2018 Brooks and Johnson Winners
National Convention, Asilomar State Park,
Host California State University- Monterey Bay, Phi Beta Chapter
May 30 – June 3, 2018

FRANK G. BROOKS AWARD WINNERS

Oral Presentations
Session 1: Microbiology

1st Place — Miears, Hunter. Epsilon Gamma, Angelo State University. Staphyloxanthin Mutants of *Staphylococcus aureus* and Their Response to Antimicrobials

2nd Place — Freedenberg, Alex, Quinn Mageria, Brooke Nearhood, Irena Ardelean-Growden, Kristen Picardo and Jonelle Mattiacio. Upsilon Rho, Saint John Fisher College. Investigation Into the Interaction Between Bacteriophage and Quorum Sense Inhibitors and Their Effects on Bacterial Biofilm Degradation

3rd place — Evans, Nicholas. Epsilon Sigma, Angelo State University. Creation of a MEGA-plate to understand the nature of *Pseudomonas aeruginosa*

Session 2: Molecular and Cellular Biology

1st Place — Dorrity, Tyler J. Upsilon Delta, Drew University. Cytokine Responses Generated by cGAMP and Other CDNs Depend on Delivery Method

2nd Place — Rivera, M. Angelica Rosa. Zeta Epsilon, University of Puerto Rico at Cayey. Characterization of UBR4 and UBR5 Interactors Involved in the Formation of K11/K48-Branched Ubiquitin Chains

3rd Place — Moore, Stephen. Theta Pi, University of Pittsburg at Greensburg. Targeted DNA breaks determines age-1 gene's role on DNA repair machinery and nvestigates how energy utilization affects *Caenorhabditis elegans* life span

Honorable Mention — Garber, J and R. McGrane. Delta Sigma, Southwestern Oklahoma State University. Investigating the Effects of Varying Surface Conditions on Phytopathogens

Session 3: Ecology

1st Place — Kolander, Noah. Epsilon Chi Delta, Concordia University. Insight Into the Demographics of Pismo Clams (*Tivela stultorum*) in Orange County, CA, Following a Four-decade Gap in Data Collection

2nd Place — Motley, M'Kayla G., and Bonnie B. Amos. Epsilon Sigma, Angelo State University. A Preliminary Report on the Seed Dispersal of *Sclerocactus brevihamatus spp. Tobuschii:* An Endemic Cactus

Session 4: Cell, Organismal and Developmental Biology

1st Place — Sutter, Pearl A. Upsilon Delta, Drew University. Effects of DCP-LA on Learning and Memory in an *in vivo* Alzheimer's Disease Model With Ovariectomized Rats

2nd Place — Allen, D., and J. Fadool. Sigma Tau, Florida State University. *Syntaxin3a* is Essential for Photoreceptor Survival in Zebrafish

3rd Place — Wilcox, J., C. Rodriguez. Sigma Tau, Florida State University. Advancing Diabetes Care: The Optimization of Insulin Pump Medication Delivery

Honorable Mention — Pietrantoni, Dylan and Fr. Shawn Anderson. Upsilon Gamma, St. Vincent College. The Effects of High-intensity Interval Training (HIIT) and Continuous Moderate-intensity Training (CMIT) on Grip Strength and Muscular Endurance in Mice

JOHN C. JOHNSON AWARD WINNERS

Poster Presentations
Session 1: Microbiology

1st Place — Sniezek, Olivia and Dr. Joshua Corrette-Bennett. Alpha Sigma, Westminster College. Fractal Modeling and Suppression of *Staphylococcus aureus* Biofilm Formation

2nd Place — Miller, Chelsea and Regina McGrane. Delta Sigma, Southwestern Oklahoma State University. Looking Beyond the Leaf: Understanding the Impacts of Motility on *Pseudomonas syringae* Seed Colonization

3rd Place — Rankin, Brooke and Regina McGrane. Delta Sigma, Southwestern Oklahoma State University. Ice Nucleation: A Look at Evolutionary Significance Beyond Frost Injury

Honorable Mention — Hutchinson, Sara and Regina McGrane. Delta Sigma Chapter, Southwestern Oklahoma State University. Investigating Phytopathogen Transitions From Aquatic to Surface Based Environments

Session 2: Molecular and Cellular Biology

1st Place — Martin, Leah. Phi Beta, California State University, Monterey Bay. Galectin-3 Inhibitor GR-MD-02 Increases CD8 T Cell Infiltration of MCA-205 Tumors

2nd Place — Meredith, Melissa. Saska, K., Kashef, N., Stafford D., Sogard, S.M., Hamilton, S.L., Bernardi, G., Logan, C.A. Phi Beta, California State University, Monterey Bay, Effects of Ocean Acidification and Hypoxia on Larval Brown Rockfish Transcriptomes

3rd Place — Pellot Ortiz, Karolina I., Fernando Vidal-Vanaclocha, Neena M. Mirani and Lawrence D. Gaspers. Zeta Epsilon, University of Puerto Rico, Cayey, P.R., Valencia University Medical School, Spain, Pathology and Laboratory Medicine, Pharmacology, Physiology and Neuroscience, Rutgers-NJMS, Newark, NJ. Potential Role of Inositol-trisphosphate 3-kinase in Colorectal Cancer Liver Metastases

Honorable Mention — Olin, Taylor A. Gamma Alpha, St. Catherine University. Hox Transcription Factor Regulation of Neuronal Development in *Caenorhabditis elegans*

Session 3: Ecology

1st Place — Repas, Emily. Eta Nu Chapter, Samford University and Elmira College. Impacts of Severe Drought on Remnant Longleaf Pine Communities at Oak Mountain State.

2nd Place — Sidor, Stephanie. Effects of Copper and Zinc on the Hunting Abilities in Polyps and Swimming Behavior in Ephyrae of *Aurelia aurita*

3rd Place — Blackwell, Sharon and Thomas Bliss. Psi Rho, University of North Georgia and UGA Marine Extension and Georgia Sea Grant Shellfish Research Lab**.** Establishing an Effective Diet to Increase Growth in the Eastern Oyster (***Crassostrea virginica***) to Aid Shoreline Restoration Efforts

Honorable Mention — Rivera-Arce, Luis, Derek Rodríguez-Piñero, and Marcos Flores-Valdés. Zeta-Epsilon, University of Puerto Rico at Cayey. Assessing the Damages Caused by Hurricane María to the Tree Diversity at the University of Puerto Rico at Cayey

Session 4: Cell, Organismal and Developmental Biology

1st Place — Gallucci, Madison & Dr. Katherine Robertson. Alpha Sigma, Westminster College. Efferent Mushroom Body Axons Terminate in Lateral Horn of the *Pogonomyrmex barbatus* (harvester ant) brain

2nd Place — Roba, George, Siti Sarah Safura, and Dr. Edward Freeman. Upsilon Rho, St. John Fisher College. Evaluating the Effects of Bisphenols F and S With Respect to Bisphenol A on Primordial Germ Cell Migration in Zebrafish (*Danio rerio*) Embryos Using Fluorescent Microscopy

3rd Place — Zangwill, Dina. Epsilon Mu, Chapman University. Investigating the Molecular Mechanism of Inhibiting Epithelial to Mesenchymal Transition in Pancreatic Cancer Cells Treated with a Combination of Pomegranate Juice Extract and Caffeine

Honorable Mention — Izadpanah, Hasti and Corey Cleland. Psi Chapter, James Madison University. Muscle Synergies and How They Contribute to the Movement of the Tail During the Nociceptive Withdrawal Response in the Rat's Tail

ABSTRACTS FOR PAPER PRESENTATIONS

Session 1 Microbiology

Miears, Hunter. Epsilon Gamma, Angelo State University. Staphyloxanthin Mutants of *Staphylococcus aureus* and Their Response to Antimicrobials

Staphyloxanthin is a golden pigment that is produced by the bacterium, *Staphylococcus aureus*. This pigment is a virulence factor for the bacterium and is hypothesized to have the dual function of acting as an antioxidant to protect against action of oxidizing agents, a common form of immune response in the human body, and stabilizing the cell membrane, much like cholesterol does in human cells. In this experiment, mutants with little or no staphyloxanthin were successfully created using UV light. These mutants were then tested against various agents, including oxidants, cell membrane active antibiotics, and *Pseudomonas aeruginosa* exoproducts, to determine if there was a difference in bacterial response between the mutants and the wild type, or non-mutated, bacterium that still produced the staphyloxanthin pigment. I hypothesized that the lack of staphyloxanthin would cause the mutant bacteria to be more drastically affected by the antibacterial agents. This was tested using a standard Kirby-Bauer method where the test compounds are impregnated into standard filter paper discs and tested against lawns of bacteria. Zones of inhibition were measured after 48 hours. Among other data recorded was the influence on pigment production of the various test compounds. Results indicate that differentially pigmented mutants of *S. aureus* differ in their response to cell membrane active antibiotics and *P. aeruginosa* exoproducts.

Freedenberg, Alex, Quinn Mageria, Brooke Nearhood, Irena Ardelean-Growden, Kristen Picardo and Jonelle Mattiacio. Upsilon Rho, Saint John Fisher College. Investigation Into the Interaction Between Bacteriophage and Quorum Sense Inhibitors and Their Effects on Bacterial Biofilm Degradation

Antibiotic resistance is a major threat to the American public. This year the Center of Disease Control estimates that 23,000 people will die from an antibiotic resistant microbial infection. While this number causes concern, the death toll from these pathogens is expected to continue to rise as antibiotic resistant pathogens become more common. In healthcare settings, certain species have come to be common threats for nosocomial infections due to their ability to survive in aerobic environments easily transfer antibiotic resistance and put up defenses to prevent the effects of antibiotics. As the need grows in finding novel bactericidal therapies, renewed interest has emerged for bacteriophage therapy. Bacteriophage are viruses that only infect bacteria and have been co-evolving with bacteria for millennia, and bacteriophage can be a potent, effective, and safe bactericidal agent if prepared correctly. One of the most common and effect ways that bacteria protect themselves is with biofilm. Biofilms form a matrix that physically deny access of biocidal agents to their cells. Biofilms can block bacteriophage access and help bacteria to perform horizontal gene transfer to spread resistance genes. By identifying compounds that can disrupt the biofilm without degradation of bacteriophage, treatments could be developed that would be able to clear chronic infection in novel ways that bacteria are not as likely to evolve against. Focus was put on the bacterial communication inside of the biofilm, as groups of

bacteria act differently together than isolated due to quorum sensing. Recent publications suggest that the signal pathways that the bacteria use to communicate in this group sensing or quorum sensing can be shut off using different compounds. Our hypothesis is that by blocking the cell to cell communication with quorum sensing inhibitors while using bacteriophage, a synergic effect will be possible that will be able to both degrade the biofilm and kill the bacteria. Early data with *Pseudomonas aeruginosa* strains Pa01 and Pa14 with a known *Pseudomonas aeruginosa* quorum sense inhibitor sodium ascorbate suggests there may be some synergistic effects between bacteriophage and quorum sense inhibitors in prevention of biofilms, but bacteriophage alone was found to be most effective against preestablished biofilm leading to future studies into the idea that the environmental bacteriophage may have evolved novel accessory proteins that degrade the biofilm.

Evans, Nicholas. Epsilon Sigma, Angelo State University. Creation of a MEGA-plate to understand the nature of *Pseudomonas aeruginosa*.

The MEGA-plate was originally used by Harvard University to study how *Escherichia coli* gains antibiotic resistance across a spatiotemporal landscape. This is beneficial for testing new and existing drugs to counter the rise in antibiotic resistance. *P. aeruginosa* is an important nosocomial pathogen that afflicts patients with open wound and cystic fibrosis. *P. aeruginosa* infection, in cystic fibrosis patients, is treated with tobramycin, but a high incidence of resistant strains has been observed. I hypothesized that a MEGA-plate could be made to grow *Pseudomonas aeruginosa* and that it would be able to spread across the plate, into antibiotic regions. A suitable growth medium was determined for the soft agar through testing with a minimum nutrient medium including tyrosine and ammonium sulfate. The soft agar used for the plate consists of a cetrimide soft agar with tyrosine as the primary carbon source. Building a plate similar, but modified, in structure to Dr. Roy Kishony's lab at Harvard University, *P. aeruginosa's* ability to grow and spread on the plate was observed. *P. aeruginosa* was able to move into areas containing tobramycin. Samples were taken from each run and their colony morphologies and antibiotic susceptibilities were observed.

Session 2: Molecular and Cellular Biology

Dorrity, Tyler J. Upsilon Delta, Drew University. Cytokine Responses Generated by cGAMP and Other CDNs Depend on Delivery Method

Cyclic GMP-AMP synthase (cGAS) is an important protein in pattern recognition pathways involving viral DNA. Activated cGAS produces the small molecule 2'3'-cyclic GMP-AMP (cGAMP) as a second messenger. cGAMP will normally bind to its downstream receptor STING and induce an interferon (IFN) response. In order to understand cGAMP signaling, THP-1 cells were stimulated with cGAMP with or without viral DNA. Two methods were used to deliver cGAMP to the cells: lipid transfection or addition straight to the media. Analyses of the cells' responses were completed via qPCR to measure either *cGAS* or innate immune products *IFNb*, *ISG56*, and *IL-1b*. It was found that cGAMP delivered to the media repressed expression of *cGAS*. Untransfected cGAMP also led to repression of *ISG56*, while lipid-delivered cGAMP led to increased expression of *ISG56*. It was hypothesized that this activity of cGAMP was dependent on location of cyclic dinucleotide (CDN) exposure, inside or outside the cell, which may due to cGAMP's structural similarities to bacterial quorum sensing molecules. Location-dependent activity of cGAMP was compared to location-dependent activity of other CDNs: c-di-GMP, c-di-AMP, and c-di-UMP. Preliminary results indicate a trend that CDNs delivered to the media had repressive effects on *ISG56*. However, this pattern was reversed when *IL6*, a bacterial immune product, was measured. The data suggest that there is an extracellular receptor that senses CDNs in addition to the currently known intracellular receptor, and that both pathways activated by cGAMP can interact with one another.

Rivera, M. Angelica Rosa. Zeta Epsilon, University of Puerto Rico at Cayey. Characterization of UBR4 and UBR5 Interactors Involved in the Formation of K11/K48-Branched Ubiquitin Chains

Moore, Stephen. Theta Pi, University of Pittsburg at Greensburg. Targeted DNA breaks determines age-1 gene's role on DNA repair machinery and investigates how energy utilization affects *Caenorhabditis elegans* life span.

As human life expectancy increases, so does the danger of age-related illnesses in the developing world. According to the NIH, the cost of these illnesses from 2006-2015 has been $84 billion. A major problem that contributes to these illnesses are the breakdown of human DNA repair machinery that protects our cells from losing critical genetic information. This genetic information when lost contributes to cancers, neurological age-related diseases, and many other problems. In *C. elegans*, both aging and DNA repair pathways have been studied, such as the mutation in the insulin signaling pathway in *Caenorhabditis elegans* causes a longer lifespan. I hypothesized that this phenotype is a result of more efficient DNA repair mechanisms. To test this hypothesis, I set up a developmental arrest assay, a longevity assay, and a clutch size assay using wildtype *C. elegans* and worms that had been drugged with 6-OHDA, a known DNA damaging agent in comparison to age-1 mutants that are long lived. The results indicate that there is a significant difference in lifespan to drugged animals in comparison to non-drugged

animals, and the age-1 mutants (mutation in the insulin signaling pathway) were better able to recover from the drug's effects.

Garber, J and R. McGrane. Delta Sigma, Southwestern Oklahoma State University.
Investigating the Effects of Varying Surface Conditions on Phytopathogens

In the laboratory setting *P. syringae* exhibits three distinct motility behaviors, but the mechanisms regulating these behaviors in the phyllosphere is unknown. We hypothesized that *P. syringae* responds to changes in surface tension to modulate motility behaviors. In this study we evaluated two flagella stators and two flagella glycosylatransferases. The flagella stators generate necessary power for flagella rotation. Previous studies suggest MotAB functions as a low torque stator while MotCD functions as a high torque stator. Flagella glycosyltransferase stabilizes the flagella in high friction environments and prevents breakage. To identify the surface signals which modulate surface behaviors, expression of motility factors was evaluated in conditions that simulate mechanical stress, disruptions in flagella rotation, and acute osmotic stress. These conditions were simulated using varying agar, ficoll, and salt concentrations, respectively. To investigate the potential of the flagella itself as a sensor, both the wild type and a mutant strain of *P. syringae* lacking the gene encoding flagellin were evaluated. Our results indicate that expression of the flagella stators and glycosyltransferase are altered in response to mechanical stress and disruptions in flagella rotation and that the flagella serves as a surface sensor. Studies are underway to determine the impact of osmotic stress.

Session 3: Ecology

Kolander, Noah. Epsilon Chi Delta, Concordia University. Insight Into the Demographics of Pismo Clams (*Tivela stultorum*) in Orange County, CA, Following a Four-decade Gap in Data Collection

In 1977 Pismo clam surveys on the Newport Beach, totaled over 2,000 clams harvested in a single weekend. Since 1977, there have been no surveys conducted. Historically, Pismo clams have nearly been harvested to local extinction on certain beaches. The possibility of local extinction, and a gap in data collections (1977-2017) should cause alarm. DFG data (recreational fishery count, not organized survey) from three locations along Newport Beach were used as starting points to see if there has been any noticeable change in distribution or overall abundance of Pismo clams on Newport Beaches. The clam abundances from several beaches in Orange County were also surveyed, revealing their presence on other beaches in Orange County. Data collected on the clams included height, length and distance above mean lower low water line. After surveying 245 m², nine clams (length $\bar{x}$=52.6mm & $\tilde{x}$=40mm) have been found at the three historic sites, and with an additional 106 m² of Orange county sites, three more clams were found (length $\bar{x}$=47.7mm & $\tilde{x}$=47mm). There is no clear cause for the apparent decline in the Pismo clam population, however it has been suggested that an allee effect, seasonal factors, and spatial heterogeneity are influencing the clam population.

Motley, M'Kayla G., and Bonnie B. Amos. Epsilon Sigma, Angelo State University. A Preliminary Report on the Seed Dispersal of *Sclerocactus brevihamatus spp. Tobuschii:* An Endemic Cactus

The Tobusch fishhook cactus (*Sclerocactus brevihamatus* spp. tobuschii) (TFC) is a small dome-shaped cactus found in Ash Juniper-Liveoak associations in nine counties in the Edwards Plateau, Texas. The cactus bears one to nine fruits, which ripen early May to mid-June. In 1979, US Fish and Wildlife Service listed TFC as endangered. Much is known about the taxon's breeding system and pollination; however, little is known about its seed dispersal. Therefore, our objectives were to: define fruit/seed attractants and identify fruit visitors and their behavior for TFC populations at Kerr Wildlife Management Area in Kerr County, TX. Time-lapse cameras were used to obtain approximately 40,000 images and videos of TFC fruit development and visitation. The only fruit visitors observed, in images, videos or field observations, were two species of ants: the fire ant (*Solenopsis invicta* or a hybrid *S. invicta* X *S. geminata*) and a smaller ant, *Forelius pruinosus*. Neither visited the plants until the fruits opened but then swarmed the fruits (N=10) feeding on the pulp and also harvesting pulp from the fruit. However, neither harvested seeds. Data analyses show that fruit visitation is short-lived with 1.5 to 3 days from first observation of ants to collapse and subsequent drying of the fruit. Seeds remain in the fruit and fall onto and around the plant. These observations differ from those of Emmett (1995) who reported the ant Forelius maccooki (=F. foetida) transported as much as 85% of TFC seeds back to the ant mound at three different sites. Studies in 2018 are planned to obtain additional visitor data, conduct exclusion experiments, and monitor sugar content in fruits.

Session 4: Cell, Organismal, and Developmental Biology

Sutter, Pearl A. Upsilon Delta, Drew University. Effects of DCP-LA on Learning and Memory in an *in vivo* Alzheimer's Disease Model With Ovariectomized Rats

Alzheimer's disease (AD) is the sixth leading cause of death it the United States and impacts females disproportionately more than males for reasons unknown. Previous studies have shown that infusion of a mixture of ferrous sulfate, amyloid-β, and buthionine sulfoximine (FAB) can induce AD pathologies and behavior deficits in rodents. Furthermore PKC-ε activator, 8-[2-(2-pentyl-cyclopropylmethyl)-cyclopropyl]-octanoic acid (DCP-LA), has shown to reverse the effects of AD in male *in vivo* AD models. In this study, female rats received intracerebroventricular infusions of FAB or saline, and half of the animals were ovariectomized (OVX) to mimic postmenopausal hormonal conditions. After 4 weeks of FAB infusion, the Morris Water Maze (MWM) was used to evaluate spatial learning and memory. Animals received intraperitoneal injections of DCP-LA or vehicle 24 hours prior to the first day of testing. FAB treated animals showed a significant decrease in learning and memory as compared to the controls. OVX rats showed deficits in memory, but not learning. Pretreatment with DCP-LA was able to restore the deficits in learning and memory caused by FAB treatment, however it was not able to restore deficits caused by the OVX. Immunohistochemistry is currently being conducted to determine neuronal and synaptic density differences between treatment groups.

Allen, D., and J. Fadool. Sigma Tau, Florida State University. *Syntaxin3a* is Essential for Photoreceptor Survival in Zebrafish

SNARE proteins are essential for membrane fusion in eukaryotes. Syntaxin binding proteins (STXBP) mediate SNARE-dependent vesicular binding to the plasma membrane. A mutation was previously isolated in *stxbp1b* resulting in rapid degeneration of retinal photoreceptors. I hypothesize that Stx3a, a member of the SNARE complex, is also essential for photoreceptor survival. Mutations were induced in *stx3a* by injecting gRNA targeting exon 2 and mRNA encoding Cas9 into 1-cell stage zebrafish embryos. Embryos and adults were genotyped using PCR and DNA sequencing. Retinal phenotypes were characterized for visual deficits using the optokinetic reflex (OKR). Histological sections were immunolabeled for photoreceptor-specific antigens. Using this approach, I isolated novel alleles of *stx3a*. One allele is predicted to result in a frame shift mutation and premature stop codon. 25% of the offspring from matings between 2 heterozygous carriers of the novel *stx3a* allele failed to display an OKR. Larvae lacking an OKR were homozygous for the mutation, and immunolabeling revealed photoreceptor degeneration. These data show that the SNARE complex is essential for photoreceptor survival in the developing zebrafish retina. Supported by the NIH and FSU.

Wilcox, J., C. Rodriguez. Sigma Tau, Florida State University. Advancing Diabetes Care: The Optimization of Insulin Pump Medication Delivery.

Type 1 diabetes is a chronic, autoimmune illness that demands those diagnosed to give daily injections of insulin, a hormone required for stabilizing the body's blood glucose levels and

promoting healthy growth. A method to combat the damaging effects of this disease is insulin pump therapy. This form of treatment allows persons with type 1 diabetes to administer insulin continuously via an automated machine into their body; however, injection malfunctions can occur on a routine basis. These injection malfunctions lead to the diabetic user not receiving their insulin properly and affecting medication reception. Without insulin, a diabetic is severely affected by hyperglycemia, dehydration, kidney failure and may be induced into diabetic ketoacidosis, a life-threatening condition that is the result of sustained hyperglycemia. This research project aims to identify the occurrence of insulin pump medication delivery failure by recognizing intratubular pressure differentials. The combination of a Pendotech PRESS-S-000 pressure transducer affixed to the tubing of a Medtronic Paradigm Revel insulin pump system will allow for the measurement of erratic backflow pressures associated with blockages, cannula kinking and injection regions of insulin-induced lipohypertrophy. Mechanical detection of insulin delivery failure will allow for a novel detection system to alert users if their insulin pump system is not administering medication properly.

Pietrantoni, Dylan and Fr. Shawn Anderson. Upsilon Gamma, St. Vincent College. The Effects of High-intensity Interval Training (HIIT) and Continuous Moderate-intensity Training (CMIT) on Grip Strength and Muscular Endurance in Mice

A time-saving alternative to continuous moderate-intensity training (CMIT) is high-intensity interval training (HIIT), which uses high intensity workouts of short duration. This project tested the hypotheses that male Swiss-Webster mice with HIIT training (n=4) would show greater gains in *in vivo* strength in a wire-hang test and greater endurance in a weighted swim test than mice having CMIT training (n=4) and sedentary (SED) mice (n=4) without exposure to either HIIT or CMIT training. They further assessed *in vitro* force generation and fatigue in soleus and extensor digitorum longus (EDL) muscles dissected following euthanization. HIIT sessions consisted of 3x5 min wheel running and 3x3 min wall climbing, with 30 sec rest between intervals. CMIT sessions consisted of 40 min wheel running and 10 min wall climbing, with 5 min rest between exercises. Training occurred twice weekly for 6 weeks. There were trends for HIIT mice to show greater grip strength in the wire-hang test than both controls and CMIT subjects. These results correspond to data showing that EDLs of HIIT mice generated significantly more twitch force relative to muscle weights compared with those of CMIT and SED subjects ($P<0.05$). Conversely, HIIT subjects swam shorter times in the weighted swim test than other mice, suggestive of decreased endurance in HIIT subjects. These data correspond to results showing that soleus muscles dissected from HIIT mice showed greater levels of fatigue than muscles from SED and CMIT subjects. Taken together, these data suggest that HIIT training successfully promotes increased muscle growth, but not endurance.

ABSTRACTS FOR POSTER PRESENTATIONS

Session 1: Microbiology

Sniezek, Olivia and Dr. Joshua Corrette-Bennett. Alpha Sigma, Westminster College. Fractal Modeling and Suppression of *Staphylococcus aureus* Biofilm Formation

Staphylococcus aureus is an opportunistic bacterial pathogen that causes infections in humans. Colonies of *S. aureus* can produce biofilms which makes them resistant to antibiotic treatments. Treating bacterial infections resistant to antibiotics is rigorous and long-term. We utilized RNA interference (RNAi) as a sequence specific approach for the suppression of biofilm formation. We used siHybrids, short segments of complementary DNA and RNA, to suppress the *SarX* gene, which is a biofilm activator. Two methods were used for the quantitative and qualitative analysis of biofilm formation: crystal violet staining and fractal analysis. To quantify biofilm formation, colonies were stained with crystal violet and the optical density was analyzed using a spectrophotometer. The structure and complexity of *S. aureus* colonies grown on congo red agar were analyzed using fractals. Based on crystal violet staining, biofilm formation in *S. aureus* treated with *sarX* siHybrids was not statistically reduced from biofilm formation in untreated samples. Colonies treated with siHybrids, when grown and imaged on congo red agar, exhibited no significant changes in edge dimension structure. An increased fractal dimension is indicative of disassociation of bacteria from the colony when biofilm is suppressed; thus, with a lack of significant biofilm suppression there was no change in fractal morphology. In the future, we would like to increase our sample size and continue to analyze the impact of biofilm suppression on fractal dimension of *S. aureus* colonies.

Miller, Chelsea and Regina McGrane. Delta Sigma, Southwestern Oklahoma State University. Looking Beyond the Leaf: Understanding the Impacts of Motility on *Pseudomonas syringe* Seed Colonization

Pseudomonas syringae, an opportunistic phytopathogen, causes disease in agriculturally important plants and can have devastating effects on the global crop production. *P. syringae* is known to employ a surface motility called swarming to colonize leaf surfaces, which is mediated by the flagella, pili, and biosurfactants. Mutants lacking the biosurfactants syringafactin (*ΔsyfA*) and rhamnolipid (*ΔrhlA*) have been shown to have impaired swarming and leaf colonizing abilities. We hypothesize that *P. syringae* uses swarming motility in the soil to move toward and colonize seeds. The objective of this experiment is to evaluate the role of active motility in *P. syringae* seed colonization and to determine the impact of rhamnolipid and syringafactin biosurfactants in movement towards seeds. To test this hypothesis, common bean seeds were incubated in sand inoculated with *P. syringae* parent, *ΔrhlA,* or *ΔsyfA* strains and bacterial populations were tracked. Results show that *P. syringae* actively moves through sand and that biosurfactants play a role in *P. syringae* seed colonization independent of growth. Understanding the impact of *P. syringae* swarming motility in soil could lead to control methods that prevent *P. syringae* colonization of seedlings at the beginning of a growing season.

Rankin, Brooke and Regina McGrane. Delta Sigma, Southwestern Oklahoma State University. Ice Nucleation: A Look at Evolutionary Significance Beyond Frost Injury

Ice nucleation catalyzes the formation of ice in sub-freezing water. The phytopathogen *Pseudomonas syringae* is a common biotic ice nucleator because it produces ice nucleation proteins (ICE). ICE+ *P. syringae* strains are studied due to their pathogenicity to plants and induction of frost injury near freezing temperatures; however, ICE are expressed at above freezing temperatures and are encoded by non-pathogenic *P. syringae* strains. This insinuates ICE serve an additional evolutionary role. We hypothesize ICE enhance the ability of bacteria to survive hypertonic conditions and aerosolization. To test this hypothesis, experiments were performed comparing ICE+ and ICE- strains of *P. syringae* and *Pseudomonas putida*, a bacteria lacking natural ICE production. An analysis of growth during osmotic stress demonstrated ICE- strains showed significantly decreased growth compared to ICE+ strains. The ability to aerosolize was compared by nebulizing strains and determining concentration of viable cells. Aersolized ICE+ *P. syringae* resulted in significantly more viable cells than aerosolized ICE- *P. syringae*. Collectively, these results suggest ICE contribute to the success of bacteria during osmotic stress encountered on leaves and during dispersal to new locations via aerosolization. This demonstrates a greater purpose for ICE beyond frost injury.

Hutchinson, Sara and Regina McGrane. Delta Sigma Chapter, Southwestern Oklahoma State University. Investigating Phytopathogen Transitions From Aquatic to Surface Based Environments

Pseudomonas syringae is a phytopathogen that alternates between two flagella-mediated motilities: swimming, occurring in autonomous cells immersed in liquid, and swarming, a coordinated movement across viscous surfaces. We hypothesize *P. syringae* senses surfaces to modulate motility behaviors when transitioning between aquatic reservoirs and plant hosts. Our objective is to evaluate the conditions controlling *P. syringae* movement and the impact of reservoir surface conditions on plant colonization. To evaluate the effect of osmotic stress on motility, we tested the impact of varying agar and salt concentrations on movement. Our results indicated cells in 0.25% agar exhibited swimming, while those in 0.3% and 0.35% agar swarmed. Salt increased the distance cells moved in 0.25% and 0.3% agar but inhibited movement in 0.35% agar, suggesting osmotic pressure may modulate motility. *P. syringae* was also exposed to varying agar concentrations prior to inoculation on leaves to determine how the surface conditions experienced in environmental reservoirs influence transitions to plant hosts. By tracking *P. syringae* populations, we found cultures from 0.45% agar were better leaf colonists, suggesting surface-based reservoirs may prime *P. syringae* for plant colonization. This work demonstrates the responsiveness of *P. syringae* to changing environments and its importance for disease transmission.

Session 2: Molecular and Cellular Biology

Martin, Leah. Phi Beta, California State University, Monterey Bay. Galectin-3 Inhibitor GR MD-02 Increases CD8 T Cell Infiltration of MCA-205 Tumors

Galectin-3 (Gal3, lgals3) is a carbohydrate-binding protein that is produced by both leukocytes and cancer cells. Serum Gal3 levels have been shown to be elevated in patients with metastatic melanoma relative to patients with non-metastatic melanoma. These increased Gal3 levels are thought to help promote metastasis and angiogenesis of tumors. Gal3 has also been found to inhibit tumor-infiltrating lymphocytes (TIL) by disrupting T-cell receptor (TCR) signaling, while promoting M2 polarization in macrophages. Gal-3 has been associated with various pathological and physiological processes that play a role in cell differentiation and growth, cell adhesion, chemo-attraction, apoptosis and cell cycle regulation. The purpose of this research project is to better understand how a Gal3 inhibitor, GR-MD-02, impacts the tumor microenvironment and whether GR-MD-02 is synergistic with an OX40 agonist mAb (OX86). In this experiment, tumor-bearing mice were treated with an IgG control, OX86, GR-MD-02 or OX86 + GR-MD-02. Tumors were harvested from these mice and analyzed by Immunohistochemistry (IHC) and microarray transcriptome profiling. These experiments resulted in three key findings: **1)** GR-MD-02 was present in the tumor, but did not appear to be associated with T Cells; **2**) Both GR-MD-02 and OX86 increased CD8 T cell infiltration into the tumor, but had minimal impact on the infiltration of CD4 T cells or Macrophages; **3)** Expression of several immune checkpoint receptors were up-regulated in the tumor following treatment.

Meredith, Melissa. Saska, K., Kashef, N., Stafford D., Sogard, S.M., Hamilton, S.L., Bernardi, G., Logan, C.A. Phi Beta, California State University, Monterey Bay, Effects of Ocean Acidification and Hypoxia on Larval Brown Rockfish Transcriptomes

Seasonal upwelling in the California Coastal Ecosystem (CCE) exposes nearshore fishes to hypoxic, high pCO2 conditions. Climate change may intensify these conditions, which could be particularly challenging for fish that reproduce during upwelling season. We studied the effects of maternal exposure to hypoxia and hypercapnia during gestation on brown rockfish larvae (*Sebastes auriculatus*), an economically and ecologically important species in the CCE. Adult females were collected and held under low dissolved oxygen (4.0 mgO2/L), high pCO2 (*p*CO2~1300 *u*atm, pH 7.5), or control (*p*CO2~400 *u*atm, pH8, 8.0 mgO2/L throughout gestation. We used RNAseq to measure transcriptome-wide changes in gene expression of pooled whole larvae (n=45) following parturition. We built the first *de novo* transcriptome assembly for brown rockfish and compared differentially expressed genes (DEG) among the three treatments. Only 17 DEGs were identified in the hypercapnic treatment compared with 184 DEGs in the hypoxic treatment (edgeR; FDR<0.01). The number and identity of DEGs in the hypoxia treatment suggest that brown rockfish larvae are either more tolerant or better buffered from high pCO2 during gestation compared with hypoxia.

Pellot Ortiz, Karolina I., Fernando Vidal-Vanaclocha, Neena M. Mirani and Lawrence D. Gaspers. Zeta Epsilon, University of Puerto Rico, Cayey, P.R., Valencia University Medical School, Spain, Pathology and Laboratory Medicine, Pharmacology, Physiology and

Neuroscience, Rutgers-NJMS, Newark, NJ. Potential Role of Inositol-trisphosphate 3-kinase in Colorectal Cancer Liver Metastases

Previous studies have shown that the activation of receptor-coupled phospholipase C (PLC)/inositol 1,4,5-trisphosphate (IP3) pathway and subsequent increases in cytosolic free Ca^{2+} concentration ($[Ca^{2+}]_i$) are involved in many aspects of tumor development and progression. In contrast, the mechanisms terminating Ca^{2+} increases have received far less attention in the field of cancer biology and could represent novel strategies to suppress tumor development. IP3 kinases (ITPKs) are an enzyme family that catalyze the phosphorylation of IP3 to inositol 1,3,4,5- trisphosphate (IP4) and are involved in terminating agonist-induced Ca^{2+} signaling. In this research project, we are investigating the potential role ITPK isoform C (ITPKC) in colon cancer. ITPKC is expressed in normal human colon tissue and primary colon tumors. Real-time PCR analysis revealed that there may be a cluster of colorectal cancer patients with relatively low levels of ITPKC expression and another group with high levels of ITPKC. Immunohistochemistry studies indicated that the levels of ITPKC expression were highly depend upon the patient and the anatomical location of the tumor lesion. The effect of ITPK expression on Ca^{2+} signaling was investigated using colorectal cancer (CRC) cells derived from a primary tumor (SW480) or a metastatic lymph node (SW620) from the same patient. SW620 cells are highly metastatic whereas SW480 does not form metastases. SW620 cells express significantly lower levels of ITPKC and display larger carbachol-induced $[Ca^{2+}]_i$ increases compared to the SW480 cells. These data suggested that down regulation of ITPKC may promote tumor formation by enhancing Ca^{2+} signaling. To test this hypothesis, ITPKC was stably over expressed in SW620 cells. As expected, over expression of ITPKC decreased hormone sensitivity and the magnitude of agonist-induced $[Ca^{2+}]_i$ increases. Nude mice were intrasplenically injected with SW480, SW620 or SW620 cells overexpressing ITPKC to determine the effect of suppressing Ca^{2+} signals on metastatic potential. Unexpectedly, over expression of ITPKC increased the formation of liver metastases. We are presently investigating the mechanism underlying the increase in tumorigenicity. The rates of cell proliferation, in vitro, are not significant between the cell lines used in this study. Moreover, over expression of ITPKC did not alter NF-κB signaling or change the rates of ROS formation. Currently, we are investigating if ITPKC over expression has any effect on CRC cell apoptosis.

Session 3: Ecology

Repas, Emily. Eta Nu Chapter, Samford University and Elmira College. Impacts of Severe Drought on Remnant Longleaf Pine Communities at Oak Mountain State.

Park longleaf pine requires fire to sustain its ecosystem structure and function. Regular burning reduces leaf litter and the density of competitive species. Fire suppression has contributed to the widespread loss of longleaf pine communities across its historic range, although remnant populations still exist in small pockets across the southeastern United States. Here we show that the survival of remnant montane longleaf populations on the southern Appalachian ridges and foothills of Oak Mountain State Park in Pelham, Alabama is driven by greater variation among habitats in post-drought mortality in longleaf pine than in competing pine and hardwood species. It also appears that patterns of post drought mortality are highly similar to post fire mortality. Due to the wide variability on very small scales of microhabitat characteristics on the Appalachian ridges inhabited by remnant montne longleaf pines, further exploration of environmental variables may be necessary to determine which environmental variables are driving longleaf pine mortality. We anticipate this study to be the basis of further research attempting to determine how severe drought may explain longleaf pine persistence in the absence of fire.

Sidor, Stephanie. Epsilon Chi Delta, Concordia University. Effects of Copper and Zinc on the Hunting Abilities in Polyps and Swimming Behavior in Ephyrae of *Aurelia aurita*

As the coastal environments have continued to develop, oceans have experienced a significant increase in the number of toxins and pollutants present, including heavy metal contamination. Heavy metals, including copper and zinc, are known to have detrimental effects on a variety of marine organisms spanning from predatory fish to planktonic predators like jellies. Presently, it is not known if these heavy metals have an impact on the hunting abilities and swimming behaviors of the various life stages of *Aurelia aurita*. The purpose of the present study was to determine the effects of trace copper and zinc exposure on the hunting abilities and swimming behavior of *Aurelia aurita* polyps and ephyrae, respectively. Hunting ability was measured by determining if polyps were still capable of capturing prey after exposure to environmentally representative zinc or copper concentrations for eight days. The swimming ability was analyzed by testing the pulsation rate of 0-2 days old ephyrae after exposure to trace zinc or copper for 24 hours and 48 hours. Exposure to trace copper and zinc contamination resulted in no statistically significant differences in the hunting or swimming abilities of either life stage. This suggests that present-day copper and zinc contamination levels in the oceans do not cause acute effects on the hunting or swimming abilities of *Aurelia aurita* polyps and ephyrae.

Blackwell, Sharon[1] and Thomas Bliss[2]. Psi Rho, [1]University of North Georgia and [2]UGA Marine Extension and Georgia Sea Grant Shellfish Research Lab**.** Establishing an Effective Diet to Increase Growth in the Eastern Oyster (*Crassostrea virginica*) to Aid Shoreline Restoration Efforts

The eastern oyster (*Crassostrea virginica*) plays an important ecological role by creating habitat structure via oyster reefs. Overharvesting of oysters in Georgia has led to a decline in abundance and widespread shoreline erosion along estuaries and tidal creeks. Restoration efforts have been established to create a growing population of oysters. In this experiment, we attempted to determine the best diet needed to facilitate rapid oyster growth. Oysters were spawned and cared for following standard procedures of the host hatchery. After one month of care, the oysters were divided into three treatments and moved into downwelling tanks. The oysters were then fed a continuous flow of either: 1) a control diet of incoming filtered seawater, 2) their normal diet of Shellfish Diet 1800®, or 3) a 75%/25% mix of Shellfish Diet 1800® supplemented with Tetraselmis 3600®. For three weeks, the oysters were graded through increasing sieve sizes and removed when they reached a predetermined size. Our results indicate that oysters fed only Shellfish Diet 1800® had significantly greater growth by weight than the control diet and the Tetraselmis 3600® diet. This research will contribute useful information that can be used to further the restoration efforts currently underway in coastal Georgia.

Rivera-Arce, Luis, Derek Rodríguez-Piñero, and Marcos Flores-Valdés. Zeta-Epsilon, University of Puerto Rico at Cayey. Assessing the Damages Caused by Hurricane María to the Tree Diversity at the University of Puerto Rico at Cayey

The island of Puerto Rico has been affected by many hurricanes throughout history, where some of them have caused significant damage to its forests, the most recent being the Category 4 Hurricane María. The preparation of tree inventories, with an emphasis on their dimensions and identification of species, is imperative to assess the trees that could prove unsafe during the Atlantic hurricane season. An ideal location for such an inventory was the University of Puerto Rico at Cayey, since it was impacted directly by Hurricane María and it has a vast collection of endemic, native and exotic trees. For this reason, a set of observations were recorded in order to correlate species-specific damage based on the state of each tree. Among these observations were damages to the trees, where results show the relatively high susceptibility of branches to breakage before a Category 4 event. Endemic trees like *Stahlia monosperma* proved to be resistant even though its DBH value is low, with a 100% survival rate, compared to bigger trees like the native *Cassia siamea* that suffered more damages despite its higher DBH. This suggests that endemic trees are more adapted to withstand hurricane conditions in the Atlantic.

Session 4: Cell, Organismal and Developmental Biology

Gallucci, Madison & Dr. Katherine Robertson. Alpha Sigma, Westminster College. Efferent Mushroom Body Axons Terminate in Lateral Horn of the *Pogonomyrmex barbatus* (harvester ant) brain

The mushroom bodies, located in the dorsal posterior insect brain are responsible for processing afferent sensory signals and eliciting appropriate responses to stimuli. Much research has been conducted to map these afferent pathways from sensory regions like the antennal lobes and optical lobes to the mushroom bodies; however, there is little research published mapping efferent pathways from the mushroom bodies to responding regions of the brain. In our research, we mapped one of these efferent pathways from the mushroom bodies to responding regions of the Harvester Ant brain. By doing this, we hope to learn more about a complete response pathway to stimuli. This will contribute to the beginning steps to developing an understanding of how the insect brain receives, processes, and responds to stimuli, and therefore we may begin to ask how these neuropathways work and what types of responses they are involved with. To map these pathways, we injected single neurons in the mushroom bodies with a fluorescent Texas-Red dextran dye™ (Molecular Probes,IL). We sectioned the brain and used fluorescent microscopy to visualize these efferent pathways. To analyze the data, images from fluorescence microscopy were studied, tracing the neuropathways from the mushroom bodies to the recipient regions of the brain, then we analyzed the areas involved in this signal transmission. These pathways are indictive of the types of physiological responses elicited and perhaps the neurotransmitters involved; further research of the specific pathways mapped could help determine these.

Roba, George, Siti Sarah Safura, and Dr. Edward Freeman. Upsilon Rho, St. John Fisher College. Evaluating the Effects of Bisphenols F and S With Respect to Bisphenol A on Primordial Germ Cell Migration in Zebrafish (*Danio rerio*) Embryos Using Fluorescent Microscopy

Primordial Germ Cell (PGC) migration occurs in early embryonic development and is highly conserved across taxa. PGC migration occurs within the first 24 hours post fertilization (hpf) in zebrafish, making the organism an efficient model for observing the migration pathway. Proper PGC migration is necessary for normal gonad development and, in some species, sex determination. Disruption of this process leads to defects in gonad formation and abnormal sex determination and differentiation. Studies show that endocrine-disrupting chemicals (EDCs) such as bisphenol A (BPA) disrupt PGC migration in zebrafish. BPA is an estrogenic compound that has been linked to a variety of human diseases, including various cancers, diabetes, reproductive disorders, obesity, and cardiovascular diseases. It is one of the most widely used synthetic compounds worldwide, as it used to make polycarbonate plastics. Many studies provide evidence of the harmful effects of BPA on living organisms. In response, manufacturers have started to use replacements such as bisphenol F (BPF) and bisphenol S (BPS). However, due to their structural similarity, it is likely that BPF and BPS are just as harmful to organisms as BPA. In this study, we use antibody staining and fluorescent microscopy to confirm that BPA

exposure results in abnormal PGC migration in zebrafish embryos, as previously studied, and to illustrate that BPF and BPS exposure results in similar PGC migration defects.

Zangwill, Dina. Epsilon Mu, Chapman University. Investigating the Molecular Mechanism of Inhibiting Epithelial to Mesenchymal Transition in Pancreatic Cancer Cells Treated with a Combination of Pomegranate Juice Extract and Caffeine.

Pancreatic cancer is the fourth leading cause of cancer death in the US. Treatment is often ineffective due to the cancer metastasizing. During metastasis, cancer cells lose adhesive properties by going through epithelial to mesenchymal transition (EMT). Previous research in our laboratory showed that the combination of Pomegranate Juice Extract (PJE) and caffeine inhibited pancreatic cancer cell invasion. This project studied how the combination treatment regulated the EMT promoting proteins (SNAI1, SLUG, and AJUBA). SNAI1 and SLUG are transcription factors, while AJUBA is a helper protein for SNAI1. All three proteins must operate in the nucleus to promote EMT. It was hypothesized that cells treated with the combination would lead to down-regulation of all three proteins in the nuclear extract. Results show a trend that both AJUBA and SLUG are down-regulated in the nuclear extract by the combination treatment therefore blocking EMT. The results for SNAI1 are inconclusive. In addition, a protein used initially as a control for the experiment, Heat Shock Protein 90, was down-regulated by the combination treatment. Literature states that this protein inhibits apoptosis. These novel results support the idea that this combination treatment can induce cancer cell apoptosis.

Izadpanah, Hasti and Corey Cleland. Psi Chapter, James Madison University. Muscle Synergies and How They Contribute to the Movement of the Tail During the Nociceptive Withdrawal Response in the Rat's Tail

Noxious stimuli can evoke the nociceptive withdrawal response (NWR), which protects the affected part of the body from injury. The rat's tail, because of the large number of joint and muscle degrees of freedom, may present a computational challenge to the central nervous system. Previous studies have revealed that synergies act to reduce the number of degrees of freedom across diverse movements in a variety of animals; however, there is little information in mammals on synergistic control of the tail. The long-term specific aim of this project is to test the hypothesis that during the NWR muscle synergies controlling rat's tail reduces the muscular degrees of freedom by recording the electromyograms (EMGs) from intrinsic tail muscles during heat evoked NWRs. Adult, male Sprague Dawley rats were briefly anesthetized with isoflurane. The tail was marked in thirteen equally spaced locations on the dorsal surface of the tail for stimulation and tracking. To record the EMG, 14 fine wires were inserted at seven locations along the length of the tail. Heat stimuli were delivered at 11 locations along the tail to evoke a NWR that was captured by high speed video. Robust single and multi-unit EMG recordings were obtained. The EMG had two components, an early component right after stimulation and a late component. The early component coincided with initial movement of the tail away from the heat stimulus; however, it consistently lagged movement onset by 93 ms. The location of peak EMG closely matched the site of heat stimulation. In order to find possible synergies, principle

component analysis revealed that 93% of the movement could be explained by three synergies constructed from seven possible muscle degrees-of-freedom, thus reducing computational complexity from 7 to 3 degrees of freedom. These results demonstrate that intrinsic tail muscles contribute to tail movement, but because of the lag relative to movement they are not sufficient to fully explain the initial movement of the NWR. Further, the results support the use by the central nervous systems of synergies to reduce the substantial computational complexity of tail movement.