ABSTRACTS

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BIOLOGICAL SCIENCES PAPER ABSTRACTS

REVERSE ENGINEERING WORM MUSCLE USING CRISPR GENE EDITING. *RYAN LITTLEFIELD*, UNIVERSITY OF SOUTH ALABAMA.

The Caenorhadbitis elegans roundworm is the simplest model animal that has striated muscle. Use CRISPR gene editing techniques, my lab is developing and testing novel molecular biology tools to follow and perturb muscle development and growth in living worms by fluorescence microscopy. By precisely separating the "head" and "tail" domains of muscle myosin isoform A, we found that the myosin "tail" was able to assemble into thick filaments in the absence of the motor function contained in the "head" domain and that the lengths of the actin filaments may have been re-specified to a new length.

OPTIMIZING BODY COMPOSITION IN LABORATORY FED SEA URCHIN LYTECHINUS VARIEGATUS. *YUAN YUAN*, LAURA HEFLIN, MICKIE POWELL AND STEPHEN WATTS, UNIVERSITY OF ALABAMA AT BIRMINGHAM.

Optimization of formulated sea urchin food could improve nutrient utilization and biochemical composition of the gonad, which could directly affect the quality and economic value of sea urchin roe. Studies have examined the relationship between diet and body composition using single formulated diets which provided no options in dietary content. It is not known if sea urchins can or will preferentially store specific macronutrients or macronutrient ratios when food choices of varying macronutrient content are offered. In this study, individual urchins were offered pairwise moist gel-based diet combinations varying in the proportion of protein and carbohydrate for 43 days. Urchins offered diet combinations generally preferred the diet with most balanced macronutrients (equi-proportioned protein: carbohydrate ratio, i.e., least extreme protein: carbohydrate ratio). High protein diets were correlated with high protein content of gonads (48- 61% dry weight). High proportion of carbohydrate diets were correlated with increased carbohydrate content of gonads (9- 20% dry weight). Gonad lipid content ranged from 19- 24% dry weight, with the highest lipid levels found among urchins consuming high levels of carbohydrate. These data indicate that sea urchins choose between diets of varying macronutrients and can preferentially store specific macronutrients. In contrast to other organisms, L. variegatus can store protein while limiting carbohydrate storage. This can be an advantage to the organisms living in an environment where protein availability is episodic. We further hypothesize that gonad composition will affect the commercial appeal of roe.

THE EFFECT OF INCUBATION TEMPERATURE ON SEX AND MORPHOLOGY IN A LIZARD. *ARIEL STEELE* AND DANIEL WARNER, AUBURN UNIVERSITY.

The developmental environment plays a pivotal role in shaping phenotypes and fitness of all organisms. Perhaps the most enigmatic example of environmental effects is the influence of developmental temperature on an individual's sex, a phenomenon known as temperature-dependent sex determination (TSD). The first description of TSD was based on a study conducted 50 years on an African lizard (Agama agama). Although novel at this time of publication, this landmark study consisted of low sample sizes and provided a poor description of the sex-determining reaction norm in this species. Our goal was to revisit this work and better characterize the pattern of TSD in A. agama. In addition, we aimed to quantify the effects of constant and fluctuating incubation temperatures on a variety of fitness-relevant traits of offspring. Eggs were obtained from an invasive population of A. agama in Miami, FL, and randomly assigned to one of nine incubation treatments: six constant temperature treatments and three fluctuating treatments that mimic field conditions. We then measured hatchling morphology (snout-vent length, head size, mass), growth, and sprint performance as indicators of fitness. Size measurements will be continuously taken every six weeks to determine the ontogenetic timing of sexual dimorphism and to determine if sexual dimorphism is influenced by incubation temperature. Preliminary data suggest that warm incubation temperatures produce mostly female offspring. This ongoing research will provide a critical evaluation of the long-term effects of developmental temperature on fitness-relevant traits, and provide insights into the adaptive significance of TSD.

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SUBTLE TEMPERATURE DIFFERENCES MAY WELL DETERMINE WHO WINS: A STORY OF FOUR SUBMERGED AQUATIC PLANT SPECIES. *MOLLY MILLER*, DAVID NELSON AND TIMOTHY SHERMAN, UNIVERSITY OF SOUTH ALABAMA. JAMES MAHAN, 2PLANT STRESS AND WATER CONSERVATION LABORATORY USDA/ARS.

As temperatures increases globally, shifts in the distribution of plant species are expected, with unknown effects on invasive species abundance. It is then of value to understand the role increased temperature may have on invasive
species. Although nonhomeothermic organisms are the mercy of environmental temperatures, their physiology is still temperature dependent, with species dependent thermal optima. By identifying the thermal optimum of a species and determining the amount of time spent annually in that optimal temperature zone, success can be predicted under different temperature regimes. Here we identify species-specific differences in the thermal optima of four submerged plants, Ceratophyllum demersum, Hydrilla verticillata, Myriophyllum spicatum, and Vallisneria neotropicalis. Utilizing a biochemical approach, activity of a key metabolic enzyme NADH malate dehydrogenase (MDH) was used to assess the thermal dependencies of Km and Vmax in each species. A Michaelis-Menten model was then employed to predict reaction velocity across a range of temperatures (10 - 40DegC). The predicted reaction velocities were compared to multiyear in situ temperature data. At low temperatures (10 - 20DegC), all three species had similar thermal behavior. However, at temperature > 20DegC, enzyme activity H. verticillata exhibited a sharp increase to a level 2-3 times higher than M. spicatum and V. neotropicalis. H. verticillata is metabolically more competent at lower temperatures (earlier in season) allowing rapid growth earlier than other coexisting species. This data suggests that as water temperatures increase, the highly invasive H. verticillata will be favored over concurring species. Additionally, a northward expansion of the dioecious, southern biotype of this species is likely.

ECOLOGY OF BALD EAGLES (HALIAEETUS LEUCOCEPHALUS) IN ALABAMA. *ANDREW COLEMAN*, ALABAMA A&M UNIVERSITY.

A knowledge gap exists regarding the ecology of Bald Eagles (Haliaeetus leucocephalus) in Alabama. This species was reintroduced by the Alabama Department of Conservation and Natural Resources in the mid-1980s, and the nesting population currently stands at 100-200 nesting pairs. The present study initiated an examination of nest site selection and predation behavior of Bald Eagles in Alabama. The locations of a collection of eagle nests were compared with USGS land cover data in ArcMap 10. A buffer of one mile was set around each nest location, and the total acreage of each land use category that was within that buffer was summarized. Additionally, many of these nests were surveyed for discarded prey items, and the presence of turtle remains was noted. A variety of turtle species, including Eastern Musk Turtle (Sternotherus odoratus) and Common Map Turtle (Graptemys geographica), were documented on the ground beneath nests. If possible, the carapace length and width of the recovered turtle shells were measured to examine potential size limits of turtle prey that Bald Eagles can seize.

CAPTURING CAVITY-NESTING ANTS WITH ARTIFICIAL NEST TRAP CONSTRUCTED OUT OF PLASTER. *ISAAC HEINKEL*, GLENN MARVIN AND PAUL DAVISON, UNIVERSITY OF NORTH ALABAMA.

Artificial nest traps (a.k.a. artificial nesting sites, supplemental ant nests) made of various materials including bamboo internodes, plastic tubes, and wood (dowels, lathing, wood blocks) contain preformed cavities which attract entire ant colonies, founding queens, or colony fragments. Such nest traps have been used in studies of colony structure, resource limitations, and ant diversity. Given the common use of plaster of Paris (often augmented with activated powdered charcoal) as a substrate for artificial nests in laboratory studies of ants, springtails, and other arthropods, we tested the efficacy of artificial nest traps constructed out of plaster (Ant-Coops) with and without activated powdered charcoal. Ant-Coop design and construction details will be presented along with ant capture data from 1000 Ant-Coops placed in an oak-hickory upland forest in northwest Alabama. These inexpensive and easily constructed nest traps can be an important new tool to investigate ant ecology (e.g., distribution, abundance, and life history)

SOLVENT EFFECT ON THE EXTRACTION OF ANTIOXIDANTS. *WYVOLYN KIRKLAND*, JACKSONVILLE STATE UNIVERSITY. NIXON MWEBI, JACKSONVILLE STATE UNIVERISTY.

Numerous fruits and vegetables are believed to be rich in antioxidants. Antioxidants are key in preventing cell damage caused by oxidants found in biological systems. Garlic and red pepper are an excellent source of foods rich in antioxidants. In order to effectively study, quantify, or evaluate antioxidants, one needs to extract them from such foods. A brief literature survey portrays an array of extraction procedures that may at times be confusing. It is therefore imperative to determine the key factors that promote effective extraction of these active biomolecules from vegetables. This forms the basis of our study: to determine the solvent effect on the extraction of antioxidants and polyphenols. We used a spectrophotometric technique that employs the Ferric Reducing Antioxidant Power (FRAP) as a means of measuring the total antioxidants extracted from the vegetables. Our findings indicate that 40% aqueous Acetone, 80% aqueous Ethanol, and 40% aqueous Methanol solvents when used, yield the highest concentration of antioxidants

GEOGRAPHICAL DISTRIBUTION OF ANIMAL-ROAD MORTALITY INCIDENTS IN MOBILE COUNTY, ALABAMA: A PRELIMINARY ANALYSIS. *ADAM STERN* AND STEPHANIE JETT, UNIVERSITY OF SOUTH ALABAMA.

Our study investigates how roadkill assemblages change across a rural to urban gradient in Mobile County, Alabama and explore factors (e.g. habitat, resource availability, behaviors) that may be inclusive or exclusive to specific species. The current project is one part of a larger project designed to assess specifically scavenger ecology across urban to rural gradient, focusing on factors that shape scavenger assemblages. Roadkill surveys are recognized as a useful tool in assessing the presence of animal species in a study area. The current study will supplement the larger study on scavenger ecology by providing insight into the variety of species who are active in the study area as well as knowledge about human-animal interactions

as a result of human encroachment into these species' environments. Currently, there is a sizable body of work that seems to indicate that urbanization may present many obstacles to nonhuman animal species, such as an increase in road density and habitat fragmentation. Select species in some areas may be better adapted to the pressures of urbanization (e.g. better vehicle avoidance methods) and, therefore, be less susceptible to succumbing to animal-road mortality incidents. Preliminary results will be presented discussing differences in roadkill assemblages across the gradient as well as preliminary analyses of patterns in geographical distribution as it pertains to land use and habitat structure.

SEDIMENTARY RECORDS OF RECURRENT PHOSPHATE SPILLS TO A COASTAL ESTUARY. *RUTH CARMICHAEL*, UNIVERSITY OF SOUTH ALABAMA. JACOB HALL, ELIZABETH HIEB AND PAVEL DIMENS, DAUPHIN ISLAND SEA LAB. ELIZABETH D. CONDON, UNIVERSITY OF NORTH CAROLINA AT WILMINGTON. KIMBERLY CRESSMAN, GRAND BAY NATIONAL ESTUARINE RESEARCH RESERVE.

At least two large phosphate spills are known to have occurred from a fertilizer processing facility to the Grand Bay National Estuarine Research Reserve's Bangs Lake on the northern Gulf of Mexico since 2005. Following these spills, there was a spike in phosphate concentrations (as high as 7 mg/L), a significant drop in pH (to as low as 3.7), and on one occasion, fish and shellfish kills. To define spill periods and determine the fate of phosphorus within the estuary through time, we measured the concentration of phosphorus retained in sediments relative to distance from the spill site. Sediment cores (8 cm diameter X 50 cm long) were compared spatially within Bangs Lake and to cores collected in nearby Bayou Heron, a site more remote from the spill area. Cores were sectioned at 1 cm intervals down to ~24 cm, and each section was analyzed for grain size, particulate organic phosphorus concentration (POP), and porewater phosphate concentration. Core sections also were dated by Lead-210 activity to trace historical phosphorus inputs to each site, and trace element analyses will be used to further corroborate the source of residual phosphorus. We found higher phosphate concentrations in sediments and porewater in Bangs Lake compared to the reference site (while other nutrient concentrations were similar or lower). Peaks in POP concentrations in southeastern Bangs Lake corresponded in time to at least one known major phosphate spill (2005). Although the known source of phosphorus to the estuary is on the western side of Bangs Lake, hydrological processes that flush sediments and nutrients from the Lake may concentrate finer sediments and associated particulate phosphorus in the southeastern part of the Lake. These data provide a spatial and temporal record of phosphorus additions and retention within Bangs Lake to inform companion studies on water quality and primary production as well as future studies of effects on biota.

CITIZEN-SCIENCE PROVIDES DATA ON SEASONAL OCCUPANCY OF WEST INDIAN MANATEES (TRICHECHUS MANATUS) IN THE NORTHCENTRAL GULF OF MEXICO. *ELIZABETH HIEB*, COURTNEY NELSON-SEELY AND NICOLE TAYLOR, DAUPHIN ISLAND SEA LAB. RUTH H. CARMICHAEL AND ALLEN AVEN, DAUPHIN ISLAND SEA LAB, UNIVERSITY OF SOUTH ALABAMA.

The northcentral Gulf of Mexico was historically considered outside the typical range of the endangered West Indian manatee (Trichechus manatus); however, in recent years reported manatee sightings have increased in this region. To better define the extent of manatee occurrence in the northcentral Gulf of Mexico, we used citizen-science methods, compiling data from opportunistic public sightings of manatees in understudied areas of Alabama and Mississippi. More than 2,000 live manatee sightings were documented from 1978-2015, with peak sightings occurring in rivers and subembayments along the AL-MS coastline during warm months (Jul - Aug). Manatee mortalities, which have significantly increased since the mid-1980s, were most often recorded Nov - Feb and attributed to cold stress. We analyzed the effect of public education and outreach activities on the number and timing of reported sightings to detect potential bias in our use of citizen-science methods. Our results indicated that while targeted outreach efforts were effective in generating manatee sighting reports, the temporal distribution of sightings was primarily driven by manatee presence in local waters. We found that quantitative and consistent documentation of opportunistic, citizen-sourced data enhanced knowledge of manatee habitat use over a broad geographic area and on a decadal time-scale, demonstrating the importance of the northcentral Gulf of Mexico as seasonal manatee habitat. This long-term monitoring effort has increased our understanding of manatee movement ecology and population distribution and is essential to guide effective management and recovery efforts, especially in light of ongoing anthropogenic impacts and large-scale environmental perturbations to local waters.

AGE SPECIFIC PATTERNS IN WINDOW MORTALITY IN AVIAN POPULATIONS. *EMMA RHODES*, JOEL BORDEN AND JOHN MCCREADIE, UNIVERSITY OF SOUTH ALABAMA.

Building collisions, especially window collisions, pose a major anthropogenic threat to birds. Mortality caused by building collisions is estimated to be between 100 million and 1 billion annually, and it is the second largest source in the U.S. for direct human-caused bird mortality. While several studies have focused on the frequency of building/window collisions in avian populations and the role played by temporal differences in abundance during migration, little research has explored the possible relationship between age and mortality in window strike collisions. If juvenile birds exhibit a pattern of higher mortality from window strikes, it might possibly be attributed to less experienced individuals. However, various other factors need to be taken into account including the species specific ratio of adult to juvenile birds and how these ratios might change seasonally in periods of migration. The primary goal of this study is to determine if there is a direct age-mortality correlation in avian window strikes using a large dataset of curated museum specimens that will classify birds by age based on physiological, morphological, and plumage features. This project is a collaboration of multiple universities and museums in order to examine window strikes on a regional scale and its impacts primarily in the Southeastern U.S. In addition to the lack of research on a possible age correlation with window strikes, there is also a paucity of data from southern states, including Alabama, on window strike mortality and no known study has been done in Alabama examining a correlation with age. Current findings of this project include considering species specific ratios of age groups in avian populations as well as aging avian specimens based on presence/absence of the bursa of Fabricius, which is a key developmental organ currently considered to only be found in juvenile birds. With more increasing anthropogenic threats affecting bird populations, it is vital that preventive measures are taken to prevent unnecessary mortality due to window

collisions, which is accomplished by studying the impact of the threat. In conclusion, the goal of this research is to provide significant implications on how window strike mortality affects avian populations and to identify the mechanisms driving window strike mortality for the conservation of avian populations.

MOLECULAR CLONING OF A CDNA ENCODING A SARCO/ENDOPLASMIC RETICULUM CA2+ ATPASE (SERCA) FROM Y-ORGANS OF THE BLUE CRAB (CALLINECTES SAPIDUS) AND ANALYSIS OF SPATIAL AND TEMPORAL PATTERNS OF MRNA ABUNDANCE. *MEGAN ROEGNER* AND RD WATSON, UNIVERSITY OF ALABAMA AT BIRMINGHAM. HY CHEN, JAPANESE INTERNATIONAL RESEARCH CENTER FOR AGRICULTURAL SCIENCES.

Stage-specific increases in intracellular free Ca¬≤+ stimulate ecdysteroid production in the molting glands (Y-organs) of crustaceans. Intracellular Ca¬≤+ levels are regulated by proteins intrinsic to the plasma membrane and membranes of organelles. These include Ca¬≤+ pumps, e.g., plasma membrane calcium ATPases (PMCAs) and sarco/endoplasmic reticulum calcium ATPases (SERCAs). In order to better understand the role of intracellular calcium signaling in the regulation of ecdysteroidogenesis, we used a PCR based cloning strategy (RT-PCR followed by 3'- and 5'-RACE) to clone a full-length cDNA encoding a putative SERCA protein from the Y-organs of the blue crab (Callinectes sapidus). The cDNA includes a 3060-bp open reading frame that encodes a 1020 amino acid SERCA protein with 80% identity to known crustacean SERCA sequences. Phylogenetic analysis showed the blue crab SERCA protein clusters with other arthropod SERCAs. An assessment of tissue distribution revealed the SERCA transcript was widely distributed across tissues of the crab. SERCA transcript abundance in Y-organs was assessed by quantitative PCR after eyestalk ablation, and during a natural molting cycle. The observed stage-specific changes in SERCA cDNA levels are consistent with the hypothesis that Ca¬≤+ signaling and intracellular Ca¬≤+ regulatory proteins play a critical role in the endocrine regulation of crustacean molting.

THERMAL SPIKES CAUSED BY THE URBAN HEAT ISLAND EFFECT RESULT IN DIFFERENTIAL EGG SURVIVAL OF A NON-NATIVE LIZARD (ANOLIS CRISTATELLUS). *JOSHUA HALL* AND DANIEL WARNER, AUBURN UNIVERSITY.

Embryonic development in ectotherms is very sensitive to abiotic nest conditions. In reptiles, high incubation temperatures often result in relatively short incubation periods and large hatchling size, but extremely high temperatures can result in cardiac arrest and death. Human altered habitats, which potentially create novel thermal conditions in the soil due to the urban heat island effect, may therefore create new selection pressures for developing embryos. The urban heat island effect can increase temperatures in cities as much as 12¬∞ C, and our preliminary data suggests that soil temperatures differ markedly between urban and natural areas in locations where reptiles deposit eggs. We measured the temperatures of potential nest sites of the Puerto Rican Crested Anole (Anolis cristatellus) in both urban and natural areas of Miami-Dade county where this lizard and several other anole species are naturalized. We bred

crested anoles in the lab and subjected their eggs to 5 incubation treatments that mimic potential temperature regimes from our field data, three of which included a thermal spike ¬º of the way through embryonic development. Preliminary results suggest that thermal spikes increase metabolism and reduce egg survival and that each are a function of the magnitude of the spike. These results suggest that urban environments create novel selection pressures that potentially result in embryonic adaptation to novel temperature regimes or in novel nest-site selection strategies by females.

IMPAIRED SOCIAL BEHAVIOR IN MICE WITH TYROSINEMIA TYPE I IS ASSOCIATED WITH INCREASED MYELINATION OF THE CEREBRAL CORTEX. *MARISSA MOORE* AND GORDON MACGREGOR, UNIVERSITY OF ALABAMA IN HUNTSVILLE.

Social behavior and cognitive deficits have recently been observed in individuals with the rare disorder tyrosinemia type I, which is caused by an autosomal recessive fumarylacetoacetate hydrolase (FAH) deficiency. Without treatment with NTBC the lack of FAH causes an accumulation of harmful metabolites that leads to severe liver dysfunction within the first years of life. While the current treatment with NTBC has drastically increased the survival rate of tyrosinemia type I patients, it is unable to prevent the neurological impairments affecting them. In order to investigate the recent social behavior deficits, the sociability of mice with tyrosinemia type I treated with NTBC (Fahmut), wild-type mice drinking NTBC (WT-NTBC) and wild-type mice drinking water (WT-Water) was analyzed. The social behavior of mice was investigated using Crawley's three-chambered social test. The buried food test was also conducted in order to analyze mouse olfaction, which is critical for mouse social behavior. Mice brains were extracted and microscopically evaluated for myelin after staining the cerebral cortex with Luxol Fast Blue. Our results show that Fahmut mice spend twice as much time investigating a dummy mouse rather than a novel mouse in comparison to wild-type controls, indicating sociability deficits are caused by the disease and not NTBC treatment. Mice with Fahmut also show abnormal behavior in that they do not spend more time with a novel mouse over a familiar mouse. Tyrosinemia type I mice displayed increased myelination of the cerebral cortex compared to wild-type mice. The increased myelination could create malformed neuronal pathways and synapses that could be a causative factor in the behavioral impairments seen in mice with tyrosinemia type I.

MICROBIAL ART: AN EMERGING SCIENTIFIC INQUIRY MODEL. *SARAH ADKINS* AND J. JEFFREY MORRIS, UNIVERSITY OF ALABAMA AT BIRMINGHAM.

Microbial art has long been used as a creative outlet for microbiologists and even had a hand in the discovery of the first therapeutic antibiotic. Yet in the school setting many science students do not get to dabble in the creativity that can lead to scientific discoveries. In fact, students often do the opposite by completing "cook-book labs", i.e. prearranged labs that leave little room for curiosity and exploration.

We have proposed a new scientific inquiry model for the microbiology lab classroom at UAB that is anchored on creativity: a petri dish art model. This new curriculum allows students to create personalized living artwork as a platform for scientific inquiry. Over the course of the semester, students isolate colored microbes from natural soil samples, create artwork using

these microbes, use standard microbiology techniques to identify their isolates, and finally create personalized experimental designs to answer their own questions about the microbial ecology revealed in their paintings. During this curriculum change, we are collecting data on how effective the curriculum is to a comparable control group on the topics of student engagement, course material, and how students view the role of creativity in science.

INTERCELLULAR SIGNALING BY MICROPARTICLES CONTAINING CYCLIC AMP.

***APRIL SCRUGGS*, UNIVERSITY OF ALABAMA. THOMAS RICH AND NATALIE BAUER, UNIVERSITY OF SOUTH ALABAMA.**

Microparticles (MPs) are important for the exchange of information between cells. MPs are extracellular vesicles that range in size from 0.1 to 1 ¬µm in diameter. They are constitutively released from many cell types and are thought to play a role in vascular homeostasis. Further, the number and content of MPs are altered in pathologies involving inflammation and vascular cell activation. MPs carry intracellular constituents from parent cells that affect target cell function. However, the mechanisms of delivery of the MP payload to target cells are unknown. Understanding the payload delivery system between MPs and target cells is the focus of this research.

We recently discovered that cyclic adenosine monophosphate (cAMP), a ubiquitous second messenger, is found in MPs released from pulmonary microvascular endothelial cells (PMVECs). Additionally, MPs isolated from PMVECs treated with beta adrenergic agonists and phosphodiesterase (PDE) inhibitors have increased cAMP levels. This suggests that different levels of cAMP are packaged in MPs depending on parent cell stimuli. MPs containing maximal cAMP were therefore used to study the delivery of MP payload to target cells.

First, we developed mathematical models of MP payload delivery to subcellular compartments of target PMVECs to better understand how the cAMP signaling pathway may be altered by MP-mediated cAMP delivery. Simulations indicate that the cAMP content of MPs would elevate bulk cytosolic cAMP levels to activate protein kinase A (PKA) for several minutes.

To experimentally test the predictions of this model, MPs were collected from PMVECs treated with rolipram (a PDE type 4 inhibitor; 10 ¬µM, 5 min) and isoproterenol (a beta adrenergic agonist; 1 ¬µM, 10 min). These MPs were added to cells transfected with a cytosolic cAMP FRET sensor. Time lapse hyperspectral image stacks were acquired using a Nikon A1R confocal microscope. Custom hyperspectral analysis scripts in MATLAB were used to linearly unmix fluorescent spectra and quantify cAMP concentration changes throughout the target cell. Preliminary results indicate that MPs significantly increase cAMP levels in target cells compared to control. Additionally, several MPs are often internalized by a target cell and their combined cAMP content would sufficiently elevate bulk cytosolic cAMP levels to activate PKA. Together, these data indicate that MPs can deliver cAMP as a functional payload. Future studies will determine whether MP-delivered cAMP is sufficient to activate PKA in target cells and contribute to MP-mediated signaling events.

SOURCE-TRACKING E. COLI IN LAKE WINDERMERE, ENGLAND. *BRIAN BURNES*, UNIVERSITY OF WEST ALABAMA.

Lake Windermere, England is the largest natural lake (14.73 km2 or 5.69 sq mi) in England. It was formed in a glacial trough after the retreat of ice at the start of the current interglacial period and is now located within the Lake District National Park. Lake Windermere has become highly developed in areas and is frequented by thousands of recreational boaters and swimmers at all times of the year. Additionally, wild geese nest on the lake, often in proximity to swimming areas. Occasional high E. coli counts from Lake Windermere have raised the question of whether geese or humans may be responsible, in some part, for the bacterial contamination. In this study, 117 E. coli isolates from various sites in Lake Windermere were analyzed by antibiotic resistance analysis and DNA markers to investigate their population structure and possible sources of origin. The correct classification rate was 97.2% for isolates from humans, geese, and a laboratory reference strain 25922. Of the isolates collected from sites in Lake Windermere, 34% were classified as human in origin by antibiotic resistance analysis and 21% by DNA marker analysis.

CROP PRODUCTION ON THE RISE AS FUNGAL ENDOPHYTES HELP WITH THE CAUSE. *MANTRICIA DENSMORE*, AUSTIN TUBBS AND MUSTAFA MORSY, UNIVERSITY OF WEST ALABAMA.

Climate change is a serious problem that affect not only the environment, but also human's food security. Drought, heat waves and increased soil salinity associated with climate change is having an impact on the United States crop production. For example, the last three years were recorded as the driest weather ever in California, where a significant agriculture products are made. Another example, the rise of sea levels along the coast of Florida has increased soil salinity, where a 10% increase in salinity resulted in rapid and dramatic changes in the microbial activity in plants. Fungal endophytes are present in almost every plant growing on Earth. Those fungal endophytes obtain carbon from plants and in return they provide plants with some metabolites that can improve plants' environmental stress tolerance. We hypothesized that endophytes associated with wild plants growing in high stressed areas can improve crop production and stress tolerance. To test our hypothesis, growth rate and yield of tomato plants colonized with twelve fungal endophytes isolated from wild plants growing in saline soils were compared to non-symbiotic plants. The use of fungal endophyte is very promising and can help other crops flourish under harsh conditions like drought and salinity. While stressing the tomato plants under drought and salinity conditions, we have found that potentially five of our fungal endophytes are promising. Fuscarium oxysporum, Purpureocillium lilacinum, and Ophiocordyceps heteropoda were able to provide tomato plants with both salt and drought stress.

ANTIBIOTIC DISCOVERY IN THE SALINE GRADIENT OF THE SIMPSON WILD LIFE SANCTUARY VIA UNDERSTANDING THE BIOLOGICAL DIVERSITY OF BACTERIA. *MARA DELUCA*, RILEY KING AND MUSTAFA MORSY, UNIVERSITY OF WEST ALABAMA.

Salt works and the Stimpson Wildlife Sanctuary in Clarke County, Alabama is located at the Tombigbee River drainage, and it had many natural salt springs. The area is characterized by the presence of a gradient of salt, as a result there is a range from fresh water to water with up

to 500mm Total Dissolved Salts (TDS). The varying concentrations of salt across the land provides an opportunity to explore levels of bacterial and antibiotic diversity in response to salt stress levels. The goals of this study are: 1) to examine the diversity of bacteria found within the varying concentrations of salt in the soil of the Stimpson Wildlife Sanctuary, and if diversity is found to 2) examine if the varying salt levels impact the diversity of antibiotic producing bacteria, specifically. We collected multiple soil samples from the saline gradient of the Simpson Wild Life Sanctuary, and ensured that we had samples which ranged across the 0-500mm TDS. Soil bacteria was isolated by plating serial dilutions of soil extracts onto various bacterial media and grown at two different temperatures, in order to ensure the highest bacteria recovery possible. Nearly 3,000 bacterial colonies have been isolated. We have identified inhibition zones as a results of more than 130 unknown bacteria. The results showed that soil with higher salt tends to have more antibiotic producing bacteria. We have identified all antibiotic producing bacteria based on 16S rRNA sequencing and in the process of physiological characterization of these bacteria to gain more insight into the effect saline concentration has on antibiotic discovery as well as diversification of bacteria.

ANABOLIC GLUCOSE METABOLISM IS SIGNIFICANTLY ENHANCED IN PANCREATIC CANCER DURING THE EVOLUTION OF DISTANT METASTASIS. *ALEX COLEY* AND GLEN BORCHERT, UNIVERSITY OF SOUTH ALABAMA. OLIVER MCDONALD, VANDERBILT UNIVERSITY.

Pancreatic ductal adenocarcinoma (PDAC) is an extremely lethal malignancy that is predicted to become the second leading cause of cancer deaths in the United States by 2020 . This is attributed to the fact that early stage PDAC is difficult to detect, and late stage PDAC is resistant to treatment. Aware of this reality, our study aims to identify new molecular cues to facilitate novel detection methods and therapeutic targets for treatment.

PDAC is a stepwise, evolutionary process by which a primary tumor grows in the immediate pancreas and differentiates itself into subclonal populations which will inevitably metastasize and end the life of the patient . It is known that driver mutations are acquired early in PDAC progression and are important for PanINs and establishing primary tumor growth, however no genetic drivers of metastasis have been identified.

Knowing that the primary tumors grow within nutrient-poor environments, we hypothesized that divergent metabolic properties may arise during the evolution of distant metastasis to nutrient-rich organs. To test this, we first examined datasets tracing carbon-13 labeled glucose uptake into matched peritoneal and distant metastatic subclones collected from the same patient, which revealed that the distant metastatic subclones possessed hyperactive glucose flux through glucose-driven pathways. Next, by the use of steady state metabolomics, we detected high levels of metabolites pertinent to lipid, nucleic acid, and protein biosynthesis in the distant metastatic subclones and high levels of metabolites pertinent to the breakdown of fatty acids and scavenging of purines and methionine in the localized subclones.

From these results, we discover that anabolic glucose metabolism emerged late in PDAC progression during the evolution of distant metastasis, while catabolic and scavenging properties that are thought to emerge early were inherited during peritoneal carcinomatous. Applying this novel information, targeting the enzymes that drive these evolutionary divergent malignant metabolic pathways could represent a novel therapeutic approach for patients with metastatic PDAC, one of the most lethal of all human malignancies.

THE POTENTIAL NEUROPROTECTIVE EFFECT OF 24-EPIBRASSINOLIDE ON PC12 CELLS. *MARY ANNE SAHAWNEH*, SHANNON GILSTRAP AND KRISTIAN MARTINEZ, SAMFORD UNIVERSITY.

Brassinosteroids are plant steroid hormones that have effects on enzyme activity and resistance to environmental stressors (Bajguz and Tretyn, 2003, Khripach et al., 2000). 24-Epissinolide (24-Epi) has been studied for its proliferative and antioxidant activities in plants (Mazorra et al. 2002, Howell WM et al. 2007, Ali et al., 2008, Ikekawa et al., 1988). Here, we are investigating a potential antioxidant role for 24-Epi in mammalian cells.

C. ELEGANS THICK FILAMENTS ASSEMBLE WITH A DECAPITATED MYOSIN A. *HALLEA WARD* AND RYAN LITTLEFIELD, UNIVERSITY OF SOUTH ALABAMA.

Striated muscle makes up about 40-70% of animal muscle mass, and around 40% of that consists of contractile filaments. Actin (thin) and myosin (thick) filaments, in striated muscle, assemble together in such a way that they slide past one another to generate contractile force and shortening. Thick filaments in the body wall muscle of the nematode Caenorhabditis elegans have a unique bipolar structure that is composed of myosin A (myoA) and myosin B (myoB) isoforms. These two isoforms are located in distinct regions of the thick filament and are encoded by different genes, thus making it possible to investigate muscle assembly by genetically altering one isoform while still keeping the other isoform functioning appropriately. We used CRISPR-Cas9 homologous gene editing to make a transgenic strain that expresses the myoA head and tail domains as separate polypeptides to create a large bare zone in the center of the thick filament. By using fluorescence microscopy, we found that the myoA tail domain localizes to thick filaments in all expected muscle types including body wall muscle (BWM) and that the sarcomere organization is normal. Surprisingly, viability, development, growth, and locomotion of the transgenic and wildtype worms are indistinguishable from each other under normal laboratory conditions. Our results show that the thick filament assembly can occur when the myoA head is separated from the myoA tail. We propose an assembly model where the myoA tail is capable of nucleating thick filaments independent of thin filament interactions.

GREEN SYNTHESIS OF SILVER NANOPARTICLES, THEIR CHARACTERIZATION, AND ASSESSMENT OF THEIR ANTIMICROBIAL ACTIVITY AGAINST GRAM-POSITIVE AND GRAM-NEGATIVE BACTERIA. *AFEF JANEN*, FLORENCE OKAFOR AND TATIANA KUKHTAREVA, ALABAMA A&M UNIVERSITY.

Silver nanoparticles (Ag-NPs) have been largely studied due to their antiviral and antibacterial properties, and their uses as antimicrobial agents, topical creams in the health industry, and various other applications. This is due to their characteristics such as surface-enhanced Raman scattering and electrical conductivity. Several preparation techniques have been described for the synthesis of Ag-NPs, but the need for environmentally friendly synthesis methods is growing. In this research, leaves plants such as Magnolia grandiflora, Geranium, Aloe ‚ÄòTingtinkie' leaves broth, Actaea racemosa (black cohosh), and Eucalyptus angophoroides

extracts were used as reducing agents to produce nanoparticles. Synthesis of colloidal Ag-NPs was performed by UV-Visible spectroscopic analysis. UV-Visible spectrum showed a peak between 417-425 nm corresponding to the plasmon absorbance of the Ag-NPs that were produced within several minutes. The Ag-NPs size and shape were characterized using techniques including Dynamic Light Scattering (DLS), Atomic Force Microscopy (AFM), and Transmission Electron Microscopy (TEM) which showed a size range of 5 to 15 nm. The antibacterial activity of Ag-NPs was investigated at various concentrations ranging from 2 to 15ppm. Staphylococcus aureus, Kocuria rhizophila, and Bacillus thuringiensis (Gram-positive organisms); Escherichia coli, Pseudomonas aeruginosa, and Salmonella typhimurium (Gram-negative organisms) were treated with Ag-NPs using Bioscreen C to measure bacterial growth. Our findings indicated that, at concentrations of 2 and 4 ppm, Ag-NPs significantly inhibited bacterial growth. Our future goal is to determine the minimum inhibitory concentration of Ag-NPs for bacterial growth and to assess the effects of biosynthesized Ag-NPs on cancer cells.

A STUDY OF SOME KINDS OF VIBRIO AND THE EXTENT OF RESISTANCES TO ANTIBIOTICS. *ASIM BARNAWI*, HUSSAIN MAJRSHI, MOHAMMED ALAHMADI AND BRIAN BURNES, UNIVERSITY OF WEST ALABAMA.

Detection and analysis in the marine pathogen vibrio vulnificus and antibiotic resistance. 16 samples and 2600 colony were obtain from three different location. These samples will be test it to find out the resistance for antibiotics. In order to get more result we still work in this project until present.

USING VIDEO MANIPULATION AND VIDEO PLAYBACK TO STUDY THE INFLUENCE OF COLOR ON COMMUNICATION IN GECKOS. *NATHAN KATLEIN*, YLENIA CHIARI AND MARIA BYRNE, UNIVERSITY OF SOUTH ALABAMA.

Body color and color patterns are fundamental in prey escape mechanisms, thermoregulation mate selection, and intra- and inter-specific communication. Among the various functions, color and color patterns have been observed to be used for individual recognition (conspecific, an individual of the same or different sex, or an individual of another species). Individual recognition can have direct benefits to the viewer by limiting energy expenditure trying to mate with the wrong gender or risking injury by approaching a dangerous opponent. Individual recognition is therefore important for evolutionary processes such as speciation and sexual selection. Among lizards, geckos vary greatly in color and color pattern, ecology, habitat, and social interaction. Color and color patterns may therefore play a role in individual recognition in this group of lizards and despite its importance, knowledge on this in geckos is largely lacking. To address this question, we will compare gecko behavior in the context of direct individual interaction and playback videos that have been edited using MATLAB. Direct individual interaction will provide a baseline of behaviors occurring during individual encounters with the same or opposite species and the same or opposite sex. In the video manipulations for playback videos, we will change separately saturation, hue and brightness of the color of the gecko or of the background. Saturation, hue, and brightness of the videos (geckos and background) are manipulated independently to uncover the influence that each of these aspects of coloration has on individual recognition in geckos. This approach allows

collecting data 1) to assess if individual recognition occurs in geckos; 2) on the type and frequency individual behavioral displays shown during individual recognition; and 3) to discriminate which component of color, color pattern or background color influence individual recognition in geckos. For this study, we are using three species, of which two are nocturnal and one diurnal, and a total of 34 individuals, including both males and females. Although playback experiments are common in animal behavior studies, our approach is unique in that we will be using video streaming to isolate which aspect of coloration and color patterns ,Äì the background matching, the saturation, the hue or the brightness ,Äì stimulate a response. Our experimental approach has been designed to allow us to exclude acoustic and chemical signals, which are considered important in gecko communication. Video editing will also allow us to create an unlimited number of variants by changing the color, color pattern and background of each of our geckos to show back in playback experiments. This experiment will set a baseline for future studies of sexual selection and trait evolution in geckos and closely related species and begin to explain the coloration in such a diverse radiation of lizards.

USE OF FLUORESCENCE EXCITATION-SCANNING HYPERSPECTRAL IMAGING TO DETECT DIFFERENCES IN SPECTRAL PATTERNS BETWEEN NORMAL COLON AND COLON CANCER TISSUES. *MALVIKA LALL*, MALVIKA LALL, SHANTE HILL, PAUL RIDER, CAROLE BOUDREAUX, THOMAS RICH AND SILAS LEAVESLEY, UNIVERSITY OF SOUTH ALABAMA.

Prior studies on hyperspectral imaging have shown theoretical promise in differentiating between normal tissue and cancerous tissue with high sensitivity and specificity. The objective of this study is to examine the potential of hyperspectral imaging experimentally by demonstrating spectral changes that are concurrent with early changes in colon cancer tissues compared to surrounding normal tissue using hyperspectral imaging fluorescence excitation-scanning microscopy. Specimen pairs of fresh normal and adenocarcinoma were obtained from surgical resections of colon tissue in collaboration with University of South Alabama Departments of Surgery and Pathology, and scanned by excitation scanning hyperspectral imaging using a novel microscope constructed at University of South Alabama. All procedures were carried out in accordance with Institutional Review Board protocol # 13-120. Spectral results extracted from the imaging data demonstrated consistent spectral information among spectra of normal tissue compared to spectra extracted from colon cancer. Spectra from colon cancer tissue were more heterogeneous than that demonstrated in the normal tissue. We conclude that hyperspectral fluorescence excitation-scanning may be a method of differentiating normal colon tissue from colon cancer tissues based on spectral patterns in the colonic mucosa. This information could be used for early diagnosis of colon cancer.

AMINO ACID RESIDUE MOVEMENT SIMILARITIES BETWEEN PLANT, INVERTEBRATE, AND VERTEBRATE MBD PROTEINS. *C. JOY SHEPARD* AND SARA CLINE, ATHENS STATE UNIVERSITY. JEREMY PROKOP, HUDSONALPHA INSTITUTE FOR BIOTECHNOLOGY.

The methyl-CpG binding domain (MBD) proteins have the ability to detect and bind to methylated cytosine DNA bases. Recent findings from our group have established evidence that these proteins are found within invertebrates (Cramer et al., 2016), of which these newly

discovered proteins might connect the previously identified plant and invertebrate MBD proteins. Using DNA-protein modeling, in YASARA, simulations were run to determine if there is a methyl binding domain within plants, specifically Arabidopsis thaliana, that functions similarly to the recently identified invertebrate orthologs. Within the YASARA based molecular dynamic simulation, we simulated the methyl binding domains of Arabidopsis proteins with DNA, without DNA, with 5-methyl CpG DNA, and with 5-hydroxymethyl CpG DNA. Afterwards, the data collected was analyzed for amino acid residue movement suggesting some similarities between some of the plant paralog MBD sequences to that of invertebrates and vertebrates.

THE STUDY OF E-COLI IN LAKE MARTAIN. *ARTCHANDRA MARKS*, UNIVERSITY OF WEST ALABAMA. BRIAN BURNES, UNIVESITY OF WEST ALABAMA.

Escherichia coli, also known as E. coli, can be hazardous to humans. E. coli is also a determinant of water quality. I conducted a study by collecting over 100 water samples in Lake Martian, located east of Montgomery, Al. The samples collected showed that the E. coli counts averaged zero. The few E. coli that were collected were analyzed for their source of origin.

FACTORS DIRECTING FEED INTAKE AND SATIETY IN THE SEA URCHIN MODEL, LYTECHINUS VARIEGATUS. *MARLEE HAYES*, BEN MCCAFFERTY, LAURA HEFLIN AND STEPHEN A. WATTS, UNIVERSITY OF ALABAMA AT BIRMINGHAM. JOHN M. LAWRENCE, UNIVERSITY OF SOUTH FLORIDA. DAVID RAUBENHEIMER, UNIVERSITY OF SYDNEY.

Feed intake directs nutrient and energy acquisition for most organisms and factors affecting satiety may regulate feed intake. Sea urchins are an ideal model to study the fundamental factors affecting feed intake and satiety. In sea urchins, feed intake is presumed to proceed until one or more requirements are met. Factors potentially affecting satiation include volume satiation, nutrient satiation, energy satiation, or some combination thereof. The mechanism(s) controlling feed intake and satiety are not fully understood.

In this experiment adult L. variegatus (25-35mm) were fed to excess an agar-based formulated diet that varied in both food and nutrient density. Each day for 11 days, agar cubes, containing a formulated diet, were weighed and placed in mesh cages housing a single individual. After 24 hours, each cube was removed, rinsed, blotted dry and weighed to determine the amount consumed.

Feed intake varied inversely with food density. Volume satiation was demonstrated at the lowest levels of dry matter inclusion in this study, at which sea urchins consumed ca. 1/3 of their body weight per day. Sea urchins demonstrated satiation to apparent dry matter content of the feed. There is evidence that sea urchins demonstrate a diffuse target for protein intake, indicating some level of protein leveraging. However, intake parameters cannot be fully explained by protein and carbohydrate intake, particularly at high nutrient densities, suggesting other macro- or micronutrients may be important in regulating food intake.

THE IMPACT OF SOIL COMPACTION AND SOIL MOISTURE ON SILPHID ABUNDANCE ALONG AN URBAN RURAL GRADIENT. *HOPE REAMER* AND GRANT GENTRY, SAMFORD UNIVERSITY. TORI MEZBISH, UNIVERSITY OF MARYLAND:COLLEGE PARK.

The world is becoming more and more urbanized which effects numerous organisms in the ecosystems. In this study, we are looking at the effect of urbanization on scavengers and decomposers in the environment, specifically silphid beetles, in Birmingham, Alabama. In particular we determined if differences in soil characteristics, specifically soil moisture and soil compaction, across the urban-rural gradient affected silphid abundance. We sampled silphids using non-lethal pitfall traps over a four week period in July, 2016. We found that silphid abundance decreases from rural to urban areas. This was not significantly correlated to either soil compaction or soil moisture because of high variation between sites. There was a correlation with the amount of impervious surface within a square kilometer of the sampling area.

THE IMPACT OF COMMUNITY HEALTH WORKERS ON PROMOTING HEALTHY LIFESTYLE BEHAVIORS. *JUSTIN ALEXANDER*, JENNIFER PRATER, LATRICE LEWIS, DON BOGIE AND CYNTHIA BISBEE, THE MONTGOMERY AREA WELLNESS COALITION.

With the prevalence of chronic disease continuing to rise throughout the nation, the awareness and knowledge for self-managing health has become more and more important over time. As an initiative to educate and build health accountability, The Montgomery Area Wellness Coalition has implemented several interventions through a three year Cooperative Agreement, Racial and Ethnic Approaches to Community Health (REACH), funded by the Centers for Disease Control and Prevention. The Community Health Workers Intervention, trains liaisons from partnering organizations to identify and educate their patients concerning sustainable approaches to overcoming health barriers. Year 1 matched-case data (among other findings) indicate a decline in clients without health insurance (from 75% to 69.3%) from baseline through follow-up. There was an increase in clients obtaining a medical home (+10.2%) and clients adhering to medications as prescribed (+3.2%). Likewise, several positive changes were also indicated from baseline through follow-up for Year 2 participants, with the greatest change being in clients obtaining a medical home (+5%). Building health autonomy, raising awareness of community resources, and educating patients appear to be ways to promote healthy, sustainable lifestyle behaviors that will help to combat the threat of chronic disease.

IDENTIFICATION AND INITIAL CHARACTERIZATION OF TRICLOSAN DEGRADATION GENES IN BACTERIA ISOLATED FROM ALABAMA SOILS. *TRENTON O'NEAL* AND SINAD M. NCHADHAINN, UNIVERSITY OF SOUTH ALABAMA.

Triclosan is an antimicrobial incorporated into various personal care products including soaps, toothpastes, cleaning agents and medical instruments. Triclosan can bio-accumulate in higher organisms leading to negative effects such as disruption of T4 thyroid hormone. The goals of this project were to isolate and identify bacteria capable of degrading triclosan and identify the genes encoding triclosan degradation. Enrichment cultures were established using soil and

water collected on University of South Alabama campus in Mobile, AL. The enrichments were supplemented with triclosan as the sole source of carbon and energy and serially diluted onto agar plates in order to obtain pure cultures of triclosan degrading bacteria. Amplified ribosomal DNA restriction analysis and ribosomal intergenic spacer analysis were used to separate the isolates into operational taxonomic units (OTU). Forty-eight triclosan degrading bacterial isolates were assigned to 18 different OTUs. The 16S rRNA gene from representatives of each OTU was sequenced in order to classify the bacteria to genus or species. Pseudomonads were most abundant genus, representing 60% of the collection with other OTUs assigned to the betaproteobacteria. Degenerate primers were designed to amplify genes previously implicate in triclosan degradation, including the recently described tcsAB genes which encode a triclosan induced two-part dioxygenase. While some isolates yielded amplicons of the correct size, DNA sequencing revealed that none of the amplification products were the targeted gene. Therefore, plasposon mutagenesis was used in an attempt to identify triclosan degradation genes through loss of function. TKO29, which was identified as Pseudomonas saponiphila, was chosen for mutagenesis based on its high growth rate on triclosan. Three mutants lacking the ability to degrade triclosan were identified. The mutated regions are currently being sequenced in order to identify the triclosan degradation genes. Our inability to identify genes homologous to the previously described tcsAB genes by either PCR or Southern blot suggests that TKO29 utilizes novel enzymes to degrade triclosan. Our results indicate that the ability to degrade triclosan is widespread in the environment and that bacteria can utilize multiple strategies to degrade triclosan.

EVOLUTION OF THE GCH GENE FAMILY IN VERTEBRATES AND ITS IMPORTANCE FOR XANTHOPHORE DIFFERENTIATION. *TRENTON O'NEAL*, SCOTT GLABERMAN AND YLENIA CHIARI, UNIVERSITY OF SOUTH ALABAMA. TONY GAMBLE, MARQUETTE UNIVERSITY.

Vertebrate skin coloration is a product of specialized cells known as chromatophores that synthesize various compounds producing different pigmentations. Among the chromatophores, xantho-phores are light-absorbing cells producing yellow pigments that are found in all vertebrates except for mammals and birds. A previous genomic study on a limited taxon sampling indicated that isoforms of the gene, GTP cyclohyrdolase (GCH), might be involved in xanthophore loss in mammals and birds. GCH genes are expressed in the pigment synthesis pathways in xanthophores and melanophores and during the differentiation of neural crest cells into either melanophores and xanthophores or melano-phores and iridiophores. In this work, we used a larger and more representative taxon sampling than the previously published study to investigate the evolution of the GCH gene family and the gain or loss of xanthophores in vertebrates. Genomic data from 27 representative species, including five mammals, four birds, ten reptiles, two amphibians, and six fish, were obtained. A total of 42 different coding sequences for GCH were obtained, and a neighbor-joining analysis indicated that 25 and 17 of these se-quences belonged to the GCH1 and GCH2 isoforms, respectively. Maximum likelihood analyses of nucleotide and amino acid sequences recovered two well-supported clades corresponding to GCH1 and GCH2. While all vertebrates analyzed possess GCH1, GCH2 only occurs in amphibians, fish, and rep-tiles. As previously suggested, the lack of GCH2 may be correlated to the absence of xanthophores in mammals and birds. Preliminary synteny analysis suggests that the genes neighboring GCH2 in am-phibians, fish and reptiles are also present in GCH2 ancestral locations within mammals and birds. Fu-ture work will

focus on identifying how GCH2 was lost as well as other genes of the xanthophore or pteridine pathways that may be absent from mammals and birds.

PHYLOGENETIC RELATIONSHIP OF 13 SPECIES OF EMBERIZIDAE (AVES, PASSERIFORMES) BASED ON COMPLETE MITOCHONDRIAL GENOME. *JANINE ANTALFFY*, YONG WANG, FANGQING LIU AND LONGYING WEN, ALABAMA A&M UNIVERSITY.

Emberizidae, one of the largest families of Passeriformes, is characterized by many morphologically similar species and, therefore, historically controversial taxonomic status. To better resolve the phylogenetic relationship of Emberizidae, we sequenced the complete mitochondrial genome of Emberiza leucocephala (Pine Bunting; 16754 bp in length) and E. elegans (Yellow-throated Bunting; 16780 bp in length). We obtained complete mitogenome data from GenBank for 11 additional Emberizidae species representing Emberiza, Latoucheornis, and Melophus. Complete mitochondrial genomes were used to reconstruct the phylogeny of 13 species based off of Maximum Parsimony (MP) and Bayesian Inference (BI). MP and BI trees were similar with the exception of E. spodocephala (Black-faced Bunting) and all nodes were supported with values greater that 50%. E. cioides (Meadow Bunting), E. jankowskii (Rufous-backed Bunting), and E. leucocephala form a clade, with E. lecocephala having diverged earlier than E. cioides and E. jankowskii. Results also indicate that Latoucheornis siemsseni (Slaty Bunting) is nested within the genus Emberiza and forms a sister clade with E. elegans. Additionally, calculated genetic distances indicate that the Melophus lathami (Crested Bunting) is more closely related to Emberiza than previously suspected (maximum p-distance = .120). Our results are concordant with previous studies and question the classification of Melophus and Latoucheornis as monotypic genera and suggest they be placed within Emberiza.

EVOLUTIONARY BIOGEOGRAPHY OF THE WHITE-BROWED LAUGHINGTHRUSH IN CHINA'S SICHUAN BASIN. *JANINE ANTALFFY*, YONG WANG AND LONGYING WEN, ALABAMA A&M UNIVERSITY.

It is widely accepted that geographic complexities have influenced the evolution of distinct lineages by periodically isolating populations during historical climatic fluctuations. The Sichuan Basin is a globally recognized biodiverse eco-region characterized as a continental island isolated by mountainous topography. Such geo-physical complexity creates a unique landscape feature that has likely facilitated the present patterns of biodiversity in and around the Sichuan Basin. While the topography of neighboring regions has been recognized as factors shaping biodiversity, the Sichuan Basin has received little attention regarding its role in influencing local biogeographic patterns. The White-browed Laughingthrush (Garrulax sannio) is both abundant and widely distributed throughout much of southern Asia, making this species an appropriate model organism to demonstrate the role of the Sichuan Basin in influencing biogeographic patterns in this region. Through phylogenetic analysis of RADseq data I will investigate the genetic structure and estimate periods of historical isolation among populations of G. sannio in and around the Sichuan Basin. I will utilize morphological data to detect patterns of geographic variation in morphology along environmental gradients within this species. To estimate the historical response of G. sannio to extreme climate fluctuations I will

generate contemporary and paleo-distribution models to estimate periods of range expansion and contraction. This research will provide the scientific community with a better understanding of the factors shaping contemporary biogeographic patterns while allowing for predictions toward species' response to future climate fluctuations providing us with the tools to maintain biodiversity in one of the world's most biologically rich regions

INTERACTIONS OF NITROGEN AND CARBON METABOLISM IN THE SUBMERGED AQUATIC PLANT, HYDRILLA VERTICILLATA. *MOLLY MILLER*, DAVID NELSON, KELLY MAJOR AND TIMOTHY SHERMAN, UNIVERSITY OF SOUTH ALABAMA.

Hydrilla verticillata is an invasive, submerged aquatic plant that has been dubbed the ‚Äúperfect aquatic weed,‚Äù (Langeland, 1996). This nickname is appropriate for many reasons, not least of which is the incredible phenotypic plasticity exhibited by this plant. H. verticillata is a facultative C3-C4 intermediate with both mechanisms operating in the same cell (i.e. in the absence of Kranz anatomy). Although carbon metabolism has been well-characterized in the species, we know very little about nitrogen metabolism and its tight coupling to carbon status in this plant. Thus, the objective of this work was to determine how photosynthetic state affects nitrogen uptake and assimilation in H. verticillata. C4 photosynthesis was induced over 14 days; C4 status was confirmed via enzyme assay for phosphenolpyruvate carboxylase (PEPC). Plants maintained in the C3 state served as experimental controls. Upon confirmation of C4 induction, plants were placed in N-free Hoagland's medium for 24 h to deplete nitrogen stores, after which plants were exposed to 100 ¬µM KNO3- for 24 h. Subsequent assays for nitrate reductase (NR) activity and nitrate uptake were conducted. Within the first 3 h of induction, C3 plants had significantly higher uptake rates than C4 plants (0.49 + 0.02 ¬µmol NO3- g FW-1 h-1 cf. 0.28 + 0.04 ¬µmol NO3- g FW-1 h-1). After 8 h nitrate exposure, NR activity in C3 plants was 14-fold higher than in plants undergoing C4 photosynthesis (1651.3 + 295.6 nmol NO2- g FW-1 h-1 cf. 115.5 + 9.3 nmol NO2- g FW-1 h-1). These data suggest that nitrogen uptake and assimilation in H. verticillata is influenced by photosynthetic state, and that this metabolic coupling influences resource use and competitive outcomes in nature.

SPONTANEOUS RHYTHMIC SPIKING AT THE TENTILLA AND TENTACULAR BULB OF MNEMIOPSIS LEIDYI. *GEN DONG* AND ANTHONY MOSS, AUBURN UNIVERSITY.

Ctenophores have attracted considerable attention regarding their role in the evolution of nervous systems; yet we know little about their nervous systems due to limited electrophysiological data. Previous studies of Pleurobrachia pileus by Moss and Tamm (1993) demonstrated an afferent integrative center within the tentacular bulb. The present study used extracellular recording to examine the electrical activity of tentillae and tentacular bulb of M. leidyi. We found spontaneous slow trains of robust biphasic action potentials (0.1-0.3 mV, 0.25-1 spike s-1) in the tentilla bundles which are attached to the tentacular bulb of adult animals. Similar rhythmic firing (0.02-0.04 mV, 0.5-1 spike s-1) could also be detected in tentacles of 4 mm pre-metamorphic cydippid larvae, i.e. bearing only two tentacles. Lesion analysis of excised bulb/food groove complexes were mapped to assess distributed bioelectrical activity by electrophysiological recordings from multiple locations. This revealed

that spontaneous rhythmic spiking originated in the aboral end of the bulb. Furthermore, we demonstrate through paired electrode recording, that rhythmic spiking is conducted into the food groove tentillae. To our surprise to date we have not been able to evoke propagated action potentials by application of food (Artemia nauplii), mechanical or electrical stimulation in this region of the nervous system. In conclusion, we report here for the first time that spontaneous rhythmic action potentials likely originate inside the tentacular bulb of Mnemopsis leidyi and propagate into the embedded tentilla. Surprisingly, our results are in contrast to those of Moss and Tamm with P. pileus, which does not exhibit spontaneous firing, and which responded to the application of food and electrical stimulation with afferent activity. Our data further suggest that there appears to be a central oscillator that drives spontaneous rhythmic activity in the bulb. Future efforts will focus on the cellular source(s) of the signal, the signal conduction pathway, its chemical neurotransmitter sensitivity and its sensory and/or motor functions.

TESTING THE CYTOTOXICITY EFFECTS OF THE RAW VENOM FROM CTENUS HIBERNALIS. *BRAD BENNETT*, JONATHAN BERKUTA, SHANNON GILSTRAP, ROBERT HATAWAY AND MARY ANNE SAHAWNEH, SAMFORD UNIVERSITY. ADAM KRAHN, HOPE COLLEGE.

The venom of Ctenus hibernalis, a wandering spider native to Alabama, has not been previously characterized or tested for antimicrobial properties. However, an antibacterial effect has been found for the venom of Cupiennius salei, a species within the same family. Specimens of C. hibernalis were collected from a nearby forest preserve, and venom was extracted from anesthetized spiders by electrical stimulation of the venom gland. Different concentrations of venom were added to growth cultures of various bacterial species in order to determine any antimicrobial activity. Growth inhibition assays in liquid (broths) and solid (agar plates) media were conducted; however, no negative effects on the growth of any tested microbial species was observed. The raw venom was also tested for effects on C2C12 mammalian cells, a myocyte (skeletal muscle) culture. The venom significantly reduced the viability of the C2C12 cells in a dose-dependent manner in subsequent colorimetric assays. We also noted detachment of cells growing in culture and gross morphological changes to the myocyte cell structure upon treatment with venom. Using C. hibernalis genomic DNA is a template, an attempt was made to amplify the Tx1 toxin gene in order to recombinantly express the protein for testing. However, the amplification failed to work, most likely due to non-specific primer sequences.

MECHANISTIC INSIGHTS ON THE ROLE OF HUMIC ACID ON BLADDER CANCER CELLS. *HANNAH BROOKS*, HANNAH BROOKS, JIMMIE MCGEHEE, SHAHRZAD BADRI, ALEXANDRA STENSON AND PADMAMALINI THULASIRAMAN, UNIVERSITY OF SOUTH ALABAMA.

Whereas genetics play an important role in the development of carcinoma tissues, environmental factors have also been shown to affect the development and growth of carcinoma tissues. Humic acids occur naturally in the decomposition of natural organic matter and have pharmacological properties which suggest that humic acids could affect cancer cell growth. The purpose of this study was to examine the effects of humic acids on the growth of

RT-4 bladder cancer cells and to identify by what mechanism, if any, humic acids impacted cellular growth. Results from this study showed that treatment with 25 ¬µg/L and 50 ¬µg/L humic acids decreased RT-4 cellular growth. Our data showed that treatment of RT-4 cells with 25 ¬µg/L and 50 ¬µg/L humic acids decreased the expression of vascular endothelial growth factor A (VEGFA). However, treatment of RT-4 cells with humic acids did not alter the expression of anti-apoptotic protein, B-cell Lymphoma 2 (Bcl-2) and pro-apoptotic protein Bax . These findings provide mechanistic insight into how humic acids may regulate angiogenesis and growth inhibition of RT-4 cells.

THE STRUCTURE AND ORGANIZATION OF TENTACULAR BULB AND TENTILLA OF CTENOPHORE MNEMIOPSIS LEIDYI. *DONG GEN* AND ANTHONY MOSS, AUBURN UNIVERSITY.

The tentacular bulb and the tentilla are important physiological structures in ctenophores that minimally are involved in feeding. They are likely involved in a diversity of sensory functions. There are two bulbs, located at the base of the tentacular structures each individual Mnemiopsis. In this species each tentacle is located just aboral to the mouth. Each tentacular bulb is the source of multiple short tentilla, what originally appeared to be a thick but very short tentacle, and two epithelially-embedded apparent tentacles. There have been many studies of Mnemiopsis since the work of Mayer in 1912, yet thereis little information on the morphological organization, and detailed cellular composition of the tentacular bulb and tentilla of Mnemiopsis. The present study employs light microscopy and time-lapse video recording to examine the structure and relationship between tentacular bulb and its tentacular structures of Mnemiopsis. Close examination using off-axis illumination revealed a ridge of tissue located on the center of the bulb. Bundles of hundreds of tentilla arise from the edge of ridge, indicating the location of the formation of the tentilla. Many tentilla fibers were found connected to the aboral end the tentacular bulb, suggesting that each tentilla is directly connect to the bulb. These findings are contrary to previous belief that the tentilla are embedded in the epithelia of the food groove. We created a lesion in the food groove and used time lapse recording to reveal the behavior of the food grove post-incision. This revealed the following: 1) the immediate separation of the distal end of the tentilla, 2) aggregation of tentilla at the proximal edge of the lesion, 3) regeneration of the food groove, and 4) aboral migration of tentilla along the food groove, during restoration of normal function after focal resection of the tentacular groove. This study of tentilla formation and localization will help us reconstruct tentilla and food groove organization which is crucial for understanding feeding behavior and their remarkable regenerative abilities. Future efforts will focus on the cellular composition of both the tentacular bulb structure and the formation of tentilla.

SPONTANEOUS RHYTHMIC SPIKING AT THE TENTILLA AND TENTACULAR BULB OF MNEMIOPSIS LEIDYI. *GEN DONG* AND ANTHONY MOSS, AUBURN UNIVERSITY.

Ctenophores have attracted considerable attention regarding their role in the evolution of nervous systems; yet we know little about their nervous systems due to limited electrophysiological data availability. Previous studies of Pleurobrachia pileus by Moss and Tamm (1993) demonstrated a signal integrative center in the tentacular bulb. The present study used extracellular recording to examine the electrical activity of the tentilla and tentacular bulb

of M. leidyi. We found spontaneous slow trains of robust biphasic action potentials (0.1-0.3mV, 0.25-1 spike s-1) in the tentilla bundles which are attached to the tentacular bulb of adult animals. Similar rhythmic firing (0.02-0.04mV, 0.5-1 spike s-1) could also be detected in tentacles of 4mm nonmetamorphic cydippid larvae, i.e. bearing only two tentacles. We also performed a lesion analysis, in which we excised the tentacular bulb and took electrophysiological recordings from multiple locations. This revealed the origin of rhythmic spikes to be in aboral end of the bulb. Furthermore, through paired electrode recording, we found that rhythmic spikes are conducted in the direction from the aboral end of the bulb to the tentillae located in the food groove. In conclusion, we report here for the first time that spontaneous rhythmic action potentials likely originate inside the tentacular bulb of Mnemopsis leidyi and propagate into the embedded tentilla. Surprisingly, the results are in contrast to those of Moss and Tamm in P. pileus, which does not exhibit spontaneous firing. Our data further suggest that there appears to be a central oscillator that drives spontaneous rhythmic activity in the bulb. Future efforts will focus on the cellular source(s) of the signal, the signal conduction pathway and its sensory and/or motor functions.

ASSESSMENT OF URBANIZATION IN THE RANGE OF PSEUDEMYS ALABAMENSIS (ALABAMA RED-BELLIED TURTLE). *NICKOLAS MORENO*, SCOTT GLABERMAN, DAVID NELSON AND YLENIA CHIARI, UNIVERSITY OF SOUTH ALABAMA.

Turtles are among the organisms in the Southeastern US in greatest need of assessment, as Alabama is within one of the three global turtle priority areas for conservation and has high turtle biodiversity. Pseudemys alabamensis (Alabama red-bellied turtle) is an endemic species that occurs only in the lower drainage systems of Alabama and Mississippi, with the Mobile Tensaw delta being the northern limit of its range. It is classified as endangered by the U.S. Fish and Wildlife Service and has been placed on the IUCN Red List. The range for this species is narrow around Mobile Bay, Alabama, which is heavily urbanized and prone to large amounts of chemical runoff. Some chemicals that may be found in runoff have the potential to be genotoxic. With little currently known about the current populations of P. alabamensis, assessment of the effects of urbanization across the species range will help identify populations suffering from genotoxicity and to establish the effect that habitat quality has on them. Chemical runoff from agricultural fields has been shown to be harmful to amphibians and reptiles in ovo exposure, including increased levels of DNA damage, which may cause cancers and birth malformations. In this work, we used ARC GIS to identify watershed habitats of P. alabamensis that are heavily developed (high levels of urbanization and agriculture). The U.S. EPA Toxic Release Inventory was then used to identify industrial sites around the known habitat of this species and potentially toxic chemicals used at these sites. Of all the sites, Dog River watershed was the most developed with 61% (36124.78 acres) of its land usage being defined as developed. Toxic compounds that may be found at industrial and agricultural sites in the area include hydrazine, polycyclic aromatic hydrocarbon compounds, heavy metals, atrazine, trifluraline, and glyphosate. Future directions of this study include assessment of DNA damage in P. alabamensis at the studied sites. The results of this work will permit the development of management strategies and effective conservation actions, such as identifying areas that would require habitat restoration.

GENETIC IDENTIFICATION OF BLOOD PARASITES IN GALAPAGOS MARINE IGUANAS (AMBLYRHYNCHUS CRISTATUS). *SHIRLEY ZHANG*, REGIS BURKHARDT, YLENIA CHIARI AND SCOTT GLABERMAN, UNIVERSITY OF SOUTH ALABAMA.

The relationship between hosts and their parasites is one of the most fundamental issues in biology with repercussions for both conservation and public health. All animals, including humans, are infected by pathogens that could affect the survival and reproduction of individuals or species. In this project, we used the Galapagos marine iguana and their blood-borne pathogens as a model system to study host-parasite relationships. Island systems such as the Galapagos are ideal for studying the interaction between hosts and pathogens because each island is a discrete geographical unit that is isolated , thereby avoiding the complex interconnections that are often characteristic of mainland systems. We analyzed 18s ribosomal sequences of Haemogregarine parasites isolated from the blood of 20 marine iguanas to identify which species are causing infection and whether these pathogens are similar or variable among marine iguanas from different islands. The parasites isolated from all individuals closely matched species from the genera Hemolivia and Hepatozoon, which occur in other reptile species. We also found very little variation in parasite genetic sequences from marine iguanas within and between islands indicating that the parasite disperses easily between islands.

CURRENT STATUS OF ALNHS: THE HERBARIUM OF THE ALABAMA NATURAL HERITAGE SECTION. *WAYNE BARGER* AND CHRIS TAYLOR, NATURAL HERITAGE SECTION, AL-DCNR.

Alabama's plant biodiversity is well documented. However, due to consolidation of herbarium collections, emphasis on molecular analysis, and lack of student/public interest, the number of repositories has decreased. The fundamental mission of this herbarium is to offer an outlet for plant research and to house every plant taxa that occurs in the state. Herbarium holdings, ongoing floral projects and future plans will be presented.

DEVELOPING A 21ST CENTURY SKILLS INVENTORY. *JENNIFER BRANTLEY*, CHARLES BROWN AND LAURA POWELL, UNIVERSITY OF SOUTH ALABAMA.

Developing a 21st Century Skills Inventory

The National Academy of Sciences has proposed that beyond being competent in their discipline, today's college graduates should be positioned to transfer their knowledge across disciplinary boundaries to successfully address problems in completely novel, unfamiliar domains. According to the report developed by the Division on Behavioral, Social Sciences and Education (Pellegrino and Hutton, 2012), the capacity to transfer knowledge across disciplines is a cardinal skill that is dependent on the emergence of three competencies:

- Cognitive Competency: The mastery of facts and ability to reason in reference to the content of their discipline.
- Intrapersonal Competency: The ability of students to manage their behavior appropriately to achieve their learning goals.

- Interpersonal Competency: The ability of students to comprehend the intentions of others, work in teams, and personally reflect on the content of their discipline.

In harmony with this perspective, we seek to develop and establish reliability and validity of the 21st Century Skills Inventory. This instrument will allow educators the opportunity to systematically evaluate their curricula and determine which experiences, courses, pedagogies, and strategies support the development of these competencies. To this end, we have developed a 36-question inventory, and collected data from 800 students. In this poster, we present the result of our initial factor analysis, and discuss our current changes in approach to establishing the reliability and validity of a revised instrument.

Authorship: Jennifer Brantley, Dr. Charles H. Brown, Dr. Laura A. Powell

Summary: This poster will present research on the development and validation of a new instrument to help educators assess 21st Century Skills in college students.

SURVEY AND PHYLOGENETIC IDENTIFICATION OF ENDOPHYTIC FUNGI ON TWO AQUATIC PLANTS FOUND IN MOBILE BAY. *GRAY F. SCARBROUGH*, UNIVERSITY OF SOUTH ALABAMA. JOSEPH M. CORTOPASSI AND JUAN L. MATA, U. SOUTH ALABAMA.

Endophytes, including fungi, are organisms found inside living plants. These organisms are considered ubiquitous amongst terrestrial vascular plants, but insufficient research has been performed and documentation is scarce on aquatic vascular plants. Mobile Bay is a large estuary with a high level of species diversity. In this project we searched for fungal endophytes on plants commonly found in this aquatic ecosystem. The two plant species studied were Vallisneria neotropicalis (native; Tapegrass) and Myriophyllum spicatum (invasive; Eurasian Water Milfoil). Plants were collected from a location off the north side of the Battleship Parkway/ Causeway on three separate days over a span of six weeks. Roots, stems, and leaves were cut, sterilized with diluted household bleach, rinsed in sterile water, plated on nutritive agar, and incubated at room temperature in the lab. On a daily basis plant samples were carefully examined to detect fungal growth, upon which portions of fungal mycelium were transferred to new plates to achieve pure growth. At the end of 10 weeks most fungal growth was observed in the stems of M. spicatum (97.7%) and in roots of V. neotropicalis (73.3%). However, only 75 endophytes were recovered (out of 182 isolates in plates). Endophyte isolates were subjected to morphological examination, but not all could be taxonomically identified due to absence of reproductive structures. Therefore, isolates were grown in liquid medium to obtain pure mycelium for subsequent DNA extraction, amplification and sequencing of the ITS rDNA region. Sequences were blasted against databases in GenBank for matching sequences with a fungal name. Confident identification was possible for only 27 isolates. Most names belong to the Ascomycetes, of which Curvularia lunata was the most common. Many of these names have been reported as endophytes in terrestrial vascular plants, some in aquatic plants, and even Mycolepodiscus terrestris in M. spicatum, the aquatic invasive plant in our study.

DIFFERENTIAL PRODUCTION AND SECRETION OF POTENTIALLY TOXIGENIC ECPS FROM AN EPIDEMIC STRAIN OF AEROMONAS HYDROPHILA. *PRISCILLA BARGER*, JOSEPH NEWTON AND MARK LILES, AUBURN UNIVERSITY.

Aeromonas hydrophila is a bacterial pathogen ubiquitous in aquatic ecosystems. Disease outbreaks in fish are common in spring and summer, particularly in Southeastern pond systems. Traditionally, A. hydrophila has been considered a secondary pathogen with low morbidity and mortality. However, in 2009 a new, highly-virulent strain of A. hydrophila was responsible for widespread outbreaks of motile aeromonad septicemia in Alabama catfish production ponds. The bacterium continues to cause significant losses in the Southeastern catfish industry. This epidemic strain, referred to as virulent Aeromonas hydrophila (vAh), shows significant genetic variation from the traditional A. hydrophila (tAh) and is capable of producing disease as the primary pathogen, resulting in rapid and devastating mortality in catfish production ponds. Experimental infections via intramuscular or intraperitoneal injection in channel catfish result in death within hours with only minor gross and histologic lesions present in tissues, suggesting a toxin-mediated mode of pathogenicity. vAh are known to secrete a multitude of potentially toxigenic extracellular proteins (ECPs), potentially via a Type II secretion system. Variation in the secretome at different temperatures has been previously documented for other A. hydrophila isolates suggesting that, as natural vAh infections occur only during the spring and summer months when water temperatures are high, production and secretion of ECPs may be in direct relation to environmental temperature. In order to determine the role of ECPs in pathogenicity, and to evaluate the potential environmental factors affecting ECP production, secretory profiles of vAh cultured under different conditions were compared. Comparison of vAh secretomes by PAGE of culture supernatants found variability in ECP profiles based on complexity of media, culture conditions, and culture temperature. Furthermore, injection of concentrated cell-free supernatant resulted in rapid mortality, mimicking previous whole-cell bacterial challenges. These findings suggest that the rapid mortality associated with vAh outbreaks may be due, in part, to increased toxin production as a response to nutrient availability and seasonal temperature fluctuations. Fractionated supernatants are currently being evaluated to elucidate specific ECPs that may be responsible for disease.

CHARACTERIZATION OF NOVEL SMALL NON-CODING RNAS EXPRESSED BY SALMONELLA IN RESPONSE TO STRESS. *MIKA HOUSEROVA*, ALINE CRUCELLO, MICHAEL SPECTOR AND GLEN BORCHERT, UNIVERSITY OF SOUTH ALABAMA.

Salmonella enterica serovar Typhimurium is an enteric pathogen responsible for thousands of deaths worldwide and over a million illnesses just in the United States each year. Salmonella are resistant to several abiotic stresses e.g. elimination methods used in food processing. Due to this, stressful, sublethal conditions continue to lead to adaptations that influence subsequent survivability and pathogenicity. That said, while some of the mechanistic details contributing to Salmonella adaptation have been described, there are still many unknowns. Understanding the regulatory processes that lead to resistance and adaptation is essential to establishing new control strategies and therapeutics for this and other pathogens. Importantly, as Salmonella enterica experiences carbon starvation, it undergoes significant global changes in its cellular gene expression profile. These changes are mediated, in part, by small RNAs (sRNAs), short non-coding strands of RNA that have previously been shown to be involved in the regulation of many cellular processes in other prokaryotes. That said, little is known about the identities and roles of sRNAs involved in mediating the Salmonella stress response. Excitingly, however, through employing a cutting edge, next generation deep transcriptome sequencing technology,

we recently identified hundreds of novel sRNAs differentially expressed in response to Salmonella carbon starvation and have now selected, and are in the process of experimentally characterizing, eight of these sRNAs in order to explore their potential as novel targets for therapeutics and regulation.

ANABOLIC GLUCOSE METABOLISM IS SIGNIFICANTLY ENHANCED IN PANCREATIC CANCER DURING THE EVOLUTION OF DISTANT METASTASIS. *ALEXANDER COLEY* AND GLEN BORCHERT, UNIVERSITY OF SOUTH ALABAMA. OLIVER MCDONALD, VANDERBILT UNIVERSITY.

Pancreatic ductal adenocarcinoma (PDAC) is an extremely lethal malignancy that is predicted to become the second leading cause of cancer deaths in the United States by 2020 . This is attributed to the fact that early stage PDAC is difficult to detect, and late stage PDAC is resistant to treatment. Aware of this reality, our study aims to identify new molecular cues to facilitate novel detection methods and therapeutic targets for treatment. PDAC is a stepwise, evolutionary process by which a primary tumor grows in the immediate pancreas and differentiates itself into subclonal populations which will inevitably metastasize and end the life of the patient . It is known that driver mutations are acquired early in PDAC progression and are important for PanINs and establishing primary tumor growth, however no genetic drivers of metastasis have been identified. Knowing that the primary tumors grow within nutrient-poor environments, we hypothesized that divergent metabolic properties may arise during the evolution of distant metastasis to nutrient-rich organs. To test this, we first examined datasets tracing carbon-13 labeled glucose uptake into matched peritoneal and distant metastatic subclones collected from the same patient, which revealed that the distant metastatic subclones possessed hyperactive glucose flux through glucose-driven pathways. Next, by the use of steady state metabolomics, we detected high levels of metabolites pertinent to lipid, nucleic acid, and protein biosynthesis in the distant metastatic subclones and high levels of metabolites pertinent to the breakdown of fatty acids and scavenging of purines and methionine in the localized subclones. From these results, we discover that anabolic glucose metabolism emerged late in PDAC progression during the evolution of distant metastasis, while catabolic and scavenging properties that are thought to emerge early were inherited during peritoneal carcinomatous. Applying this novel information, targeting the enzymes that drive these evolutionary divergent malignant metabolic pathways could represent a novel therapeutic approach for patients with metastatic PDAC, one of the most lethal of all human malignancies.

GENOMIC VARIATION OF BREEDING META-POPULATIONS OF CERULEAN WARBLERS (SETOPHAGA CERULEA). *RICHARD BORTHWICK* AND YONG WANG, ALABAMA A&M UNIVERSITY.

Cerulean warblers (Setophaga cerulea), in addition to being one of the fastest declining songbirds in North America, are shifting their range to the northeast. This shift is resulting increased population fragmentation and may have significant implications for species management. Cerulean warblers are a significant conservation concern as they are listed as a species of greatest conservation need in each state breeding occurs. Further information on the genetic divergence of this species is required to formulate population units, a necessary step in

prioritizing conservation efforts. To this end, we propose completing genomic sequencing using a double-digest restriction-site associated DNA sequencing (RADseq) to identify single nucleotide polymorphisms. Over 240 blood samples have been collected from breeding cerulean warblers, with more collection planned this season (late April through June, 2017). We will isolate DNA from these samples using standard protease-K with phenol:cholorform extraction, and digest DNA using the restriction enzymes Sbf1 and Msp1. We will test genomic variation using kinship coefficients and assess isolation by distance using Mantel tests. This information will be used to describe and map population units. We will subsequently model the relationship between population units and habitat from the federal Forest Inventory and Analysis database, and we will model the relationship between population units and environmental parameters including precipitation and temperature. With these methods we intend to help prioritize populations for conservation efforts, explore source/sink dynamics, and understand underlying forces driving population persistence or decline.

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50 SHADES OF MORALITY. *CASSANDRA FIGNAR*, UNIVERSITY OF SOUTH ALABAMA.

Within American society colleges act as one of many institutions that socialize individuals to behave appropriately as defined by that society. According to the National Center for Education Statistics, in 2016 20.5 million individuals were predicted to enroll in college. Recent literature found that as a result of the interactions with college or higher education as a socializing structure the majority of individuals will experience a change in their view of the appropriate behaviors or morals. However the literature on this topic is incomplete. This study examines the views of morality with a close consideration to whether morality is seen as a fluid and fluctuating concept, a concrete and defined set of values, or something in between. Using the 2010 wave of the General Social Survey, this study finds that those with higher levels of educational attainment are more likely to view morality as a concept that fluctuates in value when controlling for sex, region of the country one resides in, race, age, and religiosity. It further finds that those who live in the southern region of the United States view morality as unchanging values rather than a fluctuating concept. Utilizing the results of this study, the effect of higher levels of educational attainment on views of morality display a need to expand and further teach nuanced thinking to allow for more individualized and intellectual growth.

ESTIMATES OF RELATIVE PREFERRED TEMPERATURES IN TURTLES. *AUSTIN RAY*, YLENIA CHIARI AND SCOTT GLABERMAN, UNIVERSITY OF SOUTH ALABAMA. PIERRE MOISSON, A CUPULATTA, VERO, 20133 UCCIANI, CORSICA, FRANCE. MIGUEL CARRETERO, CIBIO/UNIVERSIDADE DO PORTO CAMPUS AGRERIO DE VAIRO 4485-661 VAIRO, PORTUGAL.

Global climate change can negatively affect biological systems. These effects vary across ecosystems and species. However, ectothermic organisms are thought to be more sensitive to climate change as their own homeostatic processes depend on environmental conditions. Ectotherms have various strategies to regulate body temperature such as moving between sunlight and shaded areas. Because of the importance that environmental temperature has on the biology of ectothermic organisms, uncovering the preferred temperature for ectothermic species and how they select these temperatures is of vital importance to understand how

climate change may affect them. In this work, we examined the preferred temperature(s) and thermoregulatory behavior of nine different species of turtles (8 Testudinae and 1 Emydidae) in a semi-controlled environment. We examined whether individuals from each species sought higher or lower environmental temperatures in outdoor enclosures in which there were also indoor shelters available. Temperatures of each individual were continuously measured every twenty minutes for three months by attaching a data-logger on the carapace. Dataloggers were also placed in the enclosure of each species to obtain data on environmental temperatures available to the animals. Preferred temperature(s) and thermoregulatory behavior were analyzed across species and between sexes using the median of the data. Our results indicate that temperature selection generally varies between species, but not sexes, except for one species (C. denticulata). Among the studied species, T. carolina selects overall lower temperatures than the other species. Temperature selection does not seem to be necessarily related to differences in temperatures in the natural habitat of each species.

A STATE RECORD FOR THE MYGALOMORPH SPIDER SPHODROS ABBOTI (ARANEAE: ATYPIDAE) FROM BALDWIN CO., AL. *W. MIKE HOWELL* AND KRISTIN BAKKEGARD, SAMFORD UNIVERSITY. JIM EGBERT, ORANGE BEACH, AL.

In August 2015, Jim Egbert found two male purseweb spiders, Sphodros abboti, while walking along the Hugh Banyon Backcountry trail (30.279438, -87.612546) near the Orange Beach Sportsplex . They were photographed and posted to social media. We recognized that this represented a state record, returned to the area, and found several characteristic purseweb tubes, attached to bases of hardwood trees. We collected two females, now deposited in the Auburn University Museum of Natural History (AUMS 16811 & AUMS 16812) and took additional photographs of the pursewebs. Two other localities for this species in Baldwin County, AL have also been identified ‚Äì Bon Secour National Wildlife Refuge and Blakeley State Park. A literature review revealed that the closest locality for this spider is approximately 155 miles (straight-line distance) to the east in Liberty County, FL. The heart of its range is eastern Florida and south-central Georgia. It is unknown as to whether this occurrence in Alabama represents a range expansion, or that the presence of this spider has, until now, remained undocumented.

ANTIBIOTIC RESISTANCE OF VIBRIO VULNIFICUS ON THE ALABAMA-FLORIDA STATE LINE. *SIERRA FISCHER*, UNIVERSITY OF WEST ALABAMA.

Vibrio vulnificus are flesh eating bacteria found in salt water. The flesh eating bacteria were initially discovered in Florence, Italy in 1854. The physician Filippo Pacini discovered the first species of Vibrio when a cholera outbreak occurred. He however did not discover vulnificus; instead, he discovered cholera. Vibrio's shape is slightly bent similar to a comma. V. vulnificus is found when people consume raw oysters that can lead up to a 56.4% fatality rate. Most causes were believed to happen in the warm summer months. Florida's incidence rate is double the national rate for vibrios. Individuals with wound infection related symptoms were approximately 50.7% of the 276 cases of V. vulnificus from 1998 to 2007. The V. vulnificus were found in the Gulf Coast area in Florida and Alabama. In this study samples were collected at to 2 different sample sites, Pensacola beach area of Florida and Perdido Key. The 37 total

isolated vibrios were tested for the resistance to antibiotics. The purpose of this study is to test natural antibiotic resistance in Vibrio vulnificus.

TROUBLE IN THE GALAPAGOS: ARE BLACK FLIES NATIVE OR INVASIVE. *JOHN MCCREADIE*, ALABAMA A&M UNIVERSITY.

Most of the world, islands, if they have flowing freshwater, are inhabited by larval black flies. Most adult females take blood and hence many species are vectors of disease. One or more species of black flies from the Simulium ochraceum complex inhabits the Galapagos Island of San Cristobal and was first reported to attack people in the early 1990's. The Ecuadorian government wants to eradicate this species under the assumption of a recent introduction. The issue is whether the species is introduced or native. The distinction is significant because if native, sufficient time has elapsed for it to have become a keystone species in the only know running water habitats of the Galapagos Islands. This paper presents our research to date.

BIORUBEBOT, A MOLECULAR BIOLOGY GAME, IS ASSOCIATED WITH SOME EDUCATIONAL GAINS IN THE COLLEGE CLASSROOM. *SARA CLINE*, ADAM LEWIS AND LEIGH HESTER, ATHENS STATE UNIVERSITY.

BioRubeBot (For Biology Rube Goldberg Robot) is a Serious Educational Game (SEG) based on protein pathway images that are found in abundance in molecular biology textbooks. Gameplay uses simplifications of typical protein-protein interactions, which can easily be interpreted as a Rube Goldberg style game. Games that require students to use science-based rules in order to solve puzzles are known to be associated with learning gains in the classroom. Examples of such games are especially prominent in the field of Physics. Here we show that BioRubeBot, a game coded by Athens State University Computer Science students, may need further refinement in its depiction of receptors in order to promote a college level understanding. However, we also show that BioRubeBot is associated with increases in vocabulary usage that are comparable to a group creating playdough representations.

CHICKEN PROCESSING PLANT CONTRIBUTIONS TO NUTRIENT POLLUTION IN GRAVES CREEK WERE MODIFIED BY RAINFALL AND SEASONAL GROWTH OF WETLAND PLANTS. *EMILY BRIDGE*, ANNIE SMITH AND BETSY DOBBINS, SAMFORD UNIVERSITY.

Animal feeding operations create nutrient pollution in the waterways of Alabama. Less is known of the effects of processing plants and of created wetlands that seek to ameliorate such pollutants. In Blount County, Alabama a chicken processing plant discharges waste into a wetland that empties into Graves Creek. We believe higher concentrations of nitrates and phosphates will be present downstream than upstream of the plant. Water samples were collected six separate times at eight locations along Graves Creek over two years. Each sample was tested for nitrates, phosphates, conductivity, pH, and dissolved oxygen. We found that the concentrations of nitrates and phosphates downstream of Tyson Chicken plant were not only higher than upstream of the plant, but up to ten times higher than an acceptable level for drinking water (10 mg/L). An increase in nitrates and phosphates stresses inhabitants of these water systems, which can lead to community disruption. Conductivity, but not pH or dissolved

oxygen, increased downstream of wetland discharges. We found that the wetland was partially efficient during growing season at removing nitrates and phosphates from the water. However, during winter and late summer when plant growth is sparse, the wetland became saturated with nutrients and deposited phosphate into the water, further increasing the phosphate concentrations of water in the wetland. Our results suggest that wetland efficiency varies by season, so it is important that CAFO regulations consider seasonal variation as well as rainfall when creating restrictions on nutrient discharge into surface waters.

EVIDENCE OF CLIMATE CHANGE: REDUCTION IN SUGAR MAPLE GROWTH. *BRITTANY BUTCHER* AND KETIA SHUMAKER, UNIVERSITY OF WEST ALABAMA. CAROLYN COPENHEAVER, VIRGINIA TECH.

The current range of sugar maple is largely determined by climate. Models predict sugar maple's range will shift northward and eastward in response to climate change. In this study, we examined dendroclimatological data to verify these model predictions. We correlated tree-ring width data with temperature, precipitation and Palmer Drought Severity Index from study sites in the southern, western, and central parts of sugar maple's range. Sugar maple growth at the southern site was limited by drought. Sugar maple growth at the western site was limited by precipitation and in the central region sugar maple growth was not correlated to climate. The southern and western sites provided evidence of a recent (post-1950) increased sensitivity to drought. These dendroclimatic results confirm predictions of a northward and eastward shift in the range of sugar maple within the next century.