1 (NS-1) cells containing laminin-1 or the YIGSR peptide were treated showing a decrease in the cell-surface expression of 67LR causing its internalization into the cell. In addition, cAMP elevating agents, such as forskolin and rolipram, were also shown to induce this internalization. Because both laminin-1 and YIGSR were able to induce a sustained elevation in the amount of cAMP under certain conditions, this suggests that cAMP may have a causal role in the endocytosis of 67LR. However, this endocytosis was not seen within cells that were deficient in the protein kinase A nor were they observed in cells treated with either SQ 22536, which is an inhibitor for adenylyl cyclase, or ESI-09, which is the inhibitor for the protein that directly activates cAMP. When internalization was observed in NS-1 cells, 67LR and adenylyl cyclase were contained within early endosomes. When put under conditions that should have induced endocytosis, both laminin-1 and YIGSR were able to be protected from cell death via induced serum withdrawal. However, under conditions in which endocytosis would not have

occurred, neither laminin-1 nor YIGSR were able to protect these cells from cell death. The binding of laminin-1 to 67LR caused initial signaling through protein kinase A and cAMP, which caused the internalization of 67LR, thereby causing sustained signaling for protection of these cells against death induced by the serum withdrawal.

19. LOW MITOGENIC CONDITIONS MAINTAIN THE CORNEAL ENDOTHELIAL PHENOTYPE IN VITRO

***Payton M. Boere, Jessica Wu, (Ricardo F. Frausto, Anthony J. Aldave)**

University of California, Los Angeles

In vitro methods for the culture of corneal endothelial cells (CEnCs) have been developed for generating therapeutically viable CEnCs. This study compared the effects of two culturing methods (Trypsin/LN/F99 and Collagenase/ColIV/M5) on barrier function, and on the expression of transporter-, barrier- and senescence-associated genes. Electric substrate impedance sensing and quantitative PCR were used. Cells cultured in M5 demonstrated significantly greater barrier function. Twelve (12/19) barrier-associated genes showed significantly higher expression in cells cultured in M5. Five (5/6) transporter genes showed significantly higher expression in cells cultured in M5. Significant changes in expression were observed for the senescence-associated genes CDKN2A and LMNB1. We demonstrated that CEnC-associated function and gene expression profiles are better maintained in M5 versus F99. While senescence develops in both, our study identifies potential gene targets that can be manipulated to delay the development of senescence in the establishment of cultured CEnCs for the management of CEnC disease.

20. PERICYTE SMOOTH MUSCLE-ACTIN INDUCED BY INFLAMMATION OR ISCHEMIA

Devin Sanders, Kathleen G. Tallman

Azusa Pacific University

Pericytes have alpha-smooth muscle actin (α-SMA), suggesting that they help the microvasculature of the brain to constrict. To investigate the relationship between cerebral ischemia and α-SMA expression, in-vitro simulations of ischemia and bacterial infection were conducted for five hours. Bacterial infection was simulated by treating monocultures with only lipopolysaccharide (LPS), LPS and LY294002, or LPS and Wortmannin. Pericytes were exposed to oxygen-glucose deprivation (OGD) with LW6 or Wortmannin. Approximately 18-22 hours after treatment, pericytes were analyzed using flow cytometry to determine the mean fluorescent intensity of α-SMA and NF-κB expressed on pericytes. The data show that all but one treatment increased the MFI for α-SMA, suggesting that multiple pathways are responsible for increasing α-SMA following inflammation or ischemia. Only OGD increased MFI for NF-κB, perhaps

indicating complex regulation. Future studies will increase the sample size and examine trends following three hours of LPS or OGD treatments.

21. POLYGLUTAMINE REPEAT PROTEINS ON ACTIN STRUCTURE IN DROSOPHILA PHOTORECEPTORS

Annie Vu, Tyler Humphries, Sean Vogel, (Dr. Adam Haberman)

University of San Diego

Huntington's Disease (HD) and Spinocerebellar ataxia type 3 (SCA3) are fatal inherited neurodegenerative diseases, caused by a polyglutamine (polyQ) expansion either in the huntingtin (Htt) or the ATXN3 gene. The gene causing Huntington's Disease and Spinocerebellar ataxia have a region where three of the bases, CAG, is repeated many times. We have shown that expression of long form HTT and ATXN3 genes disrupt the morphology of neuronal dendrites in various polyglutamine diseases. The defects observed were found to be caused by the disruption of the F-actin cytoskeleton which could be rescued through Rac signaling. Rac is a GTPase known to regulate actin structure by interacting with Formins, like Form3, which are actin nucleating proteins that help promote the development of linear actin filaments. Overall, this research is important because we were able to model actin regulation in dendrites in Drosophila photoreceptors as the actin regulation pathway is similar.

22. STUDYING THE ONCOGENIC EFFECTS OF HPV VIRAL PROTEINS ON RETINOBLASTOMA ACTIVITY AND DEGRADATION

Lacey Culpepper*, Connor Lowey*, Amy Rausch (Heidi Woelbern, Michael I. Dorrell, (Arianne Jansma)

Point Loma Nazarene University

The Human Papillomavirus (HPV) causes most instances of cervical, anal and penile cancers as well as an increasing number of oropharyngeal cancers. However, different virus serotypes result in dramatically different complications ranging from transient, benign skin lesions ("low-risk") to lethal cancers ("high-risk"). Pathological progression of high risk HPV involves two major oncoproteins, E6 and E7 that work to block apoptosis while initiating cellular reproduction, resulting in tumor formation. Previous work demonstrated that E7 interacts with, and degrades, the tumor suppressor retinoblastoma (pRb). We are currently investigating differences between low- and high-risk E7 protein variants, and analyzing the cellular effects of pRb phosphorylation and degradation in relation to key E7 residues. Work towards optimizing transient transfections with E7 protein variants and cellular analysis of pRb post-translational modification and degradation will be discussed. These studies will shed light on the cancer-causing mechanisms of HPV and identify novel targets for prevention or intervention.

23. THE EFFECT OF T-DARPP THR-39 PHOSPHORYLATION ON AKT ACTIVATION IN HERCEPTIN-RESISTANT BREAST CANCER

Sarwyn Singh, Arabo Avanes, Dr. Jamil Momand

California State University, Los Angeles

Her2-type breast cancers are characterized by overexpression of Her2 receptor protein, typically due to increased ERBB2 gene copy number. These fast-growing cancers account for 17-25% of breast cancers in the US, resulting in high levels of mortality. The clinically-approved antibody drug trastuzumab (Herceptin) binds to Her2 and inhibits its signaling activity (Her2 - PI3 kinase - AKT). However, within an average of one year, Her2- type cancers resurge due to acquired resistance resulting in AKT reactivation (AKT phosphorylation at S473). When breast cancers acquire resistance, they frequently overexpress t- Darpp. Forced expression of t-Darpp in Herceptin-sensitive breast cancer cells induces partial Herceptin-resistance. In such cells, t-Darpp also increases protein kinase A (PKA) activity and AKT phosphorylation, both important contributors to cell survival and proliferation pathways. How t-Darpp activates PKA and AKT remains unknown. Previously, it has been suggested that phosphorylation of T39 on t-Darpp correlates with PKA activity and AKT phosphorylation. To rigorously test the effect of T39 phosphorylation on AKT phosphorylation we used isogenic SKBR3 cells expressing wild-type t-Darpp, t-Darpp with an alanine mutation at T39, and t- Darpp with an aspartate mutation at T39 (mimicking the phosphorylated state) for effects on AKT. We found that all three cell lines exhibit two-fold increased AKT phosphorylation compared to empty vector-transfected control cells. There was no effect on AKT protein levels. This indicates that a region of t-Darpp outside of T39 is responsible for mediating AKT phosphorylation. To explore whether PKA activation is necessary for AKT phosphorylation, PKA will be knocked down with siRNA directed against PKA catalytic subunit alpha (PKA-ca) and AKT phosphorylation will be measured.

24. THE EFFECTS OF CHEMOTHERAPEUTIC AGENTS ON GLIOMA CELL MOTILITY

Shanaya B. Fox, Richard L. Daniels

The College of Idaho

Glioblastoma multiforme (GBM) is an aggressive form of brain cancer and is uniformly lethal, characterized by rapid 1) proliferation and 2) migration into adjacent healthy tissue. Current chemotherapy treatments target tumor cell proliferation but not tumor cell motility, which contributes to recurrence. We present experiments that characterize the motility of a murine-derived glioma cell line (GL261) using the Scratch Wound-Healing Assay. Application of two anti-proliferative drugs currently used in chemotherapy regimens, doxorubicin (DOX) and temozolomide (TMZ), showed no significant effect on GL261 migration, suggesting a need for continued exploration of drugs that target tumor cell motility. Previous reports indicate that the calcium-activated potassium channel KCa3.1 plays a role in glioma cell migration; however, we

found that pharmacological inhibition of KCa3.1 did not significantly alter GL261 motility. Our results suggest that the role of KCa3.1 in glioma tumors remains an open question that needs to be explored further.

25. THE P24 COMPLEX IS REQUIRED FOR BROME MOSAIC VIRUS RNA REPLICATION AND PROPER LOCALIZATION OF BMV 1A

Meagan Lopez*, Kevin Munoz, Josephine Simorangkir, Cheyenne Feig, (Arturo Diaz)

La Sierra University

Brome mosaic virus (BMV) is used as a model system for studying the common features shared by all (+)-RNA viruses. BMV replication occurs on rearranged perinuclear endoplasmic reticulum (ER) membranes, forming vesicular compartments known as spherules. Our results show components of the p24 complex, which acts as cargo receptors for the transport of proteins from the endoplasmic reticulum to the Golgi via COPII coated vesicles, is necessary for proper BMV RNA replication. Immunofluorescence microscopy shows that in wild type cells, BMV 1a forms ring-like structures in the perinuclear ER. However, deleting several components of the p24 complex resulted in the formation of non-perinuclear yet ER-associated punctate structures. Additionally, some components of the p24 complex relocalize from cytoplasmic puncta to the perinuclear ER during BMV replication. These results will allow us to better understand virus-host interactions required for proper spherule assembly, which will help in developing novel antiviral strategies going forward.

Ecology & Evolution

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26. A STUDY OF THE EVOLUTIONARY HISTORY OF MOLLUSKS AT HANNIBAL BANK

Sebastian Elsenbroek*, (Walter Cho)

Point Loma Nazarene University

The phylum Mollusca is one of the largest phyla with an estimated 100,000 species. There have been many studies investigating the evolutionary history of mollusks that have resulted in multiple hypotheses of the relationships between the different classes. The purpose of this project is to test the relationships between three of the seven different molluscan classes (Gastropoda, Bivalvia, and Polyplacophora) using 28 samples collected at Hannibal Bank, a seamount-like feature off the coast of Panama known for its biodiversity and productivity. The mitochondrial COI gene and the nuclear 18S gene were used to create Bayesian, Maximum

Likelihood, and Neighbor-Joining phylogenetic trees to test these relationships. Preliminary results support the hypothesis where the class Polyplacophora is basal to sister clades containing Bivalvia and Gastropoda.

27. AGE OF RESCUE (AOR) AS AN INDICATOR FOR SOCIAL COMPETENCE LEVELS IN MALE CHIMPANZEES.

Annalise Kress*, Grace Foreman, (Bill Ettinger)

Gonzaga University

Chimpanzees with a background of social deprivation lack the opportunity for social learning during infantile development (1-5 years), resulting in social competence deficits. At Chimfunshi Wildlife Orphanage, in Zambia, eight male chimpanzees in semi-wild enclosures were observed to access their social competence levels. Focal observations tested social competence of each chimpanzee by looking at proximity to other conspecifics, location, and behaviors performed. Chimpanzee were grouped by their Age of Rescue (AOR) and analyzed to consider if AOR indicates social competence levels. All subjets were grouped into; rescued after the age of five (AOR>5), rescued before the age of five (AOR<5), or captive-born (AOR=0). Subjects rescued after the age of five were hypothesized to demonstrate decreased social competence from social deprivation and trauma during infantile development. Data from this study revealed all groups acquired enough social competence to engage in normal levels of interaction, however, there was variance between study groups.

28. AN ECOLOGICAL EXAMINATION OF THE AQUATIC INVERTEBRATES IN ANZA BORREGO STATE PARK

Zachary Schaaf*, Farhan Ahmed, Sophie Dunkleberger, Taylor Rusak, Lauren Musial, Natalie Constancio, Kate Boersma

University of San Diego

Desert springs and streams experience natural cycles of flooding and drying. However, climate change is increasing the frequency and severity of droughts in desert regions, altering natural precipitation patterns. These changes affect aquatic invertebrate communities. My study seeks to understand the effects of severe drought on aquatic invertebrates in Anza Borrego Desert State Park (ABDSP), California, USA. Over the course of two years, we collected aquatic invertebrates from 5 sites. We identified the organisms and conducted statistical tests to determine if environmental differences affected community composition. We found that species richness was affected by temperature but not pH, dissolved oxygen, or depth. This information suggests that desert aquatic organisms are adapted to survive in extreme environmental conditions but are sensitive to temperature. These findings will help us predict

future community responses to a changing environment in order to enact restorative measures to protect desert aquatic habitats.

29. CONSTRUCTING A MAXIMUM LIKELIHOOD PHYLOGENETIC EUKARYOTIC TREE USING METHIONINE SALVAGE GENE FUSIONS

Lathan Liou*, (Andre Cavalcanti)

Pomona College

Assembling a complete eukaryotic tree of life has been a long-standing quest for systematic and inferential reasons. Not only would biologists have an organized way to classify the relationships between eukaryotes, but they would also more deeply understand how species evolved and diverged from one another. I obtained sample data by writing a bioinformatics program in the programming language R that scrapes genomes from databases and finds similar sequences to multiple query sequences. I used 12 proteins of the methionine salvage pathway (mtn), a universally conserved pathway, including fusion proteins mtnBC, mtnBD and mtnAK as phylogenetic markers to construct a maximum likelihood model. My principal results show that red algae are more closely related to stramenophiles than it is to plants based on the mtn pathway. This has huge implications towards uncovering important characteristics of red algal species as well as revising eukaryotic evolutionary relationships.

30. DENSITY DEPENDENCE OF NUCLEOPOLYHEDROSIS VIRUS IN AGRAULIS VANILLAE LARVAE.

Ramon Solis*, (Arietta Fleming-Davies)

University of San Diego

Density-dependent diseases spread faster in high host density populations, compared to low density populations. Nucleopolyhedrosis virus (NPV) is a pathogen that causes deadly disease in the larvae of Agraulis vanillae, the Gulf Fritillary butterfly. To determine if NPV transmission demonstrates density-dependence in this species, I conducted a field experiment to manipulate plant density within a natural population of Gulf Fritillaries. Six potted plants per treatment were placed at a field site in high (0.12 plants/m2) and low (0.013 plants/m2) density treatments. Egg counts, healthy and virus-killed larvae (n=108 total), were recorded over 35 days. Both treatments exhibited NPV outbreaks. Due to higher oviposition on the low density plants, both treatments had similar larval densities (0.01 and 0.009 healthy larvae/m2). Thus, the field data did not provide information to determine density-dependence. A stochastic mathematical model was fit to field data and simulated using the software R to model the NPV outbreaks.

31. DO FLEA COLLARS IMPACT PREDATION IN ARTIFICIAL FOOD SOURCES?DO FLEA COLLARS IMPACT PREDATION IN ARTIFICIAL FOOD SOURCES?

Jack Underwood, Ethan Cherry

The Masters University

The goal of this study was to determine the impact of flea collars on predation rates in artificial food sources. We predicted that the collars would not impact feeding rates. We filled the bowls with an average of 50.27 g of dog food in both the control (food and no flea collar) and the experimental group (food and a flea collar). Each bowl was placed at one of eight randomly chosen sites for 18 hours. We repeated this for seven consecutive weeks from October 26th to December 7th of 2018. After collecting the bowls, we measured the amount of food remaining in each bowl. We then averaged this number for each treatment over the trials and compared the treatments using a two-sample t-test. We repeated these analyses for each of the eight sites individually. There was no difference in the feeding rate between treatments ($t = 1.02$, p-value = 0.31).

32. EFFECTS OF DEVELOPMENTAL TEMPERATURE IN DIFFERENT POPULATIONS OF THE COPEPOD TIGRIOPUS CALIFORNICUS

Lindsey Korito*, (Casey A. Mueller)

California State University San Marcos

We examined the effects of temperature on the development of the copepod Tigriopus Californicus. We maintained four T. californicus populations, two from Southern California and two from Oregon at 20°C. Gravid females were isolated in six-well plates at 20°C, 25°C, and 29°C until offspring hatched. Offspring were fixed throughout development, photographed, stages, and length measured. We examined time to adult stage and adult oxygen consumption rate (VO_2) following development at 20°C, 25°C, and 27.5°C in the Southern California populations. There was a small, but insignificant, trend for VO_2 to be lowest at 25°C. Thus, 25°C may be the optimal temperature for development in the Southern California populations.

33. EFFECTS OF FIRE ON A BLACKBRUSH AND JOSHUA TREE WOODLAND IN THE MOJAVE DESERT

Ariana M. Sanchez, Kassandra M. Rodriguez, Syndee R. Dunn, Andrew M. Jaramillo, M. Kim Koval, Jennifer L. Burnaford, Darren R. Sandquist

California State University, Fullerton

Desert organisms are often highly adapted to extreme conditions, however, native desert communities can be slow to recover after major disturbances (e.g., wildfire) and are prone to invasion by non-native grasses. We examined plant community composition of a Mojave Desert Joshua tree woodland recovering from a 2005 fire by comparing adjacent burned and unburned areas in 2018. We hypothesized that fire disturbance would increase abundance of grasses and annuals relative to an unburned area, but decrease perennial species richness and diversity. We quantified the plant community using line transects, 50 m2 belt transects, and 0.25 m2 quadrats. Cover of non-native grasses did not differ between burned and unburned areas, but percent cover of native grasses was approximately ten times higher in the burned area than the unburned area. There was an average of 5.7 ± 0.6 (mean ± SE) perennial species in the burned area and 9.0 ± 0.7 in the unburned area. The diversity of perennial plants was higher in the unburned area (mean H' = 1.742) than in the burned area (mean H' = 1.075). We found an average density of 1.94 ± 0.1 individuals per m 2 for annual plants in the burned area but none were found in the unburned area. Despite 13 years of recovery, we found that the burned area community composition and cover remained very different from the unburned area, but that active management may not be necessary to prevent conversion to a non-native grass system.

34. ESTABLISHING A MONITORING PROGRAM TO ESTIMATE URBAN PARROT POPULATIONS IN SAN DIEGO

Maisy Feeley*, Maxwell Johnson, (Janel Ortiz)

University of San Diego

Though parrots from Mexico, South and Central America, and other countries have become naturalized in Southern California, their presence is not reflected by ample study or literature. Urban environments serve as the residence of at least thirteen parrot species, and, though there is no standard protocol for surveys of introduced parrots, we will estimate population size by conducting point-counts with a double-observer dependent approach. Over seven approximately one mile transects, we will conduct five ten-minute point-counts within a 200m fixed radius. These methods may change, likely to roost surveys as we determine more efficient ways to monitor the parrots in large roosts during winter. By monitoring these parrots, we will be better equipped to determine changes in population size and use of an urban environment.

35. EXOSKELETON CALCIFICATION: EXAMINING THE RESPONSES OF INTERTIDAL SHORE CRABS TO OCEAN ACIDIFICATION

Mauricio, C., Gandhi, A., Francisco, RJ., Davis, A., Chavez, B., Anderson, K., Romano, E., Herrera, S., Wells, T. (Dr. Diara Spain)

Dominican University of California

Higher atmospheric carbon dioxide levels results in increased ocean acidification, affecting marine invertebrates that utilize calcium carbonate in their exoskeletons. This leads to lower levels of available calcium carbonate for calcification. We explored the exoskeleton deposition changes due to increased acidity of ocean water on two intertidal shore crab species, Pachygrapsus crassipes and Hemigrapsus nudus. Specimens were observed for six weeks in a recirculating chilled seawater system. The experimental pH was manipulated to imitate more acidic water conditions. The results showed that the control groups increased in weight; in contrast, it fluctuated in both experimental groups. These weight changes may occur due to short term variation in calcification levels. Large changes in calcium carbonate deposition are likely to influence the strength of exoskeletons, with negative or positive implications on survival.

36. Exploring the effects of flea death rate on a plague susceptible human population

Sevil Mahfoozi, Anne Wegmann

University of San Diego

Plague has had an immense impact on the global human population, with 200 million deaths throughout history. It is caused by bacterium Yersinia pestis, and infects multiple species including rodents and humans. Bubonic plague is the most common form of the disease and is transmitted via an infected flea, which is a vector of the disease. Pneumonic plague is another form of the disease that is transmitted through direct human to human contact. In our research, we investigated how flea death rate impacts the number of plague-infected individuals in the human population. It was hypothesized that with increased flea death rate, the fraction of infected humans would decrease. To answer this question, we used an SIR-type model, simulated with the software R, and varied flea death rate to observe the change in the fraction of infected humans. Paradoxically, the fraction of infected humans remained constantly high with an increase in flea death rate. This is likely due to the importance of direct human to human transmission, which suggests that sanitation measures might be more effective in controlling this disease than pesticides to reduce vector populations.

37. EXTRACTING CLIMATE RECORDS FROM CORALLINE ALGAL SKELETONS WITH STABLE ISOTOPES.

Madison Blumer*, Annie Cohen, Madison Hobbs, (Branwen Williams)

Dominican University of California

Environmental data are recorded in the calcitic skeletons of marine organisms. In these skeletons, the oxygen isotope composition (d18O) reflects changes in sea surface temperature (SST) and salinity (SSS). Here, we model the relationship between skeletal d18O of a coralline algae and SST/SSS to extract past SST/SSS up to hundreds of years before modern recording devices. We developed a pipeline to identify growing months in which the alga encoded SST/SSS into their skeletal d18O. We then regressed skeletal d18O with SST/SSS of growing months to model their relationship through time. The relationships between d18O and SST/SSS differed between specimens from unique locations. This likely reflects location-specific climatic differences, such as duration of sea ice cover. Further work will look at the efficacy of other skeletal compounds such as Mg/Ca in model fitting, to improve reconstruction of past climate.

38. FIRST OCCURRENCE OF A GIANT SEA COW (HYDRODAMALIS CUESTAE) IN THE PICO FORMATION, SANTA CLARITA, CA

Charles Frederico Jr, (Matthew A. McLain)

The Master's University

Sirenians are marine mammals with a fossil record extending from the lower Eocene to the present. Modern sirenians include manatees and the dugong, all of which are vulnerable according to the IUCN. Hydrodamalis custae, an extinct, nine-meter-long sirenian, once lived along the American Pacific coast and is related to the recently extinct Hydrodamalis gigas (Steller’s sea cow) that once inhabited the Bering Strait. We found a large vertebra in the Pliocene Pico Formation of Santa Clarita, California. The Pico Formation represents a nearshore environment characterized by fossil molluscs, whales, and sharks. The vertebral centrum is heart-shaped, which is unique to sirenians. Through comparison with specimens at the San Diego Natural History Museum, we concluded that it is from the posterior end of the thoracic vertebral series of a H. cuestae. This specimen is the first definitive occurence of H. custae in the Pico Formation and in Santa Clarita, CA.

39. LOCAL DISTRIBUTION OF A WOOL CARDER BEE POPULATION AND ITS RESPONSES TO RESOURCES ENHANCEMENT

Carter Odean*, (Gary Chang)

Gonzaga University

Anthidium manicatum (Hymenoptera: Megachilidae) is an invasive solitary bee native to Europe that has only recently been recorded in the Pacific Northwest region of the United States. The territorial nature of this species provides a clear behavioral mechanism illustrating interspecific competition, an interaction that has not traditionally been quantified for pollinator species in the literature. The initial portion of this study consisted of mark and recapture observations conducted throughout 2017 and 2018 which were used to determine territorial characteristics such as location and duration. Together these data sets produced a sample size of 140 male specimen, 85 collected during 2018 and 55 from the previous field season. Gauging local pollinator response to resource availability was performed through experimental trials measuring activity on different types of potted plant species. Both male and female Anthidium manicatum exhibited a statistically significant preference for blue salvia that directly corresponded to current resource abundance.

40. NEPHILA CLAVIPES PREDATORY RESPONSE TO CICUTOXIN SEQUESTRATION WITHIN THE FOOD CHAIN

Robyn N. Cully*, Anna N. Maronick*, Kellie M. Kuhn, PhD

United States Air Force Academy

This study examines the impacts of cicutoxin produced by Cicuta douglasii (water hemlock) on the performance of and predation upon Lepidoptera species Pierie rapae, Vanessa cardui, and Manduca sexta reared on the plants Brassica oleracea, Achillea millefoliem, and Solanum lycopersicum. Cicutoxin is thought to deter predation and is a driving force in the coevolution among plants, herbivores, and plant competitors. Seeds were grown in purified water or 0.1% hemlock extraction solution, and plant growth, caterpillar growth and pupation, and spider predation were measured. Plants grown in hemlock solution grew significantly slower than control plants and were stunted at maturity. Caterpillars reared on hemlock-exposed plants grew significantly faster and pupated earlier than caterpillars reared on unexposed control plants. And, golden silk orb weaver spiders (Nephila clavipes) preferentially predated upon caterpillars not exposed to hemlock. Because spiders preferred control caterpillars to hemlock-exposed caterpillars, we know cicutoxins are entering the food web.

41. NEST SITE COMPETITION BETWEEN BLACK PHOEBES AND HOUSE FINCHES

Gabriela Ochoa and Elise Ferree

Scripps College

Nest usurpation, a form of competition, occurs when one individual overtakes the nest of another, either within or between species. As with other forms of competition, rates of nest usurpation can vary with a change in available resources needed for mating and rearing seasons. In southern California, we have observed House Finches (Carpodacus mexicanus) usurping Black Phoebes (Sayornis nigricans) nests, and we suspect that Black Phoebes have adapted spatial and behavioral mechanisms to minimize this threat. We hypothesized that active Black Phoebe nests will be further away from House Finch nests compared to usurped Black Phoebe nests. Additionally, we expect to see defensive behavior exhibited by Black Phoebes in response to House Finch presence. In a previous study conducted in 2012, active Black Phoebe nests were located further away from House Finch nests relative to those of usurped Black Phoebe nests. Nest defense was measured with playback trials using a replica of a House Finch as well as a Bewick's Wren (Thryomanes bewickii) as a control. Responses to the House Finch were common, although we hope to get a larger sample size in order to better understand the behavioral responses of Black Phoebes to House Finches. We also plan to determine if the distribution of Black Phoebes and their defensive behavior towards House Finches have shifted over time. Ultimately, this study will improve our understanding of nest usurpation as an interspecific relationship and the defensive mechanisms formed in response.

42. PLASTIC MICROFIBER INGESTION BY MYTILUS CALIFORNIANUS IN THE CHANNEL ISLANDS HARBOR, CALIFORNIA

Chloe Mankin

California Lutheran University

Microfibers are an emerging threat to terrestrial and aquatic habitats worldwide. Their prevalence in the environment raises toxicity concerns due to their ability to concentrate high levels of persistent organic pollutants (POPs) and their potential to bioaccumulate within food webs. In past studies, Mytilus californianus has been shown to accumulate and retain these plastics through ingestion, digestion, and adherence. The number of microplastics in the Channel Islands Harbor bivalves has yet to be examined. I aim to determine the frequency and characteristics of microfiber pollution in wild M. californianus communities from two docks in this location. Hydrogen peroxide will be used to digest the organic matter and a saline solution will be added to separate the microfibers from the dissolved liquid via flotation. The mixture will be filtered by vacuum filtration over a cellulose nitrate membrane filter. Microfibers will be examined, counted, and characterized under a compound light microscope.

43. RELATIONSHIPS AMONG AGES, GROWTH RATES, BANDING FREQUENCIES, AND GROSS MORPHOLOGY IN DEEP-SEA PRIMNO

Emma Choy*, Kelly Watanabe*, (Branwen Williams)

Claremont McKenna College

Deep-sea Primnoid corals live for hundreds of years, forming alternating calcite and gorgonin skeletal bands. They provide significant habitat for fish and invertebrates. However, logistical difficulties in collecting deep-sea colonies limit our knowledge of their growth characteristics. For three Primoid colonies off the Alaskan coast, we determined 1) colony ages using complimentary 210Pb and 14C measurements, 2) number of skeletal bands by counting bands physically and in digital images, and 3) gross morphology biometrics. Results show that colonies dated to less than 75 years old. Radial growth rates change unpredictably with age, while colony height correlates with age, indicating a difference in growth mechanisms. Band counts varied systemically between the two counting methods although sequential layers physically counted generated higher band counts than were evident in photographs of a colony cross section. This relative consistency among band counts provides a non-destructive method for determining ages of physically collected specimens.

44. STONEFLY (PLECOPTERA) DIVERSITY IN INTERMITTENT STREAMS OF THE DIABLO RANGE, CENTRAL CALIFORNIA

Manuel Carrillo*, Kiara Luck*, Rosaisela Medina Ordaz*, Giovanna Meza*, Deianera Zare*, (Matthew Cover)

California State University Stanislaus

Intermittent streams (streams that lack surface water for a portion of the year) are poorly studied not afforded the same conservation focus as perennial streams, but can harbor high biodiversity of endemic insects. Recent studies have shown that stoneflies (Plecoptera), in particular, can have unique adaptations for survival in intermittent streams, and may be particularly diverse in the Coast Ranges of California. We surveyed Plecoptera diversity in 8 streams of the Diablo Range during the winter season by collecting aquatic larvae and terrestrial adults. We identified over 10 morphospecies from 3 families in our study region. Richness at individual sites ranged from 0 to 5 taxa, and nearby streams exhibited highly distinct assemblages. Richness was positively correlated with riffle habitat, and uncorrelated with stream width and watershed area. We find that additional surveys of Plecoptera biodiversity are needed to better understand the ecology, biogeography, and conservation status of these organisms.

45. TESTING THE CENTRAL MARGINAL HYPOTHESIS IN AUSTRALIAN SCINCID LIZARDS

John Wrath*, Huateng Huang, Dan Rabosky, (Sonal Singhal)

California State University Dominguez Hills

The central-marginal hypothesis predicts that across a species geographic range, genetic diversity varies. At the center of their geographic range, a species' populations are in ideal ecological conditions, leading to larger and more genetically diverse populations. As distance from center increases, conditions become more marginal. Edge populations are predicted to exist in smaller, more isolated populations. Smaller populations are more vulnerable to the effects of genetic drift, which reduces their genetic diversity relative to central populations. Our study tests the predictions of the central-margin hypothesis using genomic and geographic data from an average of 19 individuals per species for 25 species of Australian scincid lizards. For each species, we used over 2.5 Mb of genetic data to calculate nucleotide diversity, a fundamental metric of genetic variation. Fourteen out of 18 species showed a significant negative correlation between distance from center and genetic diversity, as predicted.

46. THE EFFECTS OF CLIMATE CHANGE THROUGH TEMPERATURE AND PH ON CORAL BLEACHING IN AIPTASIA PALLIDA

Andrea Huvard, Hannah Travers

California State University Dominguez Hills

Changes to ocean environments are continuously increasing due to the effects of climate change. Coral reefs are especially vulnerable to increases in ocean surface temperature and ocean acidification, which can lead to a reaction called coral bleaching. Aiptasia pallida, a tropical species of anemone, was used as the model species to understand these phenomena of temperature and pH changes predicted by the Intergovernmental Panel on Climate Change (IPCC) by the year 2100. Cell counts were taken to quantify the number (in cells per mL) of expelled zooxanthellae, or bleaching, that occurred. Control and bleaching threshold experiments were conducted to determine normal bleaching levels as well as at which temperatures and pH bleaching was induced. Temperature tests were observed from 24 to 27 degrees Celsius and pH tests were done from 7.6 to 8.1. Simultaneous experiments of both parameters were then conducted using the same measurements for comparison to understand the impact of pH and temperature concurrently, as we see in our oceans today. Results to come.

47. THE EFFECTS OF ENVIRONMENT AND JANTHINOBACTERIUM LIVIDUM ON CHYTRID FUNGUS

Elizabeth Bento

Dixie State University

Despite being commonly found carrying a lethal flesh eating chytrid fungus (Batrachochytrium dendrobatidis) that is known to suffocate most other amphibians, Zion Canyon Tree Frogs (Hyla arenicolor) populations appear to be doing fine. It has been speculated in the past that the arid climate of Arizona and Utah, which these frogs call home, creates an unfavorable environment for chytrid proliferation. This is an especially promising hypothesis because these Canyon Tree Frogs have a very unique behavior when compared to most of their amphibian brethren: they sunbathe. This unique behavior seems to limit the ability of the fungus to spread among and survive on its hosts. Another factor may be at play in inhibiting chytrid growth: the presence of Janthinobacterium lividum which is known to compete with and kill chytrid fungus. The present study seeks to determine whether the presence and activity of chytrid fungus on Zion Canyon Tree Frogs was hindered by either the environmental conditions in which the frogs were found, the presence of Janthinobacterium lividum, or a combination of the two factors. To do so, 50 DNA samples collected from the frogs were isolated using a 50 count QIAGEN DNA Isolation kit: DNeasy Blood and Tissue Kit, and then analyzed via PCR and gel electrophoresis for the presence of chytrid DNA. Afterwards, two separate agar gel cultures of chytrid were grown under the same environmental conditions: one of the cultures served as a control with only chytrid present, the other contained both chytrid and Janthinobacterium.

48. THE LIMITS OF ARMORED SCALE GENERALISM

Clarice Martinez deCastro, (Geoff Morse)

University of San Diego

Armored scale insects (Hemiptera: Diaspididae) are a group of parasitic herbivores that are incredibly common and found on most vascular plants. There are species that have the greatest diet breadth of any plant-feeding insect; however, there are also species that are highly specialized. Understanding the ecological correlates of this extreme variation will provide insight on the role of diet breadth in generating biodiversity. This study observes the relationship between armored scale insects associated with Comarostaphylis diversifolia, a shrub located in coastal Southern California. Some of these shrubs have leaves covered in glandular hairs, a feature previously shown to affect scale insect distribution and abundance. Others do not. Census and DNA sequence data were gathered from populations of armored scales on C. diversifolia around southern California in order to examine whether infestation rates of armored scale insects or population genetic structure of armored scale insects was associated with these glandular hairs.

49. THE SUCCESSION AND COMPETITION OF THE PACIFIC OYSTERS IN OXNARD, CALIFORNIA

Austin Truong*, (Andrea Huvard Ph.D.)

California Lutheran University

The native Japanese Pacific Oyster, also known as the Crassostrea gigas, is one of the most translocated marine species in the world, causing economic and ecological damage. Identified as a marine invasive species, scientists questioned the adaptability of the oyster as it could have the potential to cause ecological succession by outcompeting the keystone species. Within Channel Islands Harbor in Oxnard, California, sightings of the Pacific Oyster have recently been reported in the area. In order to track if these Pacific Oysters have the potential to cause an ecological disturbance, growth rates and experimental coverage were collected at two separate locations for the Pacific Oysters, as well as the keystone species, Mytilus. Growth rates and coverage of both species showed that the Pacific Oysters are more prevalent to outcompete in the area with a higher salinity level, while the lower salinity area leads to possible co-dominance between the two species.

50. THE TRANSPORT OF URBAN RUNOFF AND ITS EFFECTS ON WATER QUALITY IN A NATURAL ENVIRONMENT

Brittany Ducca, Jenna McKune, Austin Moore, Bonjun Koo

California Baptist University

The conducted research continues to investigate the transport of rainwater through an urban environment and its effects on stream water quality at Castleview Park. The stream receives a significant amount of runoff from the park's urban surroundings. A map of Castleview Park, which includes the surrounding topographical features, allows for the understanding of hydrological processes at larger scales. Collected water samples were tested for specific nutrient levels, dissolved oxygen (DO), pH, and turbidity. Rainfall can also have an effect on the quality and composition of the soil. Alterations of the soil pH, trace elements, and nutrients within the soil can have an array of effects on the surrounding flora and fauna. Hach® kits CEL/820, & DR 900, and DO Kit Model OX-2P, were utilized to measure water quality changes before, and after, rainfall. The results from research conducted in 2018 were also considered when comparing results of 2019 on the same stream site. First flush, as a result of a rainstorm, has the potential to significantly degrade surrounding stream water quality.

51. UTILIZING INVASIVE TUMBLEWEED (KALI TRAGUS) BRUSH PILES TO ASSESS HABITAT ENHANCEMENT AT ASCOT HILLS

Jackie Galvez, Nick Pilaud, Selena Yuan, Demian Willette

Loyola Marymount University

Brush piles are natural or artificial structures composed of dead plant biomass, generally woody debris or dried brush. Such structures have long been advocated as a means to enhance wildlife habitat and attract native species. Despite the common nature of brush piles as a wildlife management strategy, the research literature on the measurable effect of these structures remains largely unresolved. This study assesses whether brush piles constructed of prickly Russian thistle (Kali tragus) could function to enhance wildlife habitat and promote the growth of native vegetation, while also mitigating the spread of this invasive thistle. Experimental brush piles constructed from K. tragus in Ascot Hills Park in northeast Los Angeles, CA are used to address this question. Metrics including brush pile height, temperature, animal burrow, and native plant presence were measured from April 2018 to March 2019 for a total of four seasons. Preliminary data suggests that brush pile construction may have the potential to reduce local temperature fluctuation. During the summer (July 2018), average brush pile temperature remained within 10°F (68-88°F) while average control plot temperature fluctuated within 76°F (60-136°F). However, animal burrow and fecal matter presence appear to have no correlation with brush pile construction. Future research may include assessing differences in insect biodiversity between brush piles and control plots. Overall, this study serves as a preliminary look into whether brush piles can effectively serve as a method to increase local biodiversity of native floral and faunal populations.

52. INVESTIGATING FASTER RATES OF FISH SPECIATION WITHIN VOLCANIC TAAL LAKE OF THE PHILIPPINES USING RAD

Leonardo Gonzalez-Smith, Demian Willette

Loyola Marymount University

The Indo-Malay-Philippine Archipelago (IMPA) is considered a major center of marine biodiversity with the highest concentration of shore fish anywhere on Earth. Composed of over 7,000 islands, the Philippines boasts a range of different aquatic environments such as volcanic lakes, rivers, and 10,000s of kilometers of coastlines. Geographic, oceanic, and physical processes can inhibit gene flow among fish populations, and over time, may result in the origin of new species via allopatric speciation. A local example is Taal Lake, formed only 300 years ago after a series of extreme volcanic events and geological changes constricted the flow of the Pansipit River and separated the marine environment from the now freshwater Taal Lake. The vicariant event also disrupted the putative gene flow between organisms in the lake and those in the adjacent South China Sea, including sardines. Regionally there are two morphologically

similar sardines: Sardinella tawilis, an endemic freshwater lake fish, and Sardinella hualiensis, a marine fish found along the Philippines and Taiwan. Using restriction site-associated DNA sequencing, single nucleotide polymorphisms are aligned to investigate whether these two fish have a most recent common ancestor that lived prior to the vicariance event that occurred 300 years ago. Analysis of the genetic relationships will allow us to estimate a divergence time between the two species and determine if the evolutionary split between these two morphologically species pre-dated the formation of Taal Lake. The genetic data will also inform ongoing conservation efforts of endemic and threatened S. tawilis within the lake.

Genetics

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53. FUNCTIONAL ANALYSIS OF MITOGEN ACTIVATED PROTEIN KINASE 9 IN ARABIDOPSIS THALIANA

Konnie Guo*, Alexandra Lintner, Michaela Ince, (Fabien Jammes)

Pomona College

Mitogen-activated protein kinases (MAPKs) are enzymes involved in signaling transduction that are highly conserved in eukaryotes. In plants, MPK9 has been identified in Arabidopsis thaliana as a positive regulator of the reactive oxygen species-mediated abscisic acid (ABA) hormone signaling pathway that leads to stomata closure. Questions regarding the physiological roles of MPK9 remain and our goal is to complete the functional analysis of the protein. The MPK9 coding sequence and its promoter were cloned into binary vectors and used to generate transgenic plants allowing for in vivo visualization of the subcellular localization of the protein and the expression pattern of the gene. Additionally, a yeast-two-hybrid assay on MPK9 identified several potential protein partners that are currently under validation. These studies on MPK9 and its partners will work to shed light on its function in the ABA signaling pathway and in the plant as a whole.

54. A SCREEN FOR CRYPTIC EPIGENETIC VARIATION IN NATURAL POPULATIONS OF DROSOPHILA MELANOGASTER

Joanna Portillo, Alyssa Abano, Dagem Getahun, Lauren McAllister, Makena Wolfrom, Chloe Walian, Mary Kaveney, (David Marcey)

California Lutheran University

We are conducting a large scale screen for novel sources of cryptic genetic variation (CGV) in natural populations of Drosophila melanogaster. CGV may be an underappreciated component in the spectrum of natural variation upon which natural selection can act. The screen is based on a model for the production of head defects by the extra eye mutation (ee), which is incompletely penetrant, variably expressed, and conditionally dominant. The model posits RNAi-mediated transcriptional suppression via epigenetic heterochromatization of a gene that encodes a repressor of activated STAT, a key molecule in the JAK-STAT signaling cascade implicated in embryonic eye field establishment. In ee strains, a P transposable element insertion maps near a gene (Su(var)2-10), and is the putative target of RNAi-induced heterochromatization. The proposed epigenetic model predicts that new mutant phenotypes may be uncovered in crosses between ee lines and flies from natural populations that harbor P-elements at various genomic locations. Such novel mutants are predicted to be incompletely penetrant and variably expressed, caused by epigenetic silencing via RNAi-induced heterochromatization of genes residing at genomic positions near P-elements. In an initial study described here, we conducted a screen for such mutations by scoring progeny of crosses of 16 separate wild-derived lines to ee. In one such cross, a new mutation, crybaby (cby), was recovered. Cby exhibits the properties expected of an epigenetically-triggered mutation. Our results to date suggest that variation in natural populations may include cryptic, epigenetic sources linked to transposable elements, which are revealed under particular genetic contingencies. Screens of multiple wild strains for additional examples of cryptic phenotypes are ongoing, as are genetic and molecular characterization of the cby phenotype.

55. BACTERIAL VIABILITY UNDER TREATMENT WITH GLMS RIBOSWITCH ANALOGS

Clare Weber*, (Juliane K. Soukup)

Creighton University

Riboswitches are non-coding segments of mRNA that control gene expression. The glmS riboswitch regulates expression of fructose-6-phosphate amidotransferase which catalyzes the production of glucosamine-6-phosphate (GlcN6P), a precursor in bacterial cell wall biosynthesis. The riboswitch initiates self-cleavage upon binding to GlcN6P. Cleavage results in degradation of mRNA, inhibiting glmS gene expression and preventing cell wall synthesis. The glmS riboswitch, found in over 400 gram-positive bacteria, is a potential target for novel antibacterial agents. The project aims to identify an analog which mimics GlcN6P interaction with the glmS

riboswitch to affect bacterial cell viability. Growth assays were performed to monitor the growth of Bacillus subtilis and Staphylococcus aureus in the presence of potential analogs with the goal of decreasing bacterial growth. Studies found Serinol decreases bacterial growth at concentrations of 100 mM. Future studies will verify analogs are decreasing growth via interaction with the glmS riboswitch and will identify additional antibacterial analogs.

56. CHARACTERIZATION OF THE INTERACTION BETWEEN CAF-1 AND PCNA.

Jacquelyn Wright*, (Lynne Dieckman)

Creighton University

Following replication, DNA winds around histones and condenses into chromatin in a process called replication-coupled nucleosome assembly. This process is mediated by two proteins: proliferating cell nuclear antigen (PCNA), a DNA sliding clamp protein that functions as a scaffold for proteins during DNA replication, and chromatin assembly factor 1 (CAF-1), a protein that recruits histones to the replication fork. The CAF-1-PCNA interaction is integral to gene silencing, but the mechanism by which it functions in selective expression remains unknown. The largest subunit of CAF-1, Cac1, is integral to the CAF-1-PCNA interaction. Although a PCNA interacting peptide (PIP) motif has been identified on Cac1, we have identified additional sequences within Cac1 that we believe are vital to the CAF-1-PCNA interaction. We have performed site-directed mutagenesis at each of these sequences. We will carry out quantitative protein-protein binding experiments with the Cac1 mutants to determine the binding affinities of each with PCNA.

57. CHARACTERIZATION OF VIRULENCE FACTORS IN NOVEL BACTERIOPHAGE GRUNGLE IN THE PRESENCE OF STRESSORS

Brooke Crosswhite*, Christopher Huerta*, Kimberly Uehisa* , Ryan Ngo, Samuel Wu, Dr. Jordan Moberg Parker, Dr. Amanda Freise

University of California, Los Angeles

The purpose of this research was to isolate and characterize novel mycobacteriophage genomes that may aid in further understanding implications for phage therapy. If our phage is analyzed through environmental stress tests, annotation, and analysis programs, then plaque morphology will be altered, and the functions and applications of these genes may be identified. Mycobacteriophage Grungle was isolated from soil samples and tested against Mycobacterium smegmatis, a non-pathogenic, surrogate host of M. tuberculosis. Transmission electronmicroscopy provided evidence of Grungle's Myoviridae morphology. Grungle's large genome composed of 216 protein coding and 32 tRNA genes. Comparative analysis was performed on the tRNAs and glycosyltransferase genes, which are known to aid phage in

increasing phage virulency. Dot plot, GC content, and codon usage bias were used to further analyze these genes of interests as they may contribute to the lytic life cycle. Results indicate that Grungle's genome may be successful in phage therapy.

58. CHARACTERIZING THE ROLE OF THE POLYADENYLATION FACTOR, PBP1, IN PRE-MRNA SPLICING IN S. CEREVISIAE

Nathan Stutzman*, (Tracy Johnson)

University of California, Los Angeles

To further understand the function of Prp16, a DEAH-box ATPase that remodels and activates the spliceosome, a transposon-based mutagenesis screen was performed in S. cerevisiae and identified two suppressors of the temperature sensitivity of a prp16 mutant—both in PBP1. The splicing relevance of Pbp1, a protein known to be involved in polyadenylation and P body formation, was investigated genetically in several mutant spliceosome backgrounds. Phenotypic rescue of prp16-2 depended on specific allelic disruption of PBP1 while complete deletion of PBP1 partially rescued lea1Δ temperature-sensitive growth defects. No significant genetic interaction was observed between PBP1 and early splicing factors. We hypothesize that Pbp1 functionally coordinates with the spliceosome near the branch point during the second catalytic step. Ongoing structure-function analysis will characterize how specific disruption of PBP1 affects growth, splicing and polyadenylation in prp16-2 and lea1Δ cells in order to illuminate the cooperative role of Pbp1 in mRNA processing.

59. CONSTRUCTING HPV16 EXPRESSION VECTORS WITH IN-FUSION CLONING

Shilpa Rajagopal*, Frederico Omar Gleber-Netto, Meng Gao, Burak Uzunparmak, (Curtis R Pickering)

University of Texas at Austin

HPV-associated head and neck squamous cell carcinomas (HNSCCs) comprise a growing number of head and neck cancer occurrences in the U.S., with HPV-positive tumors displaying better prognosis and chemo-radiation response. Among particular significance is HPV16, a viral subtype that has been implicated as a high-risk factor for HNSCC. Several critical HPV proteins involved in head and neck tumorigenesis include E6 and affiliated E6* splice products, E7, and E1^E4. The E6 and E7 proteins impair the activity of tumor suppressors p53 and pRb, respectively. Additionally, prior research has found that lower E1^E4 RNA expression is associated with greater resistance to radiation. Novel HPV16 expression vectors containing E6, E7, and E1^E4 gene inserts were constructed using In-Fusion Cloning to ultimately test for phenotypes affecting the HPV prognostic signature at the genomic, transcriptomic, and

proteomic levels. These constructs can serve as versatile tools to evaluate key metabolic pathways involved in HPV-positive HNSCC progression.

60. CULTURAL CONTEXT AND GLOBAL HEALTH IMPLICATIONS OF THE LASTASE PERSISTENCE SNP IN HUMANS

Genesis Cruz, Kam Dahlquist

Loyola Marymount University

Consuming lactose after lactase expression has ceased (lactase non-persistence, LNP) after weaning leads to the symptoms of lactose intolerance for a majority of the world's population. However, the expression of the lactase enzyme continues into adulthood (lactase persistence, LP) in some humans, allowing for consumption of lactose with no adverse symptoms. The LP phenotype is associated with a single nucleotide polymorphism (SNP) found in an enhancer region that regulates the lactase enzyme (LCT) gene. One SNP, LCT C>T-13910, located 13.9 kb upstream of LCT is associated with the LP state in European populations. We have implemented an RFLP assay outlined in Morales et al. 2011, to detect an individual's LP/LNP genotype by amplifying a 448 bp region containing the lactase SNP and cutting the product with the restriction enzyme FacI, allowing us to explore the cultural context and global health implications of the LP vs. LNP phenotype.

61. GENERATION OF A CORNEAL ENDOTHELIAL CELL MODEL OF CHED USING CRISPR-CAS9 KNOCKOUT OF SLC4A11

Junwei Zhang*, Payton Boere, (Doug Chung, Anthony Aldave)

University of California, Los Angeles

Congenital hereditary endothelial dystrophy (CHED) is an autosomal recessive disorder of the corneal endothelium that is characterized by corneal opacities and impaired vision. While CHED has been associated with mutations in the solute carrier family 4 member 11 (SLC4A11) gene, the pathomechanisms in which SLC4A11 mutations lead to CHED have yet to be elucidated. To investigate the impact of SLC4A11 insufficiency on human corneal endothelial cell (CEnC) function, SLC4A11 was knocked out by CRISPR-Cas9 gene editing in HCEnC-21T, a human CEnC line.. After HCEnC-21T were transfected with SLC4A11 CRISPR-Cas9 guide RNA and subsequently sub-cloned, DNA and protein from each clone were extracted for validation. Genotyping by Sanger sequencing and CRISPR-ID analysis were used to select for clones with either homozygous or compound heterozygous knockout of SLC4A11 to mimic the autosomal recessive nature of CHED. Western blot validated the absence of SLC4A11 expression in the generated HCEnC-21T SLC4A11-/- cells.

62. INVESTIGATING TRANSLOCATION FORMATION IN YEAST

Felipe Becerril*, Julian Prieto*, Ellen Wang*, (M. Cristina Negritto)

Pomona College

DSB repair processes are essential for maintaining genome stability. Homologous recombination (HR) is the repair pathway of choice for ensuring accurate repair since it uses undamaged homologous DNA sequences, such as that found in sister chromatids, as a template for the repair process. Previous experiments looking at the role of the Rad3 helicase in HR identified a mutant, rad3-G595R, that resulted in higher levels of Short Sequence Recombination (SSR). SSR could result in genomic instability due to improper recombination between short repetitive sequences scattered throughout the genome. To address this hypothesis, we have designed an assay that uses the CRIPSR-cas9 system to induce DSB's within natural short repeated sequences found in the yeast genome. We hypothesize that in a rad3-G595R mutant strain the induction of DSBs in these short repetitive sequences will lead to observable chromosomal rearrangements, such as translocations, inversions, and deletions due to increased SSR.

63. NOVEL MUTATION IN ALPHA ADDUCIN (ADD1) IS ASSOCIATED WITH HYDROCEPHALUS.

Irena Feng*, Cai Qi, Christopher A. Walsh, (Xiaochang Zhang)

University of Chicago

Hydrocephalus describes a condition when excess fluid builds up in and around the brain, and can cause brain damage. Here, we report a patient with hydrocephalus and agenesis of the corpus callosum; whole exome sequencing revealed a novel homozygous point mutation in alpha adducin (ADD1), a membrane-associated protein found in a diverse range of tissues and important for neuron structure. Sequence analysis identified an A to T change, predicting an Arg-57-Trp substitution. We further found the mutation to be associated with a shortened protein as determined through transfection and Western blot. We hypothesize that this mutation introduces a new splice donor site and causes partial protein loss-of-function. Additionally, this mutation may affect ADD1 function in both neural progenitors and neurons. These findings allow for deepened understanding of brain structure and can subsequently assist in improving diagnosis of neurological and neurosurgical conditions.

64. STABILITY AND HOST SPECIFICITY OF PHAGES ZORP AND TANIS FOR USE IN PHAGE THERAPIES

Andrew Kapinos*, Lauren Remijas, Nina Canela Torres, (Amanda C. Freise, Kris Reddi, Samuel Wu, Malcolm Phung, Ryan Ngo)

University of California, Los Angeles

Bacillus subtilis and Gordonia terrae are non-pathogenic, Gram-positive bacteria with the potential to acquire pathogenicity. Phage therapies may be used to treat antibiotic resistant bacterial infections, but understanding the environmental conditions that affect bacteriophage stability is fundamental for developing phage treatments. Bacteriophages also exhibit a varying degree of host specificity that determines their utility for targeted phage therapies. This study tested the thermal stability of a novel Bacillus subtilis bacteriophage, Zorp, by observing bacterial lysis through optical density and plaque assays. Experiments demonstrated that Zorp was stable between 35˚C and 65˚C, but became inactivated at 80˚C. Additionally, Gordonia terrae phage Tanis' genome was annotated using a suite of bioinformatics programs. Comparative genomic analyses suggested a novel method for the investigation of phage host range, which utilizes nucleotide similarity, phylogenetic relationships, and codon biases in tandem to determine the likelihood that a phage will be able to infect a given host.

65. STRUCTURAL ANALYSIS OF OAZ RNA IN AGARICUS BISPORUS

Siddharth Venkatraman*, Tessa Giandinoto, (Juliane Strauss-Soukup)

Creighton University

Riboswitches are segments of non-coding messenger RNAs that bind cellular metabolites and undergo conformational changes to manipulate the expression of a downstream gene. Though riboswitch regulatory behavior in bacteria has been documented, eukaryotic riboswitch behavior pertaining to polyamine biosynthesis remains largely uninvestigated. The goal of this research is to investigate the highly conserved putative riboswitch OAZ RNA from the mushroom Agaricus bisporus by analyzing the interaction between the RNA and various polyamines using in-line probing, equilibrium dialysis, and isothermal titration calorimetry techniques. Previous work on the mouse OAZ RNA demonstrated preferential binding to spermine over other natural and non-natural polyamines. Preliminary in-line probing and equilibrium dialysis data supports the A. bisporus OAZ RNA as a polyamine-sensitive riboswitch that undergoes structural changes in the presence of the natural ligand spermine. Understanding riboswitch structure and riboswitch-ligand specificity will greatly improve the targeting and reprogramming of polyamine biosynthesis for medicinal and biotechnological applications.

66. STRUCTURAL ANALYSIS OF OAZ1 RNA IN CRASSOSTREA GIGAS

Spencer Thompson, Siddharth Venkatraman, (Juliane Soukup)

Creighton University

Riboswitches are segments of non-coding RNAs that bind cellular metabolites in order to modify expression of a downstream gene. Specifically, a riboswitch interacts with a precise ligand resulting in a conformational change in the RNA. This structural change can affect transcription, translation or RNA processing of the downstream gene, which would make more metabolite, thereby affording an elegant feedback mechanism of inhibition. The Soukup lab is investigating a potential mammalian riboswitch (OAZ1-PK RNA) that is involved in polyamine biosynthesis. Polyamines are essential for cell growth and differentiation, and play a role in replication, transcription, and translation. The ability of riboswitches to control essential metabolic pathways has opened up the possibility that novel antibiological agents could eventually be synthesized that target riboswitches. The OAZ1-PK RNA is highly conserved across a variety of organisms; suggesting RNA might have played a key role in early organisms. Riboswitches could provide a key explanation of how RNA might have functioned in roles now held by proteins. Further research is still needed to both confirm the presence of riboswitches in these organisms and to gather more data regarding their structure. This project is focused on studying the riboswitch-ligand binding interaction of OAZ1 RNA (from oyster, Crassostrea gigas) with the metabolite spermine. Preliminary evidence has been obtained using in-line probing and equilibrium dialysis that the oyster OAZ1 RNA undergoes structural changes in the presence of spermine, which is a key characteristic necessary to classify an RNA as a riboswitch.

67. THE LOS ANGELES SEAFOOD MONITORING PROJECT

Stacy Lam, Mary Balducci, Demian A. Willette

Loyola Marymount University

Seafood mislabelling is a widespread and potentially dangerous problem across the world. Previous studies have reported high rates of seafood mislabelling in restaurants, specifically in Los Angeles. Despite new government regulations attempting to counteract this issue, very little seems to have changed, and it is still unknown where the mislabelling issue originates in the line from supplier to restaurant. In order to find out more about this mislabelling rate, our project aims to use DNA sequencing to identify whether the fish being sold is accurately labeled. In this study, we are gathering samples of six different commonly ordered fish from 10 restaurants in the Los Angeles area on a monthly basis, starting in April 2018. The samples have been preserved in 95% ethanol, and the DNA is being extracted, amplified and sent to be sequenced. Using DNA barcoding, each sample can be identified as a species of fish. The identity of each sample will be compared that to its label on the restaurant's menu and to the Food and Drug Administration’s list of acceptable names for that type of fish. In a previous

study done by Willette et al. (2017), fish were sampled from sushi restaurants in the Los Angeles area and DNA sequencing results were compared to marketing labels over four years. They found that all sushi restaurants had at least one occurrence of mislabeling, with an average 45% mislabeling rate with all 26 sushi restaurants. The highest mislabeling rates were found in halibut, red snapper, yellowfin tuna, and yellowtail (<77%). In addition, they found that certain types of fish were consistently mislabelled in the same way. Our study will serve to provide more data and information on seafood mislabelling rates to the Los Angeles Seafood Monitoring Project.

68. TRANSCRIPTION INITIATION FACTOR IIH (TFIIH) AND ITS ROLE IN DOUBLE STRAND BREAK REPAIR

Norani Abilo*, Christina Beck*, Micayla George*, Khadija Thibodeaux*, (M. Cristina Negritto)

Pomona College

TFIIH is a protein complex involved in transcription and nucleotide excision repair. Mutations in subunits of TFIIH can result in human diseases that predispose carriers to cancer, implying an important role for this complex in maintaining genome stability. A third function in double strand break (DSB) repair has been proposed and recently our lab confirmed association of TFIIH with an induced DSB using Chromatin Immunoprecipitation (CHIP) analysis. However, in the assay used it is hard to discern if the association with the DSB is dependent on transcription since the break is induced close to promoter regions. We aim to build a S. cerevisiae strain in which a DSB can be induced in a region of the genome void of or with reduced TFIIH transcription activity. CHIP can then be performed to assess if the association of TFIIH with a DSB is independent of its role in transcription.

69. TUBULAR ER SHAPING PROTEINS SEY1 AND LNP1 ARE REQUIRED FOR BROME MOSAIC VIRUS RNA REPLICATION

Rhiannon Abrahams*, Jennifer Yoo, Jieun Ahn, Cheyenne Feig, (Arturo Diaz)

Pomona College

Viral replication requires the complex orchestration of viral genomes, viral proteins, and cellular components. We set to determine the role of Sey1 and Lnp1, cellular proteins involved in shaping the tubular endoplasmic reticulum, in the life cycle of brome mosaic virus (BMV), a positive-strand RNA virus. Deleting SEY1 and LNP1 resulted in a decrease in BMV RNA replication. Immunofluorescence microscopy shows that Sey1p and Lnp1p relocalize from the peripheral to the perinuclear ER during BMV replication, suggesting a role in forming the viral replication compartments. Accordingly, electron microscopy revealed that the diameter of the replication compartments is not affected in cells lacking SEY1 or LNP1 but there are twice as

many compartments in the deletion strains compared to wild type cells. We are in the process of determining the mechanism by which Sey1p and Lnp1p regulate both viral RNA replication and the number of replication compartments.

70. Y-HAPLOTYPE ANALYSIS USING HUMAN EXPECTORATE AND ANCIENT HUMAN REAMAINS.

Matthew Schumann

University of Portland

The UP PURE program is an interdisciplinary group from the University of Portland that helps excavate the ancient city of Pollentia on the island of Mallorca. Due to its unique history of invasion, the demographics of this city are nebulous. Ancient DNA (aDNA) analysis is being used to look at repetitive sequences on the male Y-chromosome to determine geographic origins of the exhumed populations. The DNA was purified, and Y-chromosome specific DNA was amplified to determine repeat sequence copy number. Preliminary results indicate successful DNA isolation but poor sequence data suggests the need for more precise amplification. Performing DNA analysis on these ancient bones provides an opportunity to gain valuable insight into the exhumed populations' geographic origins and their relationships to one another.

71. YELLOW LIGHT REGULATES NUCLEAR-, BUT NOT CHLOROPLAST-, ENCODED GENES IN CHLAMYDOMONAS REINHARDTII

Joshua Lee*, Brandon Bedolla, Brett Farthing, Cesar Anguiano, Laura Arce, Amybeth Cohen

California State University, Fullerton

The chloroplast psbA mRNA, which encodes the photosynthetic D1 protein, is translationally-regulated by several nuclear-encoded RNA binding (RB) proteins in Chlamydomonas reinhardtii. Previous studies revealed that transcription of the nuclear-encoded rb38, rb60 and psbO (encodes the Oxygen-Evolving Enhancer protein 1) genes are induced by red and blue light (Cohen and Alizadeh, 2010). Another study revealed that an animal-like cryptochrome (aCRY) in C. reinhardtii absorbs red, blue and yellow light, regulating expression of genes involved in biosynthetic and metabolic pathways (Beel, et. al, 2012). Until now, the role of yellow light in the expression of the rb and psb genes remained unexplored. RT-PCR analysis has shown that psbO and rb60 are induced by yellow light in a time-dependent cyclical manner, while psbA is constitutively expressed. Future studies will examine the expression of these genes, and rb38, using aCRY knockout and rescue strains to determine if aCRY regulates this yellow light induction.

Microbiology & Immunology

72. ABC-TYPE MULTIDRUG EFFLUX PUMP AFFECTS MOTILITY AND EPS PRODUCTION IN PARABUKHOLDERIA UNAMAE

Luiza Barseghyan, Parmis Mirshahidi, (Dr. Michelle R. Lum*, Dr. Shelley Thai)

Glendale Community College

Background: Paraburkholderia unamae is a nitrogen-fixing, symbiotic bacterium that has been shown to promote plant growth. Objective: The purpose of the study was to identify the genes involved in motility and exopolysaccharide (EPS) production, both of which are important factors in plant colonization. Methods: Random transposon mutagenesis was employed in P. unamae by introducing pRL27 vector carrying Tn5-RL27 transposon. Over 400 isolated colonies were selected and streaked to assess phenotypic characterizations of the mutants. Results: Two of the mutants (LB 2.47 and PM 1.29), exhibiting over-expression of exopolysaccharide (EPS) production and significantly reduced motility, 83%, and 75%, respectively were selected. The sequence analysis revealed that the transposon disrupted the ATP-binding (ABC) cassette gene that codes for the multidrug resistance-like ATP-binding protein which effluxes out drugs by coupling energy derived from the hydrolysis of ATP. Thus, ABC-type multidrug efflux pump affects the exopolysaccharide (EPS) production, and motility.

73. ASSESSMENT OF FLAGELLA OF AN INTESTINAL ADAPTED STRAIN OF E.COLI IN THE STREPTOMYCIN TREATED MOUSE

Tanner Collins*, Abigail Talavera-Castanoli, Ethan Loy, Gunner Demers, (Joseph Francis), (Andrew Fabich)

The Master's University

Streptomycin-treated mice are used to study microbial intestinal colonization. Using this model system, a mutant E.coli K-12 strain MG1655 was isolated which demonstrated superior colonization and was non-motile compared to the hyper-motile wild-type strain MG1655 as shown in previous studies. Non-motile MG1655 has a deletion in the flhD gene and are thought to not produce flagella while demonstrating more efficient use of sugars. However, the presence of flagella has not been assessed on these bacteria. In this study, we examined the MG1655 wild-type strain before gut colonization and examined both motile MG1655 and non-motile MG1655 at 60 days after colonization for the presence of flagella using a crystal violet stain. We report here for the first time that greater than 57% of MG1655 motile bacteria

contain flagella while less than 1% of non-motile bacteria show flagella ($p<0.05$). The flagella on the motile strains demonstrated peritrichous and amphitrichous arrangements.

74. BACTERIAL ENCYSTMENT: A SIGNAL TRANSDUCTION PATHWAY TO MOTILITY IN RHODOSPIRILLUM CENTENUM

Julia Roccato, (Terry H. Bird)

University of San Diego

Bacteria cover our Earth in abundance, from any environmental niche right to our human body. Of particular importance are bacteria that can form either vegetative cells or hardy, dormant cyst cells depending upon environmental conditions. This study aims to elucidate more on signal transduction pathway leading to motility in the bacterial species Rhodospirillum centenum to better understand the complicated genetic basis of encystment and motility. The current model pathway in R. centenum follows a histidine kinase and response regulator pattern, with the phosphorylation of the CtrA protein ultimately promoting motility genes. By studying a related bacterium, Caulobacter crescentus, additional homologous proteins involved in this signal transduction pathway are identified. This study characterizes the homologous protein SciP through a series of gene knock-out and phenotype evaluation experiments. It is likely that SciP regulates motility, with further studies focusing on its potential interactions with CtrA and position in the signal transduction pathway.

75. BACTERIOPHAGE SELECTIVELY LYSES ANTIBIOTIC-RESISTANT EAEC IN VITRO AND IN VIVO.

William Scott*, (Jay Mellies),

Reed College

Over-use of antibiotics has contributed to the ever-growing prevalence of multidrug-resistant (MDR) bacteria, constituting one of the greatest emerging threats to public health. The host-specificity of bacteriophage therapy offers an advantage over conventional antibiotics in that a phage can target a specific pathogen rather than kill beneficial commensal bacteria of the microbiome. This study aims to characterize the in vitro and in vivo therapeutic capabilities of a Myoviridae bacteriophage dubbed PDX against pathogenic Enteroaggregative E. coli (EAEC). Previous findings suggest PDX does not kill human commensal bacteria. 16S metagenomic sequence analysis indicates PDX is able to selectively lyse EAEC in the presence of human commensal bacteria. Our in vivo results indicate that a single-dose of PDX is able to significantly decrease the number of EAEC bacteria in a mouse model over a 5-day period. Our findings point towards the viability of PDX as a therapy against the MDR pathogen EAEC.

76. CAFFEINE, ETHANOL, AND GENOMIC FACTORS INFLUENCE BACILLUS AND GORDONIA PHAGE LIFE CYCLE DECISIONS

Emily Hays, Eddie Hernandez, Andy Lechuga, Philip Sell*, (Amanda Freise)

University of California, Los Angeles

Due to the rise of antibiotic-resistant bacterial infections and systemic side effects caused by lytic phage therapies, there is a need to better understand how temperate phage life cycle decisions are made for possible phage therapy alternatives. A novel Bacillus subtilis-infecting bacteriophage, GPAKiller, was isolated to test the effects of the commonly ingested antimicrobial substances on phage-mediated lysis. Subinhibitory concentrations of caffeine and ethanol significantly enhanced phage-mediated lysis. The genome of Gordonia phage Fireball was annotated and bioinformatically analyzed for factors influencing phage life cycle decisions. The analysis revealed that Fireball contains an immunity repressor and Cro repressor. The immunity repressor showed structural and sequence homology to other CI, SOS-response and Quorum-sensing repressors, as did the Helix-Turn-Helix DNA binding domain to Cro repressors of other phage. The implications of these findings may be useful for developing novel strategies to control growth of antibiotic-resistant, pathogenic bacteria for applications in phage therapy.

77. CHARACTERIZATION OF A BACTERIOPHAGE THAT DISPLAYS INFECTIVITY TOWARDS FOUR OF THE FIVE MAJOR DISEASE

Yuendie Guridie*, Victoria Chavez*, Courtney Rundio*, Alexander Earle, Taylor Steele (Michael McConnell, Ryan Botts)

Point Loma Nazarene University

In 1972, Myron Levine used chemical mutagenesis to create a derivative of bacteriophage P22 he named P22virB-3. Unlike its parental phage, P22virB-3 infected lysogenic Salmonella typhimurium bacteria carrying P22 prophage. Levine showed that this extended host range phenotype was associated with two mutations he called K5 and Vx. We have extended Levine's host range studies by showing that in addition to infecting P22-lysogenized S.typhimurium cells belonging to serogroup B, P22virB-3 also infects Salmonella strains belonging to serogroups A, D and E; serogroup C strains are resistant.. Sequencing of the P22virB-3 genome has revealed the basepair changes associated with Levine's K5 and Vx mutations and has also uncovered a mutation in the gene coding for P22virB-3's tail fiber protein. We will describe this tail fiber alteration and offer a model for how it enables P22virB-3 to infect strains belonging to four of the five major Salmonella serogroups that cause human illnesses.

78. CHARACTERIZATION OF BACILLUS AND GORDONIA PHAGES ZORP AND FIREBALL IN FOOD AND WASTEWATER BIOCONTROL

Michael Kina Wei*, Diane Lee*, Andrew Ly*, Neel Patel*, (Amanda Freise)

University of California, Los Angeles

Bacillus contaminations represent a growing concern for the food industry. Similarly, Gordonia populations impose significant costs in wastewater treatment. One alternative biocontrol strategy involves the use of bacteriophages. The novel soil Bacillus phage Zorp was examined for viability within various environmental conditions common to the food industry, including temperatures ranging from 25-42°C and desiccation for up to 1 week. Exposure of Zorp to these conditions revealed high innate resistance to each stressor with insignificant changes in plaque morphology and titer. Difficulties in sequencing Zorp's genome prompted a switch to genomic analysis of Gordonia phage Fireball, revealing genes characteristic of a temperate life cycle. Fireball also possesses tail proteins and a DNA methylase that share homology with Rhodococcus bacteria proteins, suggesting a possible HGT event that aids Fireball in host range expansion and overcoming host restriction-modification systems. These results suggest Zorp and Fireball's applicability within food and wastewater biocontrol contexts.

79. CHARACTERIZATION OF BREVUNDIMONAS SP. AND BACILLUS SP. AND THEIR PLANT GROWTH PROMOTING PROPERTIES

Sabrina Soto, (Michelle Lum)

Loyola Marymount University

Plant growth promoting rhizobacteria (PGPR) are located in soil and form commensal relationships with plant roots allowing for increased nutrient/water availability for plants. In this study, two bacterial isolates from plant roots, strains 06KKMB14 and 08LKEC04, were identified and tested for PGPR properties. 16S rDNA sequence analysis identified the bacteria as Bacillus sp. 06KKMB14 and Brevundimonas sp. 08LKEC04. Biochemical testing showed both strains positive for nitrogen fixation, phosphate solubilization, and cellulase production, although they varied in their optimal growth temperatures. Testing of plant growth promoting potential on Arabidopsis thaliana and Trifolium pratense showed that both strains can have a positive impact on plant growth. The role of volatile production in promoting plant growth was also tested using Arabidopsis thaliana, with preliminary observations suggesting volatiles play a role in promoting plant growth. Overall, these results indicate that these bacterial strains could be developed for use as biofertilizers.

80. CHARACTERIZING THE PLANT GROWTH PROMOTING PROPERTIES OF STREPTOMYCES SP. 13GDEB02N

Giovanni Di Franco*, (Michelle Lum)

Loyola Marymount University

Biofertilizers are an alternative to chemical fertilizers due to their ability to promote plant growth and mitigate pollution events where chemicals would leach into the ground. Biofertilizers are comprised of microorganisms such as fungi and plant growth promoting rhizobacteria (PGPR). PGPRs form commensal relationships with plants through colonization of the rhizosphere, allowing for increased nutrient availability. Bacterial strain 13GDEB02N was isolated from nodules of Pisum sativum (pea). 16S rDNA analysis identified it as a species of Streptomyces. Whole genome sequencing and analysis showed that the strain is closest to Streptomyces sp. SirexAA-E. 13GDEB02N did not renodulate pea, suggesting it requires another bacterium to enter nodules. Biochemical testing showed the strain positive for nitrogen fixation and production of cellulase and auxin. PGPR properties were tested on Arabidopsis thaliana, Zea mays, and Trifolium pretense. Increased growth of some plant species indicates potential for Streptomyces sp. 13GDEB02N as a bioinoculant.

81. COMPARING THE COMMUNITIES OF PLANT-GROWTH PROMOTING BACTERIA IN CULTIVATED AND FALLOW FIELDS

Alan Chien, Alexander Ham*, Louise Pua, Gideon Tseng, Christopher Dao, (Jordan M. Parker)

University of California, Los Angeles

Managing microbial communities could be a sustainable solution to promote soil health and benefit plant growth. To determine the effects of crop cultivation on plant growth-promoting bacteria (PGPB), we characterized microbial differences between cultivated and fallow fields at Pierce College Farm. In autumn 2018, isolates were cultivated from both types of field and assayed for PGP properties. A higher proportion of isolated bacteria from the cultivated field were capable of phosphate solubilization and siderophore production. 16S rDNA Illumina sequencing of soil samples combined with community profile analysis revealed that the fields had distinct microbial compositions. Interestingly, the fallow field had greater abundance of Actinobacteria, while the cultivated field had greater Acidobacteria, a plant growth promoting phylum. Additionally, a gene associated with phosphate solubilization was detected at a higher rate in the cultivated field using KEGG inferred function analysis. These findings verify community and functional differences between cultivated and fallow fields.

82. EFFECT OF ENVIRONMENTAL CHANGE ON INNATE IMMUNE FUNCTION IN GARTER SNAKES

Lucia Combrink, Lilly Brummett, Anne Brownikowski, Dave Miller, Amanda Sparkman

Westmont college

Rising global temperatures and changing environmental conditions, such as the recent drought in California, may place strain on the interactions between organisms and their environment. In order to cope with limited resources, organisms may alter both their behavior and their physiological investments. In particular, immune function may be costly to develop and maintain, and therefore indices of immunity may decrease when available resources are scarce. To test this hypothesis, two species of garter snakes (Thamnophis sirtalis and T. elegans) were sampled from four populations in northern California from 2012-2018. Blood and plasma samples were obtained and analyzed for two indices of innate immunity: bactericidal competence and complement mediated lysis. Preliminary results indicate that there was no effect of changing climatic conditions on immune function in these populations.

83. EVALUATING THE RHOZOSPHERE MICROBIOME ASSOCIATED WITH ALLELOPATHY OF AN ICONIC DESERT SHRUB

Caroline Plecki, (Dr. A. Elizabeth Arnold)

University of Arizona

Plants have evolved strategies for accessing water and nutrients, including allelopathy – exudation of compounds inhibiting the growth or germination of other plants. This study is designed to advance our understanding of microbe diversity associated with desert plants. The desert shrub Larrea tridentata (creosote) is known for allelopathy. Increasingly it is appreciated plant microbiomes alter the chemical expression of their host plants. However, the roles of rhizosphere microbes in allelopathy are obscure. The goal was to evaluate potential contributing microbes to creosote's allelopathy. In phase one we surveyed the root microbiome of creosote in monodominant stands west of Tucson, Arizona. Surveys encompassed aerobic, anaerobic, and oligotrophic microbes. This provides a rich culture library used in phase two, an inhibition assay, designed to measure the inhibition capacity of these microbes on seed germination. Overall, this provides a perspective on the capacity of plant-microbe interactions to influence the allelopathic properties of desert shrubs.

84. FECAL MICROBIAL COMMUNITIES DIFFER BY INTRINSIC AND EXTRINSIC VARIABLES IN UROCYON LITTORALIS

Madeleine Becker*, (Nicole Adams, Suzanne Edmands),

University of Southern California

This project investigates the scat microbiome of Urocyon littoralis (island fox) to find correlations with extrinsic (island environment, captivity, collection time) and intrinsic variables (sex, age, weight). Paired samples of U. littoralis blood and scat were collected from the Channel Islands, along with scat samples of captive U. littoralis specimens in zoos and mainland Urocyon cinereoargenteus. The whole exome was sequenced from blood samples using commercial Canis familiaris baits, while the 16S rRNA v4 amplicon was sequenced from scat samples. Both the U. littoralis scat microbiome and exome significantly differed by geographical origin, and genetic distance of the exome correlated with Euclidean distance of the 16S community across all islands. Significant differential bacterial abundance was also found between males and females on Santa Catalina, fall and winter samples on Santa Rosa, and low and medium weight samples on San Clemente. Captivity and species were not found to be significant correlates.

85. IMPEDING BACTERIAL RESISTANCE TO ANTIBIOTICS WITH THE DEEP EUTECTIC SOLVENT CHOLINE GERANATE.

Charlotte L Evans*, (Andy Koppisch)

Northern Arizona University

Bacteria develop resistance to antibiotics in a number of ways; a common mechanism involves membrane transporters that eject the drugs out of the cytoplasm. Our group has demonstrated that the ionic liquid/deep eutectic solvent choline geranate (CAGE) both disrupts the protective layer of extracellular polymeric substances covering biofilms and neutralizes cells, the latter of which is believed to occur through disruption of membrane homeostasis. In this work, we have assessed the ability of CAGE to influence the function of membrane localized enzymes. Recombinant E. coli BL21-insertnameofplasmid was constructed and expresses proteins enabling resistance to tetracycline and ampicillin. Growth of the strain in varied concentrations of antibiotics were used to measure the antibiotic synergy of CAGE with tetracycline (which is effluxed by E. coli BL21-pBR322 using a membrane transporter) relative to that of CAGE with ampicillin (which is degraded by cytosolic enzymes). Implications of the results will be discussed.

86. INFILTRATION OF A PHAGE: FINDING THE HOST RECEPTOR

Loralee R. Bandy, Jay L. Mellies

Reed College

Due to the growing number of multiple-drug resistant bacterial pathogens, bacteriophage therapy (using cocktails of bacteriophage as an alternative treatment to antibiotics) is increasingly important. This research seeks to understand the adsorption mechanism of bacteriophage PDX, a myoviridae phage that targets multiple enteroaggregative Escherichia coli (EAEC) and enteropathogenic E. coli (EPEC) isolates. We attempted to characterize the host receptor through neutralization assays and SDS-PAGE with silver staining of susceptible and mutant strains. So far, results suggest that both lipopolysaccharides and outer membrane proteins are involved in the reversible and irreversible receptors. Understanding the receptors can be used to tailor phage cocktails for various possible mutations, and to manipulate either phage or host to renew susceptibility. Ongoing research is utilizing transposon mutagenesis to create a library of knockout mutants that will be screened for phage susceptibility and the corresponding insertion sites examined. The potential clinical use of PDX for phage therapy requires an identification and further understanding of its host receptors.

87. INVESTIGATING THE INTERACTION OF PARABURKHOLDERIA SP. 06GHJ03R WITH PLANTS

Alex Kalfa

Loyola Marymount University

Some species of Paraburkholderia sp. symbiotically nodulate and fix nitrogen in legume plants and therefore have potential as bioinoculants. The objective of this experiment was to characterize Paraburkholderia sp. 06GHJP03, isolated from bean nodules, for its plant growth promoting properties. 16s rDNA analysis showed that 06GHJP03R has greatest similarity to the nodulating species P. tuberum. A hydroponic setup with four treatments was used to determine if 06GHJP03R is able to nodulate black bean in the absence of nitrogen. Treatments included inoculation with P. tuberum or 06GHJP03R alone, co-inoculation with both bacteria, or no inoculant. 06GHJP03R alone was not able to nodulate bean or promote plant growth, although P. tuberum and the co-inoculated plants had nodules and reduced signs of nitrogen stress. Since 06GHJP03R is most closely related to P. tuberum, which nodulates, further comparison of this strain to nodulating Paraburkholderia may give insight to the origin of nodulation.

88. INVESTIGATING THE REGULATION OF THE NOD GENES IN PARABURHOLDERIA TUBERUM

Ashwarya Sharma, Hassan Abdulla, (Dr. Michelle Lum)

Loyola Marymount University

Rhizobia fix atmospheric nitrogen into ammonia within a symbiotic mutualism. In α-rhizobia, nodule formation is triggered by Nod Factor, rhizobial signaling molecules that induce plant nodulin genes. The nodABC gene products create the chemical backbone of Nod factor, while NodD is a major transcriptional regulator of the nod genes. This project investigates the role of NodD in the regulation of the nod genes of β-rhizobia Paraburkholderia tuberum. Previous analysis showed that flavonoids genistein and daidzein upregulate nodABC gene expression. We identified two copies of nodD in P. tuberum, suggesting that each has a unique role in nod gene regulation. A nodABC promoter fusion to green fluorescent protein is being constructed to introduce into P. tuberum and nodD1, nodD2 and nodD1D2 mutants to determine when in the symbiosis each nodD copy is active. Inoculated roots will be observed through fluorescence microscopy to determine the requirements of each nodD copy.

89. INVESTIGATION OF MYCOBACTERIOPHAGE GRUNGLE AS A THERAPEUTIC AGENT FOR BACTERIAL INFECTIONS

Lovelyn Edillo*, Melissa Folkerts*, Neiki Rokni*, Richmund Tan*, (Samuel Wu), (Ryan Ngo), (Kris Reddi), (Jordan Moberg Parker), (Amanda Freise)

University of California, Los Angeles

Tuberculosis is caused by the deposition of Mycobacterium tuberculosis in the lungs. Dependence on antibiotic treatments has increased antibiotic-resistant M. tuberculosis strains, necessitating investigation of phage therapy as a novel, alternative treatment. This study assessed lytic mycobacteriophage Grungle's potential to treat tuberculosis by in vitro experimentation and bioinformatics analyses. Grungle successfully propagated at temperature, pH, oxygen concentration, and mucus viscosity conditions mimicking the lung microenvironment. Comparative genome analyses revealed that phages within Grungle's cluster, Cluster C, are not found to infect Mycobacterium tuberculosis or other pathogenic strains. However, phylogenetic analyses revealed the potential for horizontal gene transfer outside of the same cluster. Grungle was also found to be part of the Myoviridae family, the rarest and least characterized of tailed phages. This study shows that Grungle may be used in combination with antibiotics or phages known to infect pathogenic strains, and serves as a resource in studying novel phage-host interactions.

90. MATING FREQUENCIES OF CONJUGATIVE RESISTANCE PLASMIDS IN LIQUID AND BIOFILM CULTURES

Shelby Kenney*, Madelaine Brown, Taryn Kucey (Ryan Botts, David Cummings, Dawne Page)

Point Loma Nazarene University

Antibiotic resistance in bacterial infections has become increasingly common in the clinical setting, making wound care, surgery, childbirth, and other medical innovations we take for granted increasingly dangerous and difficult. Possibly the most powerful and threatening mechanism for the spread of antibiotic resistance is horizontal gene transfer by way of conjugative plasmids – small, circular DNA that can replicate independently of the chromosome, catalyzing its own transfer from a donor into a recipient cell. In this study, the rates at which conjugative resistance plasmids transfer between donor and recipient were compared in liquid cultures and biofilms. The results of this study are important for our understanding of the spread of antibiotic resistance among bacteria of clinical relevance.

91. MICROBIAL SYMBIONTS OF AN INVASIVE GRASS DIFFER IN URBAN AND EX-URBAN ENVIRONMENTS

Victoria Howard*, (A. Elizabeth Arnold)

University of Arizona

Cenchrus ciliaris (buffelgrass) is a widespread invasive plant in the Sonoran Desert. It establishes readily, weathers drought, alters fire regimes, and is costly and labor-intensive to eradicate. Investigating microbial symbionts of buffelgrass may identify factors that promote its establishment and spread. We examined fungal microbiomes associated with buffelgrass in urban areas (alleyways with poor soil and limited plant cover) and ex-urban areas (sites with natural soil and vegetation) in and near Tucson, AZ. We isolated fungal endophytes from healthy roots and shoots and characterized them via DNA barcoding. We found that endophytes of buffelgrass were more abundant in urban areas, but more diverse in ex-urban areas. Endophyte communities differed between urban and ex-urban sites. Our data suggest context-specific symbioses in which buffelgrass recruits distinctive microbiomes under different environmental conditions. In future research, we will identify plant-microbe interactions that influence the fitness and stress tolerance of buffelgrass as an invasive plant.

92. OVER EPS PRODUCTION AND DECREASED MOTILITY THROUGH TRANSPOSON MUTAGENESIS IN PARABURKHOLDERIA UNAMAE

Nickolas Yedgarian, Ania Shirvanian, (Dr. Shelley Thai)

Glendale Community College

Intro: This study is based on the bacterium Paraburkholderia unamae known for its ability to fix atmospheric nitrogen (Caballero-Mellado et al., 2004). Objective: To mutate P. unamae by disrupting genes that regulate EPS (exopolysaccharide) production and motility. Methods: Colonies of Escherichia coli carrying the transposable element, Tn5-RL27, were conjugated with P. unamae. Genomic DNA of P. unamae carrying the Tn5 insertion was isolated and transformed into competent E. coli. Isolation and sequencing were performed to determine the location of the Tn5 insertion. Results: The mutants produced demonstrated overexpression of EPS and reduction in motility, and had disruptions in either ATP-dependent proteinase or S-formylglutathione hydrolase. Conclusion: Both genes affected are involved in EPS production and motility for P. unamae.

93. QUANTIFICATION OF CYSTS IN THE BRAIN POST INFECTION OF TOXOPLASMA GONDII IN BRAIN HOMOGENATE

Ashli Barnes, Kristina V. Bergersen, (Dr. Emma H. Wilson)

University of California at Riverside

Toxoplasma gondii is an obligate intracellular parasite capable of invading any nucleated cell and can live in a dormant stage for the lifetime of its host. Following cell invasion, T. gondii replicates exponentially in its fast replicating form, the tachyzoite. Upon entering the brain, tachyzoites typically encase themselves into a latent cyst made up of slower replicating bradyzoites and remain encysted for the duration of the host. Cyst formation plays a crucial role in the protection of Toxoplasma gondii and is the transmissible form of the parasite. Studies have validated the presence of these cysts in the brain after infection with in vivo cultured Me-49 parasites, a Type II avirulent strain. However, when observing other strains of T. gondii, there is no indication of cyst formation present. Infection with tachyzoites leads to far fewer cysts in the brain than infection using cysts. However, cyst infection includes homogenized neural tissue. We tested if neural tissue enhances parasite tropism for the brain and increases cyst formation. To determine if brain homogenate is a catalyst for cyst formation, in vitro cultured tachyzoites and in vivo cultured cysts were injected into mice using intraperitoneal injections with and without brain homogenate. Injections of Me-49 cysts into the brain are normally accompanied by brain homogenate prior to injection so we hypothesize that the composition of brain homogenate can trigger cyst formation of in vitro cultured tachyzoites. Results will either allow enhanced purified cyst formation by transgenic parasite and/or reveal important mechanisms of parasite tropism for the brain.

94. ROLE OF NODC GENES IN PARABURKHOLDERIA TUBERUM

Nicole Villa, Ashley Arnell

University of California at Riverside

Paraburkholderia tuberum is a β-rhizobia that forms a nodulating, nitrogen fixing symbiosis with legumes such as Phaseolus vulgaris (bean). P. tuberum has the nodulation gene, nodA, and two copies of nodC, responsible for the synthesis of Nod factor, a lipochitooligosaccharide required for nodule morphogenesis in plants by the well-studied α-rhizobia. To determine whether nodC is critical for the β-rhizobia symbiosis, nodC deletion mutants are being analyzed. Primers were designed to amplify the border regions of nodC1 and nodC2 and the fused products cloned into the pk18mobsacB vector to be used to generate each deletion. We successfully generated the nodC2 mutant and found that it did not nodulate black bean. This shows that nodC1 is not redundant to nodC2. However, we are in the process of making the nodC1 mutant to see if it also has some function. Overall, this shows that nodC is important for both α- and β-rhizobia symbioses.

95. SEASONAL PREVALENCE OF PATHOGENIC AEROMONAS IN SAN DIEGO'S COASTAL WATERS

Jaime Garcia*, Veronica C. Ardi

National University

California has an extensive coastline, with rivers that outlet into the ocean. This study examined the prevalence of Aeromonas, a known pathogen in coastal waters, at the San Diego River (SDR) outlet and in Ocean Beach (OB). Water samples were processed by membrane filtration, which were placed on selective medium for Aeromonas growth. Three replicates and three dilutions were analyzed using the MPN method. Suspected Aeromonas spp. were counted and all microbes on the membrane were collected for DNA extraction and subsequent qPCR to detect hemolysin genes. Aeromonas spp. were detected in every water sample at 200 – 1,300 cfu/ 100 mL. Concentrations in SDR were always higher than the levels in OB, up to 6-fold higher. The highest levels occurred during summer at SDR, approximately 10-fold higher than at OB. Current research includes detecting the prevalence of the hemolysin genes in Aeromonas population to determine the potential public health risk.

96. STARCH GRANULES THAT SUSTAINABLY DELIVER IODINE AND THE BACTERICIDAL EFFICACY

Kate O'Brien, Jake Michaels, Catie Sanders, (Terry Bird)

University of San Diego

Biofilm-related infections of wounds continue to be a problem in medicine. Evidence suggests that the protective matrix of bacterial biofilms contributes to delayed healing and resists antibiotic treatment. Iodine is a well established antiseptic, and growing evidence suggests that iodine prevents and kills biofilms. However, iodine can be toxic to mammalian cells at high concentrations. As a result, slow, sustained release of iodine is desirable. To achieve this, amylose has been chemically and physically modified to form an inclusion complex with triiodide, which slows the diffusion of iodine out of the granules. These granules can be inserted into hydrogels and used for clinical applications. Hydrogel supernatant effectively killed 100% of planktonic E.coli and S.aureus cells at a concentration of 0.08µM. Next, the ability of the hydrogel supernatant to both kill and prevent E. coli and S. aureus biofilms will be tested.

97. SYMBIOSIS BETWEEN CHAMAECRISTA FASCICULATA AND NITROGEN-FIXING BACTERIA

Victoria T. Nguyen, Lauren Pennington, Nancy Fujishige

Loyola Marymount University

Nitrogen-fixing bacteria reside in nodules on roots of legumes such as Chamaecrista fasciculata (partridge pea) and convert nitrogen gas to ammonia, a bioavailable form of nitrogen that the plant can use for nutrition. The two strains of nitrogen-fixing bacteria known to form symbiotic relationships with Chamaecrista fasciculata are Rhizobium tropici (alpha-rhizobia) and Burkholderia tuberum (beta-rhizobia). This project examines nodulation in the primitive plant species, Chamaecrista fasciculata, and aims to determine whether nifH (nitrogenase) gene expression occurs in Rhizobium tropici during symbiosis. Previously, a RtnifH::Km mutant was generated through PCR amplification of the nifH internal fragment, digestion and ligation into pKNOCK-km vector, and triparental mating of Rhizobium, E. coli with pKNOCK nifH plasmid, and E. coli with helper plasmid. Mutants have been verified to be Kanamycin resistant, suggesting that insertional mutagenesis occurred (location of insertion currently being validated by DNA sequencing.) Genomic DNA isolated from the R. tropici mutant was grown on Kanamycin TY plates to ensure that the Km resistance gene was properly inserted. The nifH region was PCR amplified and will be sequenced. To observe the functionality of the nifH gene in R. tropici, plants will be infected with either the nifH mutant or wild type Rhizobium tropici. Additionally, plants will be co-inoculated with B. tuberum and R. tropici (both mutant and wild type) to see in which bacteria nifH expression is occurring.

98. SYNERGISTIC EFFECTS OF SINORHIZOBIUM MELILOTI AND BACILLUS SIMPLEX ON ROOT INFECTION AND NODULATION

Talyssa M. Topacio, Sarah A. Pardi, and Nancy A. Fujishige

Loyola Marymount University

Legume plants form mutualistic relationships with various rhizobacteria in the soil, which promote plant growth by improving nutrient acquisition, modulating plant hormone levels, and protecting the plant from biotic and abiotic stress. The rhizobacteria Sinorhizobium meliloti and Bacillus simplex are known to have symbiotic relationships with white sweet clover, Melilotus alba. S. meliloti is an alpha-Rhizobium species which forms a host-specific endosymbiosis with Melilotus, Medicago, and Trigonella species where the bacteria fix atmospheric nitrogen into ammonia that can be used by the plant. In exchange, the legume provides the bacteria with carbohydrates; it houses and protects the rhizobia in specialized structures on the root called nodules. The effect of B. simplex on plants is not as well-characterized; however, it has been shown to increase plant biomass, enhance resistance to fungal disease, alter lateral root architecture, and improve nodulation in pea. This study examined whether B. simplex could enhance infection and nodulation by S. meliloti. Furthermore, B. simplex was assessed for its ability to rescue various infection-deficient S. meliloti mutants. The pilA and exoY genes encode Type IV pili and exopolysaccharide biosynthesis, respectively; mutation of pilA genes delays root infection and mutation of exoY leads to fewer infection sites and abortive infection threads. M. alba roots were inoculated with individual strains (S. meliloti or B. simplex) or they were co-inoculated with S. meliloti and B. simplex. Plants co-inoculated with S. meliloti and B. simplex displayed greater biomass, more root nodules, and more infection sites than plants inoculated solely with an individual S. meliloti strain.

99. SYNTHESIS AND CHARACTERIZATION OF NOVEL ANTIBACTERIAL IONIC LIQUID/DEEP EUTECTIC SOLVENTS

Nikola M. Williams*, (Paul D. Philips, Rico E. Del Sesto, Andy K. Thomas)

Northern Arizona University

Microbial biofilms are ubiquitously found in nature and are responsible for the majority of clinical infections in humans. Biofilms are recognized for their ability to withstand common antibiotic therapy. The pursuit of new anti-biofilm compounds is important because of the many dangers these microbial communities present to the health industry. Our group has demonstrated that the ionic liquid/deep eutectic solvent (IL/DES) choline geranate (or CAGE) is an effective antibiofilm agent. In this study, we have further investigated the antibacterial properties of a series IL/DES derivatives based upon the molecular scaffold of CAGE. Five CAGE derivatives were synthesized via salt metathesis and chemically characterized. Antibiofilm testing of the series of CAGE variants were conducted against in vitro biofilms of a clinically

isolated strain of Pseudomonas aeruginosa. The aim of this study was to demonstrate the utility of novel materials that are capable of biofilm removal and elimination.

100. THE EFFECT OF OVEREXPRESSION OF TYPE IV PILI IN SYMBIOTIC SINORHIZOBIUM MELILOTI-LEGUME RELATIONSHIP

Desiree Gonzalez*, (Dr. Nancy Fujishige)

Loyola Marymount University

Legumes have symbiotic relationships with bacteria that grow inside of nodules on their roots. These relationships are beneficial due to their conversion of atmospheric nitrogen. In order to have a successful bacterial symbiosis, there needs to be a strong bacterial attachment on the legume's roots, during nodulation. During the rhizobium-legume symbiotic relationship the bacteria Sinorhizobium Meliloti has pili that assist in its attachment, mobility, and cell interactions. The goal of this research project is to generate a strain of Sinorhizobium Meliloti that can overproduce the Type IV pili gene. The overexpression of the mutant strain will be used to determine role of pili in attachment to biotic and abiotic surfaces (soil and the roots of the host plant). In addition, the bacterial mutant will be used to determine the role of an overexpression of pili during symbiosis when plants are co-inoculated with other strains of bacteria found prominently in soil.

101. TRANSPOSON MUTAGENESIS OF H-NS AND FLIF PROTEINS REGULATES MOTILITY IN PARABURKHOLDERIA UNAMAE

Alisa Gasparyan*, Perjuhi Christina Halajyan*, Reni Sahakian*

Glendale Community College

The genus Paraburkholderia belongs to phylum Proteobacteria and is vital in non-pathogenic and plant-associative research. The model organism, Paraburkholderia unamae is a motile, flagellated, rod-shaped, gram-negative bacteria that is found in the rhizosphere of plants such as sugarcane, maize, and coffee. Microbiology, molecular biology, bioinformatics, and DNA sequencing techniques were used to cause genomic mutations for the purpose of observing phenotypic variations. Research was conducted through means of transposon mutagenesis using a pRL27 plasmid, which carries the transposable element Tn5-RL27. The insertion of the transposon in the genome of P. unamae resulted in mutations affecting the phenotypes for motility and exopolysaccharide (EPS) production. The isolated mutants AG 2.50, CH 4.51, and RS 3.26 displayed changes in their phenotypes relative to the random transposon insertions. The transposon insertion mutated the H-NS and Fli-F regulatory proteins in the P. unamae genome resulting in reduced motility and overproduction of EPS.

102. TRANSPOSON MUTAGENESIS OF TRANSPORTER GENE AFFECTS MOTILITY AND EPS IN PARABURKHOLDERIA UNAMAE

Maria Vardapetyan*, Shant Terzyan*, Luiza Barseghyan, Annelisse Montes, Melanis Ghadimi, (Dr. Shelley Thai, Dr. Michelle R. Lum)

Glendale Community College

Intro: Paraburkholderia unamae is a highly motile, non-pathogenic, and diazotrophic bacterium, that can be found in maize, sugarcane, and coffee. Objective: The objective of this experiment was to study the genes of these bacteria that contribute to the reduction of motility and overexpression of EPS and to understand the positional effect of the transposon insertion on the targeted gene expression. Methods: Transposon mutagenesis was performed by introducing a vector that contains the transposon into P. unamae. Results: The transposon was inserted in the intergenic region of the cation diffusion facilitator family transporter and H-NS histone family gene. This study indicates that motility decreases as the transposon nears the transporter gene. Conclusion: The gradual decrease in motility is hypothesized to be due to enhancer-like and silencer-like regions of the transporter gene that could be located in the intergenic region. The interruption of these two regions alters the function of the gene.

Neurobiology

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103. 2-N-HEXYL LKE-P RESCUES ABNORMAL SLEEP &MOBILITY IN C9ORF72 GLYCINE-ARGININE DROSOPHILA MODEL OF ALS

Haylee Hamilton*, Cody Peplinski, Dunxin Shen, Laken Kruger, (Travis T. Denton, Jason R. Gerstner)

Gonzaga University

Sleep disturbances are common in neurodegenerative diseases and may be a clinical factor in disease etiology. ALS patients have various types of sleep disturbances, such as insomnia, nightmares, and daytime sleepiness. Recent studies suggest the C9orf72 gene is the strongest genetic risk factor associated with ALS/FTD. We observe decreased locomotor activity and increased sleep time in a fruit fly C9orf72 ALS/FTD model with expanded PolyGR36 dipeptide repeats expressed in motor neurons, compared to control flies. Lanthionine ketimine ethyl ester (LKE) is a natural sulfur amino acid metabolite thought be neuroprotective by stimulating autophagy pathways in neurodegenerative animal models. Here we test the LKE derivative, 2-n-hexyl-LKE-P, for effects on the C9orf72 ALS/FTD fly model. 2-n-hexyl-LKE-P treated flies rescued locomotor and sleep abnormalities in ALS flies back to normal control flies. Future studies

examining 2-n-hexyl-LKE-P effects on neurodegeneration in ALS/FTD animal models will be useful to determine its therapeutic potential.

104. CONDITIONAL CNTNAP4 KNOCKOUT RESULTS IN CRANIOFACIAL BONE DFORMITIES AND HYDROCEPHALUS

Alan Chien*, Samantha S. Lee, Andrew Lee, Banghong Zheng, (Pin Ha, Xiangyou Luo, Zhong Zheng, Kang Ting, Chia Soo, Xinli Zhang)

University of California, Los Angeles

Contactin-associated protein-like 4 (Cntnap-4) is a member of the neurexin superfamily of transmembrane molecules that have critical functions in neural communication. Interestingly, Cntnap4 was recently identified as a specific cell receptor for the osteogenic protein Nell-1 that is critical for Nell-1-mediated osteogenesis. In order to better understand the osteogenic properties of the receptor, transgenic mice with Cntnap-4 conditional knockout (Cntnap4Wnt1KO) in cranial neural crest cells (CNCC) were analyzed for changes in bone metrics. Compared to healthy litter mates, Cntnap4Wnt1KO mice experienced significantly decreased bone volume (17%) and bone mineral density (8.8%) in the frontal and parietal bones. Among the surviving Cntnap4Wnt1KO mice, 32% died of hydrocephalus, a condition of central spinal fluid (CSF) buildup inside of the brain ventricles. These preliminary results validate Cntnap4 not only as a novel CNCC regulator for healthy frontal and cranial bone formation but also as a possible therapeutic target for craniofacial abnormalities.

105. EFFECTS OF SLEEP DEPRIVATION ON DECISION MAKING IN DROSOPHILA

Catherin Shorb*, (Divya Sitaraman)

University of San Diego

Lack of sleep has negative cognitive and behavioral implications; however, it remains unclear if and how sleep deprivation alters neural circuits involved in these processes. The goal of this study is to characterize the effects of sleep deprivation on neural circuits underlying decision-making using genetic model organism Drosophila melanogaster. We analyzed decisions critical to species success by courting frequency, number of eggs laid, and type of nutritional media in which to oviposit (egg-lay). Our experiments show that sleep deprivation in wildtype males reduces courting which can be mapped to male-specific neural correlate, P1 neurons. In the results presented here, we use genetic, pharmacological, and mechanical sleep deprivation protocols to establish the link between distinct modes of sleep deprivation that produce varying sleep needs and decisions related to courtship and ovipositional decision making. These studies pave way for in-depth mechanistic understanding of how different modes of sleep deprivation affect decision-making circuits.

106. EXPOSURE TO THE ENVIRONMENTAL NEUROTOXICANT POLYCHLORINATED BIPHENYL-95 PHENOCOPIES A COMMON AUTISM

Aliyah Penn, Kaitlin Danziger, Lillian Murphy, Kimberly Nguyen, Zaed Hindi, Chloe Welch, Brandon Stryder, Kristina Ghenta, (Kimberly Mulligan)

California State University, Sacramento

Evidence indicates the interaction of environmental chemicals with specific genetic susceptibilities is linked to autism spectrum disorder (ASD). Yet, identification of chemicals that interact with genes to cause ASD remains a critical gap in our understanding of ASD etiology. This project involves the development of assays using Drosophila melanogaster for identification of chemicals that molecularly converge with fmr1 (fragile X mental retardation 1)—an ASD-associated gene that is functionally conserved in Drosophila. We used the courtship assay—a paradigm for behavioral analysis of Drosophila—to determine that PCB-95 exposure significantly decreases the courtship index of wild-type flies and elicits a synergistic decrease in fmr1 flies. We used immunohistochemistry to show that PCB-95 exposure causes an increase in axon-pathfinding defects in wild-type flies at a similar frequency as found in fmr1 mutants. Our data suggests that PCB-95 may confer increased risk of ASD by affecting similar neurodevelopmental processes as fmr1.

107. EXPRESSION OF LL-37 ATTENUATES THE NEUROTOXICITY OF AB42 IN A MODEL OF ALZHEIMER'S DISEASE

Manpreet Kaur*, Sydney Gutierrez, Celine Neudorf, Brandy Baird, Tari Kurman, Annelise Barron, & (Jeremy Lee)

University of California, Santa Cruz

Alzheimer's disease (AD) is the most common form of dementia and is characterized by amyloid plaques in the brain composed primarily of the AB peptide. Although AB's function is unknown, recent studies indicate that it has antimicrobial properties and might have similar biophysical functions to LL-37, a human antimicrobial peptide. Previous in vitro studies have shown that LL-37 and AB are direct binding partners, but it is still a question if they are binding partners in vivo. Also, it is unknown what the consequences are of an interaction between LL-37 and AB with respect to AB effects on neuronal function. We have developed a Drosophila model for in vivo experimentation on the effects of co-expressing human LL-37 and human AB42 peptides. Adult longevity and pre-adult developmental assays were conducted with four groups of flies: flies that only expressed AB42 (AD model flies), flies that only expressed LL-37, flies that co-expressed AB42 and LL-37, and wild type flies. Results showed that while AB42-expressing adult flies had significantly shorter lifespans than wild type adult flies, adult flies co-expressing both AB42 and LL-37 lived longer. In addition, co-expression had a rescue effect on pre-adult mortality compared to flies only expressing AB42. The expression of AB42 was quantified to

confirm expression in equal levels between flies that only express AB42 and the flies that co-express AB42 and LL-37. To quantify AB expression quantitative PCR with primers specific for AB42 to quantify AB42 mRNA levels. These data suggest that LL-37 interactions with AB, in vivo, partially ameliorate the effects of AB on neuronal function.

108. METHAMPHETAMINE ASSOCIATED MEMORIES INDEPENDENTLY AND SELECTIVELY GO THOROUGH RECONSOLIDATION

Alexis Osborne, Tiffany Tadros, Megan Jeske, Taylor Underwood, Michael Hanna

Vanguard University of Southern California

A major contributing factor to drug relapse is exposure to environmental stimuli that have been previously associated with drug administration. Exposure to such cues evokes memories of the effects of the drug and induces drug-seeking behavior. Drug associated memories go through a process of consolidation wherein unstable memories are placed into a permanent state. When these memories are later triggered they go through reconsolidation, in which a memory becomes temporarily unstable and liable to disruption before becoming stable once again. Using the conditioned place preference (CPP) paradigm, previous research from our lab has shown that injection of the NMDA receptor antagonist memantine immediately after brief exposure to a methamphetamine (MeAM)-paired compartment attenuated drug seeking behavior. In this study we aimed to determine the specificity of memantine in interfering with the reconsolidation of multiple drug-associated memories. Administration of memantine (10mg/kg) after exposure to one MeAM paired compartment disrupted drug-seeking behavior for that particular compartment, but not for a second MeAM-associated compartment. Additionally, we found that exposure to a single modality, an olfactory cue, of a drug-associated memory that involved multiple modalities was sufficient to render a memory liable to reconsolidation interference. Our data suggest that individual drug-associated memories go through reconsolidation selectively and independently.

109. OCTOPAMINERGIC REGULATION OF SLEEP AND AROUSAL

Roxanne Moghadam, Siwei Wu, (Divya Sitaraman)

University of San Diego

Octopamine (OA), the invertebrate homolog of norepinephrine, has been implicated in multiple behaviors in Drosophila such as feeding, sleep, and aggression. The precise circuit mechanisms by which octopamine regulates these behaviors remains largely unexplored. Using a high resolution neurogenetic screening we have identified a subset of octopamine neurons (VPM 3,4) that increases wakefulness. Neuroanatomical analysis reveals that these neurons project to the mushroom body (MB), an associative neural network analogous to the mammalian cortex.

Using genetic, anatomical, and behavioral approaches we show that the OA-VPM neurons release octopamine that interacts with subsets of dopamine, kenyon cell, and output neurons in the MB. Calcium imaging studies show that flies that are sleep deprived display reduced activity within OA-VPM neurons as compared to sleep-replete controls. Furthermore, certain receptor mediated mechanisms underlying these connections were identified. Taken together, these results reveal octopamine is important in sleep regulation through these neuronal connections.

110. TERATOGENIC EFFECTS OF ETHANOL ON NEUROGENESIS AND CRANIAL BLOOD VESSEL DEV. IN ZEBRAFISH LARVAE

Jocelyn Huang*, Micah Stoltzfus*, Rebekah Wong*, Kathryn Pillai*, Boyden Myers*, (Hyuna Lee)

Biola University

In Fetal Alcohol Spectrum Disorder (FASD) prenatal exposure to ethanol often results in neurodevelopmental and craniofacial abnormalities. Similar defects are seen in zebrafish, but the effects of EtOH on neurogenesis and vasculogenesis remains poorly understood. Zebrafish embryos were exposed to ethanol concentrations (0.5%, 1.0%, 1.5%, and 2%) at 4hpf or 24hpf for 24 hours. Confocal images of Tg(ETvmat2:GFP) and Tg(fli1:EGFP) embryos were taken at 48hpf and 72hpf to visualize monoaminergic neurons and blood vessels, respectively. A decrease of monoaminergic neurons in the telencephalon, locus coeruleus, and medulla oblongata regions was observed by 72hpf. Blood vessels lost organization, interconnectedness, and structure in the developing basilar, central, optic arteries, lateral dorsal aorta, anterior and posterior cardinal veins. Our results indicate that embryonic alcohol exposure affects both the developing neurons and blood vessel formation and that the severity depends on the concentration and timing of ethanol exposure.

111. THE DOWNREGULATION OF ASTROGLIAL GLUTAMATE TRANSPORTER-1 (GLT-1) DURING CHRONIC TOXOPLASMA GONDII

Mike Akaraphanth, Kristina V. Bergersen, Edward A. Vizcarra, Emma H. Wilson

University of California Riverside

Toxoplasma gondii is a successful obligate intracellular protozoan parasite that infects approximately a third of the human population. It can invade any nucleated cell and encyst within neuronal tissue for the remainder of the host's lifetime. Infection of the immunocompromised host leads to serious neurological pathologies such as Toxoplasmic Encephalitis, which is fatal if untreated. In addition, we now know that there are infection induced neurological changes in the immunocompetent host that leads to subclinical

pathologies. Recently, we have shown that Toxoplasma gondii infection in the brain leads to an increase in extracellular concentrations of glutamate due to a downregulation of the astrocytic glutamate transporter-1 (GLT-1). This neurological pathology is of clinical interest due to the implication of excessive glutamate in seizures, neuronal damage, hyperalgesia, and anxiety. The mechanisms by which Toxoplasma infection causes decreased GLT-1 expression is not understood. Using primary astrocyte cultures, the regulation of GLT-1 by Type I, II and III parasites was investigated. Results suggest that direct infection of cells by Toxoplasma gondii is capable of down regulating GLT-1 but that this is independent of classic parasite virulence. Furthermore, our data demonstrate the ability of specific neuronal growth factors to rescue this down regulation. These data support the ability of this common protozoan parasite to directly alter the neurochemistry of the infected brain.

112. TIME IN THE HIPPOCAMPUS: A NOVEL APPROACH TO EXAMINING THE FUNCTION OF TIME CELLS

Nina Tabrizi, Greer Marshall, Ali Mclagan, Linda Leiji, Marta Sabariego, and Jena Hales

University of San Diego

Space and time are both essential features of episodic memory, for which the hippocampus is critical. The involvement of the hippocampus in spatial processing was first described following the discovery of neurons, known as place cells, which fire with spatial-specificity (O'Keefe and Dostrovsky, 1971). More recently, the existence of hippocampal neurons that fire at successive moments in temporally structured experiences has been reported. These cells were dubbed time cells because it was suggested that they represented time (MacDonald et al., 2011). While spatial tasks have been used for the study of place cells, the tasks used for the study of time cells do not use time as an independent variable and therefore the behavioral relevance of this cell firing is unclear. In order to directly study the role of the hippocampus in processing elapsed time, we created a novel time duration discrimination task suited for the study of the function of time cells in memory. Twelve rats were tested on a figure-8-maze and experienced a 10- or 20-second time delay at the end of the center arm. During this delay, a 2000Hz tone played for the 10- or 20-second duration. Rats learned to make a decision to turn left or right out of the delay box depending on the associated tone duration (10 seconds = left turn; 20 seconds = right turn). Once the rats reached criterion performance of 90% correct on two out of three consecutive days, they received either an excitotoxic hippocampal lesion or a sham lesion surgery. After recovery, rats were tested to determine hippocampal involvement in discriminating time duration. Results from the time discrimination task will be discussed in terms of the involvement of the hippocampus in the processing of elapsed time.

Physiology & Development

113. EXTRAPOLATING A SYNTHETIC, ORTHOGONAL AUXIN-TIR1 RECEPTOR PAIR IN SOLANUM LYCOPERSICUM

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University of Washington

Auxins are a class of bioregulatory hormones which impact nearly every aspect of plant growth and development. Indole-3-acetic acid (IAA) and one of its corresponding receptors (TIR1) have been shown to be involved in seed germination, lateral root formation, stem elongation, fruit set and development, along with numerous other developmental processes. In an effort to more effectively study auxin-dependent pathways, Torii et al. developed a synthetic version of the IAA/TIR1 receptor pair which was shown to act independent of the endogenous pair in Arabidopsis. Here, I extrapolate our synthetically engineered auxin-receptor pair into a model system with agricultural and environmental implications (e.g. Solanum lycopersicum, tomato) and aim to test whether we are able to 'hijack' endogenous auxin signaling in tomato to precisely modulate auxin-dependent, spatiotemporal developmental outcomes. These findings could shed some light onto the vastly complex, auxin-dependent developmental process in Solanum lycopersicum and provide a tool to study auxin's specific role in varying developmental processes such as stomatal formation, leaf morphology, temporal flowering and fruit setting.

114. KNOCKOUT OF ARABIDOPSIS THALIANA GLUTAREDOXIN GENE ATGRX950 USING CRISPR-CAS9

Cristina Ford, (Matthew Escobar)

California State University San Marcos

In plants, some glutaredoxins have important roles regarding recovery from stressful conditions like drought. Previous studies in the Escobar lab identified seven Class III glutaredoxin (GRX) genes that are up-regulated by nitrate in Arabidopsis thaliana plants. Past research conducted showed that RNA silencing of four of these glutaredoxin genes (AtGRXS3/4/5/8) in A. thaliana resulted in a 25% increase in primary root length. This suggests that Class III glutaredoxin genes negatively regulate primary root growth. Understanding the functional role of glutaredoxin genes could aid to design crops that more efficiently take up water from the soil. The objective of this experiment is to characterize the function of a previously unstudied A. thaliana glutaredoxin gene 950 (AtGRX950). We used CRISPR-Cas9

technology to generated three knockout plant lines: AtGRX950-BO1, BO2, and K10. AtGRX950 mutants were characterized with respect to seed germination, primary root growth, plant biomass, and leaf area.

115. USING NATURAL VARIATION IN ARABIDOPSIS THALIANA FOR PHYTOREMEDIATION OF HEAVY METALS

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California State University San Marcos

Heavy metal contamination in drinking water and food sources is an increasing concern in the United States, with arsenic and cadmium amongst the top ten most prevalent toxicants. These toxicants enter the environment via a plethora of anthropogenic activities such as industry, pesticide spraying, and mining. Arabidopsis thaliana is a weed that grows in many regions globally, encountering various levels of toxic heavy metals in the soil. In this study, more than 100 ecotypes of Arabidopsis from around the world were germinated and transferred onto one of three treatment media: (1) no treatment (2) arsenic (3) cadmium. Primary root length was measured and used as an indicator of arsenic and cadmium sensitivity for each ecotype. Several ecotypes that are highly sensitive or highly resistant to arsenic and/or cadmium were identified. Future genomic and transcriptomic analyses can be done to begin categorizing candidate genes involve in heavy metal resistance.

116. A COMPARATIVE ANALYSIS OF RED ABALONE GROWTH, WHEN FED VARIABLE PREPARATIONS OF GIANT KELP

Noah Kolander

Concordia University Irvine

Multiple species of abalone aquacultured for food or restoration efforts utilize giant kelp as the primary food source. However, kelp is not consistently abundant and it is unknown if algae storage methods (e.g. freezing or drying) have any impact on abalone growth. A 22-week long fully crossed experiment was used to determine if juvenile red abalone (Haliotis rufescens) exhibited any detectable growth effects when provided a diet of dried, frozen, or fresh kelp, crossed with exposure to the scent of those same kelp preparations. A diet of frozen kelp yielded significantly less growth, while exposure to dried kelp scent also caused significantly less growth. No significant interactions were found between diet and exposure treatments. While fresh kelp allows the abalone to grow the quickest, storage and later feeding of dried kelp may be a viable alternative when fresh kelp is scarce.

117. ANALYSIS OF AIR CONTAMINANTS ACROSS INDOOR STUDENT IMPACTED AREAS.

Gurleen Kaur, Jacob Lanphere

California Baptist University

Objectives for this research were to measure various air born agents that are indoors and suggest ways to improve air quality. There are multiple scientific studies that correlate air quality to public health. Air pollutants researched were carbon dioxide, formaldehyde, and particulate matter. These pollutants are not detectable by the human senses, which can result into an environment that is not only stress inducing but is related to Chronic Obstructive Pulmonary disease. At California Baptist University the locations chosen were based on high student traffic. The apparatus used to measure air quality was the Air Quality Particle Counting Meter PCE- RCM 12. The locations of interest were James Tower, The Habit, and the Recreation Center. In this study it was reported that all locations measured were within EPA standards.

118. BIOTECHNOLOGY IN INFLAMMATION RESEARCH AND CARDIOVASCULAR WELL- BEING.

Rambod Meshgi*, (Nasrin Dorreh MSc, Farnoush Yazdani, Justin Partovi, Arash Agharahimi, Ladan Vakili MD, Shirin Amini DDS, Zara Barseghyan MD, Arash Meshkat DDS, Sheila Safar MD, Hasti Horri DDS)

University of California, Los Angeles

For thousands of years, humans have used biotechnology in agriculture, producing food and in medicine. In the late twentieth century, biotechnology has expanded to include new and diverse sciences such as genomics, modern genetic techniques, applied immunology, and the development of drug therapies and diagnostic tests. In medicine, modern biotechnology is widely used in fields such as drug discovery, biology and genetic testing or genetic screening using chips some being able to do as much as a million blood tests at once. A combination of pharmacology and genomics is a technology that analyzes how genetic makeup affects the individual's response to medications. In this regard, researchers investigate the effect of genetic variation in drug reactions in patients with the correlation between variation in gene expression or single nucleotide polymorphism with drug efficacy or toxicity. The objective of the drug-based genealogy is to provide logical criteria for optimizing drug therapy according to the patient's genotype to prevent the maximum effectiveness with minimal adverse effects. Such approaches persuade the emergence of "personal medicine," in which medications and drug compounds are optimized for each individual's unique genetic makeup. Study: our group has been focusing on short HDL mimetic peptides that have very high affinity for toxic oxidized lipids that cause inflammation in the artery wall and therefore interfere with the normal function of heart, brain, kidneys, lungs the GI tract and all other organs and tissue sites. Our studies in small animal and in primates followed by phase 1 clinical trials have shown significant effectiveness and reliable safety in oral administration of these peptides. It is hoped that by

expressing the gene for these peptides in plants an economically practical approach will be generated for the human use of these molecules.

119. CHARACTERIZING ATPASES AND ION TRANSPORT IN THE LARVAL GASTRIC CAECA OF THE AEDES AEGYPTI MOSQUITO

Hannah Otte*, (Marjorie Patrick)

University of San Diego

Larvae of the tropical mosquito Aedes aegypti, the yellow fever vector, inhabit freshwater and brackish water. A larval organ, the gastric caeca, has proposed involvement with osmoregulation. Previous studies showed a remodeling of ion transporter proteins, ATPases, in freshwater versus brackish water reared larvae. ATPases, which establish favorable gradients, are indicative of cell type. We examined gastric caeca from larvae that underwent an acute salinity transfer, from brackish water to freshwater (instigating osmoregulatory stress) and vice versa (relaxing stress). Findings suggest that the gastric caeca display plasticity when transferred from brackish to freshwater as a more regionalized pattern of ATPases were visualized. Additionally, a light-excitable indicator was used to visualize sodium ions in the cells of the gastric caeca. Brackish water derived larvae had a patchy appearance of sodium-loaded cells throughout the gastric caeca. Freshwater larvae had cells with notable sodium amounts at the distal region of the gastric caeca.

120. DELINEATING THE LINK BETWEEN DILATED CARDIOMYOPATHY AND ARRHYTHMOGENIC SYMPTOMS.

Tyler Muser*, (Mark Mercola).

BIOLA UNIVERSITY; STANFORD UNIVERSITY

Patients with dilated cardiomyopathy (DCM) often show an increased susceptibility to drug-induced arrhythmia. The mechanisms that link DCM to ventricular arrhythmia are not well understood but are thought to involve structural alterations to the cardiac wall and ion channels. Induced pluripotent stem cell-derived cardiomyocytes (iPSC-CMs) generated from patient tissue recapitulate many pathophysiological phenotypes characteristic of congenital heart disease. To model DCM, we prepared iPSC-CMs harboring a DCM-causing mutation in phospholamban (PLN), a protein involved in calcium regulation. Using the PLN mutant cells, we tested whether the disease would increase arrhythmic susceptibility to drugs that target certain ion channels. Initial experiments found that both sodium and human Ether-à-go-go Related channel agonists elicited an exacerbated proarrhythmic response from mutant cells. Action potential durations were disproportionately increased in the DCM-afflicted mutants. These data

support the model that the PLN mutant DCM involves a channelopathy that increases proarrhythmic sensitivity to drugs.

121. DEPRESSANT AND STIMULANT EFFECTS ON VISUAL ACUITY IN ADULT ZEBRAFISH

Benjamin Woost, Talia Basch, Tori Koch, Niayla Miller, Justin Ortal, (Stephen Runyan)

California Baptist University

Vision is one of our most valued senses and Zebrafish are a proven model for studying visual function. The optokinetic response is a reflex behavior that allows us to measure the ability of a fish to see a moving stimulus. In this study we examined the effects of a depressant and a stimulant on visual function. We utilized a mechanical apparatus to determine the visual acuity threshold (in cycles per degree, cpd) in adult zebrafish exposed to EtOH, 5 Hour Energy Drink, or vehicle. We demonstrated significant decreases in the visual acuity of zebrafish exposed to EtOH (1%; 0.189 cpd +/- 0.029; n=5) and 5 Hour Energy Drink (1%; 0.071 cpd +/- 0.045; n=4) compared to (0.5% 5 Hour Energy Drink; 0.564 cpd +/- 0.048; n=5) and controls (0.452 cpd +/- 0.061; n=9). We plan to use this assay to study the impact of chemicals and diseases on visual function.

122. DEVELOPMENT OF A DROSOPHILA MELANOGASTER ASSAY TO ASSESS THE DEVELOPMENTAL TOXICITY OF PHORATE

Valeria Rodarte, Aries Torres

california State University San Bernardino

To assess Organophosphates (OPs) as developmental toxicants, the model organism Drosophila melanogaster was used because they have a high degree of genetic homology to humans. Any developmental abnormalities that occur after exposure to a potential toxicant can provide a basis for assessing toxicity and possible mechanisms of action in humans. Previous studies demonstrated high concentrations (1 µg/ml) of Fenamiphos, Phorate, and Profenophos is lethal on the embryos compared to lower concentrations. Larvae, pupae and adult Drosophila were exposed to Phorate at concentrations ranging from 0.02 µg/ml, 0.05 µg/ml, and 0.08µg/ml. Protocols were developed to determine time of lethality and morphological abnormalities in undeveloped embryos, larvae, and adults. Embryonic, larval, and adult survival were assessed in addition to behavioral assessments in adults. Future studies will evaluate Fenamiphos and Profenophos for transgenerational effects, and observing possible deformities that could occur from exposure to OPs.

123. DIET RESTRICTION MODULATES HEAT SHOCK GENE EXPRESSION IN D. MELANOGASTER

Dylan C. Englund, Megan C. Bliss, Hazel Mancia, Alison S. Buck, Jason W. Tresser*

Biola University

Diet restriction (DR) in fruit flies mimics the longevity effects that calorie reduction has in other organisms. Long-lived flies are smaller, have global down regulation of protein levels, and lower fecundity. We predicted that flies on DR food would have a limited ability to respond to heat stress. We used qPCR to measure expression levels of heat shock proteins in Drosophila melanogaster fed control food or diet restricted food at standard or high temperatures. HSP22, HSP70 and HSP83 are known to be upregulated in flies in response to various stressors. We show here that flies under diet restriction have elevated HSP22 and HSP70 expression at standard temperatures and upregulate HSP 83 in response to heat stress.

124. EFFECTS OF WESTERN DIET ON CIRCULATING AND TOLL LIKE RECEPTOR 4 IN LDL R-/- MICE

Arash Ghahremani, Shirin Amin DDS, Arash Meshkat DDS, Greg Hough, MSc. Samra Vazirian, MD, Kimia Davoodi

University of California Los Angeles

UCLA Provision of a barrier between gut bacteria and the tissues of the host is an important function of enterocytes. A high fat diet induces inflammation in mice by increasing bacterial LPS levels in the intestinal lumen as well as in the plasma. Our group sought to determine the effect of feeding a high fat Western diet to LDL R-/- mice on TLR4 levels. Female mice were provided with the Western diet for two weeks. We observed that the administration of high fat Western diet resulted in a significant increase ($p=0.002$ and $p=0.01$ respectively) in the TLR4 levels in the plasma and in the enterocytes. It appears that TLR4 is induced as a result of feeding the high fat diet which can result in an inflammatory environment in the intestine. It will be informative to determine the effect on pro inflammatory pathways by TLR4 increase in this setting.

125. ELEVATED INSULIN UPREGULATES INFLAMMATORY GENE EXPRESSION IN HUMAN BRAIN ENDOTHELIAL CELLS

Sabina Khan*, Sara Zalekian, Joseph Zales, (Robin Altman)

California State University Sacramento

Endothelial dysfunction and increased inflammation play pivotal roles in both Alzheimer's disease and diabetes mellitus, and diabetes mellitus is a risk factor for developing Alzheimer's

disease. Elevated levels of circulating blood insulin are a hallmark of type 2 diabetes mellitus and may cause endothelial dysfunction and injury, potentially contributing to Alzheimer's disease pathology. We hypothesized that high insulin concentrations can cause upregulation of inflammatory genes in immortalized human cerebral microvascular endothelial cells from the line hCMEC/D3. RNA was isolated from cells treated with increasing doses of insulin and used for quantitative real-time PCR analysis of gene expression. Upregulation of inflammatory genes was observed in cells treated with high concentrations of insulin compared to control cells. Thus, elevated insulin levels result in injury to brain endothelial cells, which could potentially contribute to Alzheimer's disease pathology and augment the disease symptoms.

126. EXAMINING PHASE II DETOXIFICATION IN SIGNAL CRAYFISH (PACIFASTACUS LENUSCULUS) ANTENNAL GLAND

Courtney Kelly*, (Dr. Mark P. Gunderson)

The College of Idaho

Metal pollution has been a long-standing concern with adverse effects often observed in exposed wildlife populations. Bioindicators are commonly used as part of monitoring efforts to determine whether organisms exhibit biological responses to metals present in their environments. Previous studies have demonstrated that endogenous antioxidant biomarkers can be detected and modulated in the crayfish hepatopancreas, gill, and tail muscle tissue. However, no work has been done to detect these biomarkers within signal crayfish (Pacifastacus lenusculus) antennal gland. Antennal glands, hepatopancreas, and gill tissues were collected from untreated crayfish and crayfish treated with varying concentrations of zinc and copper chloride. Glutathione S-transferase and metallothionein colorimetric assays were run to detect and compare expression among the tissues. Species and tissue specific patterns are reported for these markers emphasizing the importance of understanding and characterizing the regulation of these endogenous antioxidants when using them to screen populations for evidence of contaminant exposure.

127. EXAMINING THE IMPACT OF MEDICATION BELIEFS ON MEDICATION ADHERENCE AMONG UNCONTROLLED HYPERTENSIVE PATIENTS

Justin Cha, Elizabeth Ordonez

University of California, Irvine

Medication nonadherence poses a threat to patients and their healthcare treatments. Previous studies have found that socioeconomic status (SES) is a key contributor to medication nonadherence and further assessment of medication related beliefs is needed to identify factors that contribute health outcomes among different socioeconomic classes.The current

study is an extension of Mi Propio Camino (MPC), an NIH funded study aiming to assist low-income Latino patients with uncontrolled hypertension engage in more productive discussion about medication concerns with their providers. This study focuses on individuals diagnosed with comorbid type 2 diabetes and hypertension to evaluate the differences in medication related beliefs among two groups with different SES. A Beliefs About Medicine Questionnaire (BMQ) will be administered to 60 participants with high SES who receive care from an academic medical center, compared to those with low SES at a federally qualified health center (FQHC). Considering external and internal factors ,the BMQ will measure health-related social support, familism, crowding, and previous patient-physician experiences concerning medication to obtain a comprehensive analysis of concerns about medication adherence beliefs. Additionally, hemoglobin A1c and blood pressure measurements will be taken to evaluate the management of comorbid hypertension and diabetes. In conducting this study, we expect to understand the differences in chronic disease control among the two different SES groups. Differences in health outcomes, may be attributed to familism, social support, or other contextual factors that are identified through the BMQ.

128. EXPLORING THE ROLE OF GASTRIC CAECA IN OSMOREGULATION OF SALTWATER MOSQUITO LARVAE: FURTHER INVESTIGATIONS

Larissa Ekwevi*, (Marjorie Patrick)

University of San Diego

This study proposes a working model of the osmoregulatory process of saltwater mosquito larvae Aedes taeniorhynchus by examining NKA/VHA expression patterns and activity in gastric caeca (GC). The NKA/VHA immunolocalization in gastric caeca indicated that larval A.taeniorhynchus exhibits similar regionalization of cell types and localization of NK and VH pumps in both 30% and 150% water salinity. We saw that Ion Transporting (IT) cells localize at the distal tip and the resorbing-secreting (SR) cells occupy the proximal region of the GC. The unchanging localization patterns of NKA/VHA in the GC suggested that the proportion of active NKA and VHA is changing in response to osmoregulatory stress. The rate of NKA and VHA activity in gastric caeca from larvae hatched and reared in 30 and 150% saltwater was quantified in an ATPase activity assay that showed changes in the proportion of NKA and VHA with varying salinity. The results of this prove that gastric caeca manage osmotic stress by altering the proportional activity of NKA and VHA.

129. EXPOSURE TO ELECTRONIC CIGARETTE LIQUIDS TRANSFORMS OSSEOUS TISSUE OF EMBRYONIC G. GALLUS DOMESTICUS

Colton Merges, Emily Bartlett, Daniel Hernandez, (Dr. Sara Heggland, Dr. Thomas Pirtle)

The College of Idaho

With the popularity of electronic cigarettes and personal vaporizers on the rise, the health risks and concerns of inhaling these vapors is widely unknown. We studied the effects of different non-nicotine vaporizer liquids on developing osseous tissue in embryonic G. gallus domesticus. We treated embryos with 0.1 ml of diluted vaporizer liquids using a windowing method. Each embryo was treated with either vaporized or un-vaporized electronic cigarette vaporizer liquids on day 7 of embryonic development and dissected on day 14. We examined the length and girth of the dissected tibias and femurs, which revealed statistically significantly difference with mango strawberry and mocha flavor. Additionally, comparison of bone mineralization through ash weighs of the bones indicate a significant difference with the mango strawberry flavor having more bone mineralization with much larger ash weights. Mango strawberry treated embryos also had a trabecular bone area that is larger when compared to other flavors.

130. GEOMETRIC MORPHOMETRIC ASSESSMENT OF SKULL SYMMETRY IN 6-8.0 YEAR OLD HUMANS.

Ana Shaughnessy*, Jane Vannaheuang, Jessica Cronin, (Gary D Richards)

University of California, Berkeley

Skull asymmetries are well documented, but little is known of the factors that result in skull asymmetry. Consequently we are ill equipped to differentiate potentially problematic changes resulting from the current epidemic of plagiocephaly related to SIDS prevention. Here we provide a geometric morphometric assessment of normal children to establish the normal range of asymmetry from which to address divergence from the normal condition. We compiled 38 normal skulls with developmental ages of 5.8-7.9 years. We used a Microscribe to digitize 38 3D landmarks. The sample was split into right/left halves. Principal Components Analysis (PCA) of Procrustes-aligned shape variables were carried out in Morphologika 2.

131. GLUCOCORTICOID RECEPTOR FUNCTIONS AND ACTIVITES IN CASTRATION-RESISTANT PROSTATE CANCER

Dalal El-Barbarawi*, (Tiha Long, PhD)

Roosevelt University

Commonly used therapies for prostate cancer (PC) that block androgen receptor (AR) signaling inhibit regrowth, but aggressive “castrate-resistant” (CR)PC abrogates anti-androgen therapy. Recently published data shows that glucocorticoid receptor (GR) can drive the growth of CRPC when AR is blocked, by mimicking AR activity. Due to the evolution of CRPC into a more invasive disease, we hypothesized that GR-driven CRPC has different activities than AR that promote progression to metastatic disease. To test this hypothesis, we performed gene expression analysis on available datasets to determine which pathways correlate with GR target gene expression. Furthermore, we investigated gene expression in CWR-22Rv1 CRPC cells via qRT-PRC. Our results show that GR-activation in AR-blocked cells induces different genes than AR, suggesting that GR-driven CRPC is unique from AR-driven disease. The scientific contribution of our research may reveal new mechanisms by which GR drives PC progression and unveil novel therapeutic targets.

132. IMPACT OF FACEBOOK USE ON THE ANTICIPATORY STRESS RESPONSE IN ATHLETES BEFORE A COMPETITION

Quinn Johnshoy*, (Jay Campisi)

Regis University

While some young adults find enjoyment in using social media sites, others find social media use to be stressful. In addition, although many athletes experience stress prior to competition, it is unclear if social media use could modulate this stress. In this study, undergraduate athletes spent time before each of two competitions either engaging in their normal routine or on their Facebook account, and submitted a saliva sample before and after that time period to assess for salivary cortisol concentration. Athletes demonstrated a significant increase in cortisol before competition and Facebook use modulated the stress-induced increase in cortisol in females as there was a significant decrease in cortisol concentration in the female athlete that did not use Facebook. This suggests that social media use prior to a competition might have differential impacts on stress levels in some users.

133. IMPROVING THE FUNCTION OF HIGH DENSITY LIPOPROTEIN

Farnoush Yazdani, Nasrin Dorreh, Sarvin Zangeneh, Nahal Khalkhali, Sheila Safar MD, Zara Barseghyan MD, Nima Moini, Rambod Meshgi, Samra Vazirian MD, Justin Partovi, Shirin Amini DDS, Arash Meshkat DDS, Farin Yazdani, MD.

University of California, Los Angeles

Background: Measuring the good cholesterol, HDL levels may not accurately predict the composition, functionality, and anti-inflammatory properties of this lipoprotein. HDL has been found to be dysfunctional and proinflammatory in diseases associated with a chronic acute-phase response. In clinical practice currently, there are no tests widely available for measuring the composition, functionality, and inflammatory properties of HDL. However, it appears that the composition, functionality, and inflammatory properties of HDL are directly related to the presence or absence of conditions that are known to induce a chronic acute phase response. These conditions are clinically recognizable (e.g., diabetes, visceral obesity, CHD, rheumatic diseases, chronic inflammatory gastrointestinal conditions, chronic renal disease, and chronic infections). Studies in our group using HDL and HDL mimetics as therapeutic agents have been in early-phase clinical trials. Studies in animals and in the early clinical trials are encouraging, but it likely will be some time before the outcome of definitive studies is known. In the meantime, our therapeutic approach must continue to emphasize lifestyle modification, control of diabetes, hypertension obesity, and hyperlipidemia as well as the appropriate use of aspirin, statins, ACE inhibitors, and blockers for patients with coronary heart disease.

134. INVESTIGATING THE MATURATION POTENTIAL OF VIRGIN BETA CELLS WITHIN MOUSE PANCREATIC ISLETS

Marcus Flisher*, Supraja Saravanakumar*, Sharon Lee, (Mark Huising)

University of California, Davis

Type 1 diabetes (T1D) is an autoimmune disease that results in the destruction of insulin-secreting beta cells. Thus, significant research is aimed towards treating T1D by restoring beta cell mass. Our lab discovered a novel population of functionally immature “virgin” beta cells which derive from non-beta progenitors at a neogenic niche near the islet periphery. We hypothesize that these virgin beta cells develop into functionally mature beta cells. To test our hypothesis, we selectively lineage-labeled all beta cells in mice using an inducibly expressed fluorescent reporter. We then followed the fate of these cells over time. By quantifying changes in the number of lineage-labeled virgin and mature beta cells, we can determine if virgin beta cells mature over time. The outcome of our experiment will inform on the maturation capacity of virgin beta cells, which could potentially be targeted for beta cell regeneration as a treatment for T1D.

135. INVESTIGATING THE ZEBRAFISH AS A MODEL FOR THE STUDY OF PHYSIOLOGY AND DEVELOPMENT

Antonio Guevara*, Corah Chan*, Joshua Ventenilla*, Timothy Koo*, Amanda Barba (Daniel Szeto, Stephen Runyan, Nathanael Heyman)

California Baptist University

The zebrafish model system is an excellent study for the development and physiology of the cardiovascular system in a vertebrate animal. In the current ongoing project, we have continued development of the zebrafish as a model system for studying physiology and development in an undergraduate laboratory. Toward this aim several areas have been investigated. In vivo analysis of cardiovascular function in both embryonic and adult zebrafish has been approached using both electrocardiography and videography. Ex vivo analysis of heart function using isolated, beating hearts from anesthetized adult zebrafish was also performed using both electrocardiography and videography. Future aims include the development and characterization of transgenic heart models and using the clearance of injected fluorescent tracer molecules to study renal function in both healthy and disease models in zebrafish.

136. IT IS THE HDL FUNCTION THAT MATTERS IN AN INDIVIDUAL AND NOT THE HDL LEVELS

Nahal Khalkhali, Shirin Amini DDS, Sheila Safar MD, Arash Meshkat DDS, Elnaz Kasiri MD, Hasti Horri DDS, Kimia Davoodi.

University of California, Riverside

HDL has two important roles: first, it promotes the reverse transport of cholesterol from tissues to liver, and secondly, it modulates inflammation. Epidemiological studies suggest that cholesterol levels are inversely related to the risk of cardiovascular disease in large paopulations. However, in many patients with cardiovascular complications, HDL levels are normal or even high. Measuring HDL levels provides information on the pool size but not composition, performance, and protective capacity. The main component of HDL is apolipoprotein AI which is responsible for reverse cholesterol transport. Our group has shown that the apoA-1 can be damaged by oxidation. HDL contains a number of other proteins that can also be damaged by oxidative modification. Our group has demonstrated that correcting the protein and the lipid components of the dysfunctional HDL can return the HDL protective capacity convert it to an anti-inflammatory molecule again. Methods, Our group has made small peptides that imitate apoA-I and in circulation form HDL like particles. These molecules have an extremely high affinity (Kd= 1x10E9) for toxic oxidized lipids. Results, studies in preclinical and early phase 1 clinical trials showed that in patients with cardiovascular complications, the peptide increases the protective capacity of HDL with no adverse effects. This is without altering the circulating cholesterol levels. Conclusion, Future trials should provide more information on the safety and efficacy of the HDL mimetic peptides in long run.

137. LIVER EXPRESSION OF PROLACTIN RECEPTOR ISOFORMS THROUGHOUT THE MURINE ESTROUS CYCLE

Gillian M. Wright*, Kelly C. Radecki, (Ameae M. Walker)

University of California, Riverside

Prolactin (PRL) is a pituitary hormone involved in many biological functions. Unlike many other hormone-receptor relationships, PRL upregulates its own receptor. Alternative splicing of the murine prolactin receptor (PRLR) gene results in four isoforms: one long form (LF) and three short forms (SF1-3). While the LF promotes cell proliferation, the SFs are generally understood to promote apoptosis. PRL is protective in the liver, signaling predominantly through the SFs, as evidenced by female hormone-dependent resistance to hepatocellular carcinoma and liver steatosis. PRL levels fluctuate along the reproductive cycle, but the expression of the PRLR has never been evaluated with respect to the stages of the murine estrous cycle. We have collected livers of staged mice for real-time quantitative PCR analysis of the PRLR isoforms. We hypothesize the liver will maintain a preference for SF PRLRs, with peak expression occurring during the estrus stage, shortly after the surge in PRL during proestrus.

138. LYSOSOME DYSFUNCTION IN A FLY MODEL OF ALZHEIMER'S DISEASE

Mackenzie Minehan, Maya Hall, (Dr. Adam Haberman)

University of San Diego

Alzheimer’s Disease (AD) is an irreversible cognitive disorder involving memory disruption and is associated with the accumulation of amyloid (Aβ) plaques. This disrupts neuronal communication in the central nervous system. Previous studies have shown that amyloid aggregates reduce lysosome function in neurons. This study investigates the impact of Aβ plaque exposure on lysosomal proteolysis in Drosophila melanogaster photoreceptors. Drosophila melanogaster were induced to express Aβ in the eye to study the impact of Aβ on the endolysosomal pathway. Lysosome function was analyzed by measuring relative levels of processed Cathepsin via Western Blot. Inactive Cathepsin is cleaved into a smaller, active form in the acidic organelles within the cell. Therefore, an accumulation of the larger form of Cathepsin indicates diminished endosomal trafficking or lysosome maturation. Preliminary results showed that Hk RNAi, which speeds up protein trafficking to the lysosome, partially rescued lysosomal function in AD neurons. We seek to further analyze the lysosomal pathway in this fly model of AD, in hopes that this research gives way to potential drug targets for Alzheimer’s Disease.

139. MD-2, LY96 IS INCREASED IN THE JEJUNUM ENTEROCYTES AND IN THE PLASMA OF LDL RECEPTOR DEFICIENT MOUSE

Parsia Vazirnia, Gabriel Esmailain, Justimn Partovi, Arash Agharahimian, (Zara Barseghian, MD, Elnaz Kasiri MD, Sara Motahedan MD, Samra Vazirian MD, Ladan Vakili, MD)

University of California, Los Angeles

Background, MD2, also known as Lymphocyte antigen 96, also known as is a protein that in humans is encoded by the LY96 gene.LY6 refers to a family of proteins found in leukocytes. They are used as surface markers for leukocyte identification. The protein encoded by this gene is involved in binding lipopolysaccharide with toll-like receptor 4. TLR4 is a transmembrane protein, member of the toll-like receptor family, which belongs to the pattern recognition receptor (PRR) family. TLR4 activation leads to an intracellular signaling pathway NF-κB and inflammatory cytokine production, which is responsible for activating the innate immune system. Objective. We sought to determine the effect of a high fat high cholesterol diet (Western Diet, WD) on jejunum enterocyte and o0n plasma levels of MD2 in LDL receptor deficient mouse. Methods. Female mice, 6 to 8 months of age in groups of 20 each were placed on a Western diet for two weeks. The mice were then fasted and the small intestine and blood were removed. Enterocytes were isolated by standard procedures and cell lysates were used in the Western blot analyses and in an ELISA. Results. We found that the administration of the high cholesterol high fat diet resulted in a significant increase ($p=0.0015$ and $p=0.018$ respectively) in the MD-2 levels and in the enterocytes and in plasma. Conclusion. The present data shows that the high fat high cholesterol diet which can result in an inflammatory environment in the intestine induces MD-2 levels and that in turn affect the plasma levels of MD-2 as well. It will be helpful to investigate the effect of increased levels of MD-2 on pro inflammatory pathways related to systemic inflammation and cardiovascular well being.

140. MEASUREMENT OF INDOOR AIR QUALITY PARAMETERS IN HIGHLY TRAFFICKED LOCATIONS

Gurparsad Suri, Jacob Lanphere

California Baptist University

While public focus has shifted to outdoor concerns, the truth is that indoor air pollutants are far more concentrated. Air pollutants cause much more harm than temporary irritations. Exposure to indoor pollutants can have both short and long-term effects. It is important to understand these risks to promote research in this area. Many diseases can result from exposure to indoor air pollutants. Respiratory diseases, cancer, and other maladies are common results from overexposure. Because humankind spends much of life indoors, it is essential to eliminate these risks for healthy living. In this study a series of experiments were conducted to measure parameters of air quality (e.g., carbon dioxide, formaldehyde, particulate matter). The results

show the immediate effect of good ventilation as well as research on many ways to lower the concentration of air pollutants or eliminate pollutants entirely.

141. METABOLISM OF NITRIC OXIDE AND NITROSOGLUTATHIONE IN THE SHEEP PLACENTA.

Bobby Mendez, Alexandra Shin, Arlin Blood

California Baptist University

METABOLISM OF NITRIC OXIDE AND NITROSOGLUTATHIONE IN THE SHEEP PLACENTA. Bobby Mendez*, (Alexandra Shin, Arlin Blood), California Baptist University, Department of Biological Sciences, 8432 Magnolia Avenue, Riverside, CA 92504; Loma Linda University Department of Pediatrics, Division of Neonatology, and Lawrence D. Longo Center for Perinatal Biology, 11175 Campus Street, Loma Linda, CA 92350 Nitric oxide (NO) is an endogenous free radical that exerts its functions in its primary form or after being metabolized to one of several products including nitrite and nitrosothiols (SNO). This study determined the rate of metabolism of NO and SNO within sheep placenta. Near-term pregnant sheep were euthanized, placentas were collected and homogenized, and either NO donor or the SNO nitrosoglutathione were added to measure their rates of disappearance. Data collected from this experiment were compared with the NO metabolism rates of sheep brain tissue. The results showed that both NO and SNO are metabolized at a faster rate in placental compared to brain tissue. Overall, this study found that NO and SNO metabolism in the placenta is bi-phasic, consisting of an initial rapid disappearance followed by a slower rate of metabolism. Taken together, this study suggests that placental NO and SNO concentrations are significantly regulated by rapid metabolism.

142. METAL TOXICITY EFFECT ON ION REGULATION IN ACIDOPHILLIC FISH

Jad Shami*, (Dr. Richard Gonzalez)

University of San Diego

Metal toxicity was investigated in two pH tolerant species of cichlids, Tapajos cichlids (Geophagussp.) and Oscars (Astronotus ocellatus) from the Rio Negro, an ion-poor acidic blackwater water. We measured rates of Na+uptake and loss during exposure to dissolved copper, and silver. Exposure of Tapajos cichlids to 1000 µg/L Cu2+ inhibited Na+ influx by 45.5% and stimulated Na+efflux by 23.9%. Exposure to 1 µM Ag+completely inhibited Na+ influx of Tapajos while increasing efflux threefold, and 200 mg/L Ni2+ increased efflux by 43.8%. These metals and others will be looked at on Astronotus ocellatus. These results indicate cichlids show high resistance to copper and nickel, but Ag completely inhibits Na+influx and causes leaky gills.

143. METHODS OF NA+ INFLUX BY ACID-TOLERANT AMAZONIAN CICHLID ASTRONOTUS OCELLATUS

Roger Hsu

University of San Diego

We investigated the role of carbonic anhydrase (CA) in Na+ uptake in an acid-tolerant Amazonian cichlid, the Oscar (Astronotus ocellatus). It is proposed that carbonic anhydrase in the gill epithelium combines CO2and H2O to form HCO3- and H+. The H+is then exchanged for Na+, replacing Na+ lost by diffusion across the gills. We measured rates of Na+influx in the presence of compounds that inhibit CA, to test its role in Na+ uptake. Exposure of Oscars to 100 µM acetazolamide had little effect on Na+uptake but exposure to 100 µM Ethoxzolamide inhibited Na+uptake by 50%. These results indicate that Na+uptake in the Oscars involves the production of H+ by carbonic anhydrase to be utilized in exchange for Na+influx. The difference in effectiveness of the two compounds can be explained by the higher affinity of Ethoxzolamide for CA.

144. MIDDLE MENINGEAL ARTERIOVENOUS AND DURAL SINUS VARIATION IN 6-8.0 YEAR OLD HUMANS

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Background: The meningeal arteriovenous system supplies or drains blood from the dura mater and bone while the dural sinuses drain blood from the brain, dura, and bone. Assessment of these systems, based on patterns exhibited on endocranial casts, has a long history in the study of primate brain evolution. However, recent reviews demonstrate a significant need for new data and investigative procedures. We address some of the issues by analyzing a large ontogenetic sample in three dimensions. Materials and Methods: We CT-scanned 40 crania developmentally aged from 5.8-7.9 years. Ages derive solely from tooth calcification patterns. Meningeal and dural sinus systems were reconstructed in 3D on isosurfaces. Variously-sized 3D markers were placed to map relative sizes and patterns. Results: Using the traditional Adachi types for the meningeal system resulted in 45%, 15% and 40% of Types I, II, and III, respectively. Right/left differences in these types occurred in 65% of the sample. Alternatively, looking at the 3D complexity of branching and anastomoses, right/left differences were observed in 60% of individuals, with right-dominance and left-dominance equally represented. Middle meningeal branches crossed the coronal suture in 95% of individuals. The frequency and number of such branches were higher on the left side. The right transverse dural sinus was dominant in 55% of cases, with 30% showing left dominance and 15% having equal drainage. Only 25% of cases showed occipital marginal drainage. Discussion: Three-dimensional mapping of the

arteriovenous and dural sinus drainage systems has the potential to reveal their relationships to the developing neural contents and functional cranial regions.

145. MYD88 PROTEIN IS ELEVATED IN PLASMA AND IN JEJUNUM IN LDL RECEPTOR DEFICIENT MICE.

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A high fat high cholesterol diet increases bacterial lipopolysaccharides in the gut lumen and in circulation by altering the composition of the intestinal microbiome and increasing gut permeability through induction of toll like receptor 4. The pathway leading to TLR4 activation and signaling involves LPS first interacting with CD14 and LBP, which deliver LPS to TLR4 and its partner MD-2. Subsequently, TLR-4 signals through MyD88. Objective. Our group sought to determine the effect of a Western diet (a high fat-high cholesterol diet) on the MyD88 levels in plasma and in the cells of the jejunum. Female LDL receptor deficient mice, 6 to 8 months of age in groups of 20 were each placed on the high fat high cholesterol diet (WD) for two weeks. The animals were then fasted and the small intestine and blood were removed. Enterocytes were isolated by a procedure utilizing salt solutions and enterocyte lysates were used in the Western blot and in the ELISA analyses. Results. Our group shows that a significant increase ($p=0.001$ and $p=0.02$, respectively) in the MyD88 levels in the plasma and in the enterocytes was observed following the administration of the Western diet. Conclusion. The present data shows that the high fat diet, which can result in an inflammatory environment in the intestine, induces MyD88 levels and that in turn affect the plasma levels of MyD88 as well. It will be helpful to investigate the effect of increased levels of MyD88 on pro inflammatory pathways in the intestine, liver and the organism as a whole.

146. PERICYTE AND ACELLULAR CAPILLARY PRESENCE IN RETINAS OF 12 WEEK DIABETIC RETINOPATHY MOUSE MODELS

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The purpose of this study is to determine when pericyte presence decreases and when acellular capillaries proliferate in the early stages of diabetic retinopathy (DR). Early stages are characterized by pericyte loss, possibly by apoptosis, and increased presence of acellular, non-perfused capillaries. This study analyzed the presence of pericytes and acellular capillaries in mice twelve weeks after diabetes was induced via intraperitoneal streptozotocin injections. Retinas were fixed and immunostained with antibodies against markers for pericytes (α-NG2)

and apoptosis (α-Caspase-3) and stained for cell nuclei (DAPI) and epithelial cells (Isolectin). They were subsequently imaged with confocal microscopy. Using ImageJ, total pericytes were counted in the retinal ganglion cell layer and inner and outer nuclear layers. Microvasculature was analyzed for type (acellular or normal), length, width, and area. Experimental results evaluate the number of pericytes and the total length and area of microvasculature they cover between control and DR model mice.

147. SODIUM ION REGULATORY MECHANISMS IN A. OCELLATUS FISH NATIVE TO THE ION-POOR WATER OF THE RIO NEGRO

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The cichlid family of fish are native to the acidic and ion-poor blackwater of the Rio Negro, a major tributary of the Amazon River. The Astronotus ocellatus, or Oscars, are a member of this family. In a series of flux experiments, we examined the influx of radioactive sodium isotope as pH and sodium concentrations are altered. From this flux data, the Oscars showed an ability to regulate sodium despite the pH dropping to extremely acidic conditions. Furthermore, at high sodium concentrations, the Oscars showed increased ability to downregulate sodium ion intake via gill transporters. To further our research, we conducted immunohistochemistry to investigate and isolate the location of Na+/K+ transporter and H+-ATPase location on the fish gills. Location of these transporters were located in normal conditions then reevaluated after fish had been exposed to low pH as well as low sodium levels. The movement of these transporters in response to extreme conditions is thought to be a key factor in Oscars' tolerance.

148. THE EFFECT OF SEX ON THE GROWTH RATE OF SERIOLA DORSALIS

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The development of economically and environmentally sustainable aquaculture requires an understanding of the genetic basis of traits that can limit or enhance the growth or health of target species. Genomic resource development is of particular interest for Seriola dorsalis, commonly known as the California Yellowtail, as economically valuable traits such as growth rate or response to aquaculture procedures may be linked to sex. Specimens of S. dorsalis from an exercise enhanced growth study at the Southwest Fisheries Science Center (SWFSC) were dissected and DNA extracted. Individuals can be identified as male or female using sex-specific genetic markers for S. dorsalis. Growth rate data from the SWFSC study will be analyzed for differential response by males and females. This research aims to examine the effect of sex on

the growth rate of S. dorsalis and may shed light on whether males or females respond differently to specific aquaculture procedures.

149. THE ROLE OF AUTOPHAGY IN WOUND HEALING

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It is understood that the turnover of immune cells and fibroblasts is important for the wound healing process; however, it is not understood if the turnover of proteins and organelles within the cells at the wound site is also important. We hypothesized that autophagy, the process responsible for turnover of cellular materials within a cell, is needed during the wound healing process. Examination of wounded skin shows an increase in the autophagy marker, LC3, at the wound site, indicating an induction of autophagy at the site of the wound. Wounded autophagy-deficient mice experience delayed wound healing compared to autophagy-proficient mice, suggesting autophagy is essential for proper wound healing. Wounds of autophagy-proficient and autophagy-deficient mice harvested at various time points over the healing process suggest an upregulation of the non-canonical NF-κB pathway, a pathway responsible for cytokine regulation, which in turn is important for wound healing progression.

150. THE ROLE OF RAB5 IN DROSOPHILA HEMATOPOIESIS AND HEMOCYTE DIFFERENTIATION

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Drosophila hemocytes are essential to protecting immunity, but much is unknown regarding the mechanisms and signaling pathways by which these cells operate. Endocytic pathways help regulate signaling cascades that lead to hematopoiesis, but the role of Rab5, a key regulator of early endocytosis, has not yet been established in Drosophila hematopoiesis. We find that knockdown of Rab5 in hemocytes results in an overabundance of circulating larval hemocytes and larvae die before pupation. Similar phenotypes are found using the dominant negative and constitutively active forms of Rab5. Rab5 knockdown also impacts hemocyte differentiation, with an increase in crystal cells and possible differentiation to lamellocytes. We have also constructed transgenic fly-lines with hemocyte specific drivers and fluorescently tagged hemocyte subpopulation markers to further test the role of Rab5 in hemocyte differentiation.