

Biology (and Biology related collaborations) student abstracts 2013
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Effectiveness of Kinesio Taping on Contusion Healing In Student-Athletes

Brittany Berkopec and Andrew Gannon

Kinesio Tape (KT) is an elastic, non-inhibiting, non-invasive tape that facilitates healing while mimicking skin tendencies. Manufacturers claim that KT physically lifts the skin off of the injured area. This function of KT helps with healing of contusions by promoting blood and fluid flow through the damaged area as suggested in previous research. This study focuses on treatment of contusions in collegiate athletes by three different treatments: traditional RIE treatment (rest/ice/elevation), Kinesio Tape (KT), and the control treatment (no treatment). It is hypothesized that the treatment of contusions with KT will induce a faster recovery rate than RIE or the control. This was assessed by collecting data on the change in contusion area over a 9 day treatment period with data collection every other day. There was found to be no significance statistical difference of percent change in contusion area between KT ($M = 42.72\% \pm 29.37 (SD), n = 10$), ICE ($M = 54.39\% \pm 32.22(SD), n = 10$), or control ($M = 42.70\% \pm 28.41 (SD), n = 10$) treatment groups. Results suggested no evidence that KT expedites the healing process for contusions. Pre- and post-treatment questionnaires on attitudes towards KT efficacy indicated that 70% of subjects believed that KT increased their recovery rates, suggesting that a placebo effect might occur, but this was not supported by the actual measurements of recovery. While no support was found for contusion healing, KT may still have benefits for its other uses of providing structural support and facilitating muscle movement.

Phytochemical Investigation of Medicinal Plants Used in Both Traditional Chinese and Native American Medicines

Noel Brassett and Wayne Shew

Traditional Chinese Medicine (TCM) and Native American medicine are forms of complementary and alternative medicines (CAM) which utilize plants for medicinal purposes. The medicinal value of plants can be attributed to phytochemicals, which have been shown to have physiological effects on humans. Plant species in the same genus or family are expected to share similar chemical characteristics including phytochemical content. This study investigated 9 plant species that are indigenous to the area around Birmingham, Alabama: *E. purpurea*, *L. spicata*, *L. microcephala*, *H. amarum*, *V. altissima*, *R. glabra*, *C. terniflora*, *S. byzantina*, and *C. americana*. The plants were collected, plant parts were separated, dried, ground into powder, and stored at -20°C. Phytochemical analyses were conducted using qualitative tests for saponins, terpenoids, glycosides, tannins, and flavonoids. A semi-quantitative GC analysis was conducted to determine relative alkaloid content. We found that plants used by Native Americans in the same genus as those used in TCM were often used for similar medicinal purposes, and many of them contained the same phytochemicals as those published in the literature. Some of the deviations in our results from those reported by other authors can be attributed to examining plants in the same genus but different species from those in the published literature. All species contained alkaloids, and in all parts of the plants except in the flowers of *H. amarum*. *Callicarpa americana* contained the highest concentration of alkaloids of all samples investigated (86.41 mg/g leaf tissue).

Sediment characteristics of habitats favored by the endangered Watercress Darter (*Etheostoma nuchale*) in Roebuck Spring, Alabama

Jarred Brookins and Scot Duncan

The watersheds of Alabama contain half of the twelve most critically endangered fishes in the Southeast known as the “Desperate Dozen.” One of these, the watercress darter (*Etheostoma nuchale*), is endemic to Jefferson County. The population at Roebuck Spring is arguably the most important because it is large and genetically unique. It is known that submergent aquatic plants, *Fontinalis* sp. and *Ceratophyllum desmersum*, support high densities of *E. nuchale*. Because there are continual natural and man-made disturbances to the spring, restoring and increasing habitats for these plants would facilitate species recovery. However, little is known about the environmental requirements of these plants. Because sediment is important for aquatic plant ecology, I am describing the sediments where these species are found and also in random habitats at Roebuck Spring. Soft sediment depth was measured and sediment samples were collected. For each sample particles were separated and weighed according to their size and the inorganic fraction was measured by burning off the organic material at 550°C. Sediment depth, particle size, and organic content will be compared between the three studied habitats. Based on initial observations and previous research, I expect that *Ceratophyllum* will grow in deeper soft sediments with smaller particle size composition and containing more organic material than where *Fontinalis* grows. We expect the findings to be highly variable from the random sample sites. Data collection is ongoing and results will be presented at the conference.

Inhibition of SbnH and select NIS synthetase enzymes in the siderophore biosynthetic pathways of *Staphylococcus aureus*

Allyson Cox, David Schedler, and William Kittleman

Staphylococcus aureus is one of the leading causes of hospital-acquired infections. It is also notorious for developing resistance to known antibiotics. The purpose of this research is to develop new therapeutic agents that inhibit, or eliminate, the growth of *S. aureus* by targeting the biosynthesis of the essential, iron-scavenging siderophores staphyloferrin A and staphyloferrin B. Transition state/multi-substrate inhibitors of the citrate-activating NIS synthetase enzymes SfnaB, SfnaD and SbnE have been designed along with a fluorinated substrate analogue of the PLP-dependent decarboxylase SbnH. SfnaB and SfnaD synthetases are located in the staphyloferrin A pathway, while SbnE and SbnH catalyze the first and second reactions, respectively, of staphyloferrin B biosynthesis. Cloning of all four enzymes has been carried out along with pilot expression and purification experiments. Synthesis of the fluorinated SbnH analogue and the enzymatic production of the SbnH substrate are underway.

Monitoring the Hydroperiod of a Vernal Pool at Oak Mountain State Park: Can Amphibians Complete their Lifecycles?

Meredith Councill and Megan Gibbons

Vernal pools are temporary pools of water which serve as habitats for many organisms, including amphibians. These pools give amphibians a place to reproduce while protecting them from predators and are important in maintaining amphibian diversity. In 2012, a vernal pool at Oak Mountain State Park was surveyed for amphibian diversity to determine if the species present could complete their lifecycles before the pool dried. Results of this previous research showed that the vernal pool was not present long enough to support all amphibian species' aquatic stages. In this study, the pool was monitored throughout fall 2012 and spring 2013. Terrestrial and aquatic surveying and nighttime call identification were done to identify the species within and near the pool. While several years of data are necessary to fully understand the challenges faced by the amphibian community using this resource, trends between the 2012 data and this study will be an important step in understanding the hydrodynamics of a vernal pool and the resulting effects on the amphibian community.

Effect of Black Widow Spider Venom on Fatigue and Latent Period of *Bufo marinus* Gastrocnemius Muscles

Corey DeLoach and Andrew Gannon

Black widow spider venom (BWSV) has a chemical component known as α -Latrotoxin that affects the central nervous system and the neuromuscular junction by stimulating release of acetylcholine (ACh). In this study, we observed the effects of BWSV on cane toad gastrocnemius muscles. Specifically, we conducted an in vivo study on latent period, the time between nerve stimulation and initial muscle contraction and tetanic fade, the amount of muscle contraction possible after continuous stimulation, after BWSV injections. We found significant differences on latent period (p-value for unpaired t-test=0.002) with mean \pm SD for the control and experimental groups equal to 0.0245 ± 0.0019 and 0.0218 ± 0.0016 respectively, but we did not find significant differences on tetanic fade percentage (p-value=0.056) with mean \pm SD for the control and experimental groups equal to 77.42 ± 13.37 and 86.75 ± 11.59 . Our results suggest that the dosage used caused initial muscle conditions to be more affected than the long term effects. Therefore, envenomation will initially cause ACh to be massively released but the cell is still able to recycle the ACh when the muscle is continuously stimulated. Understanding the effect of BWSV on ACh release may help with treatment for envenomation as well as biological weapons and diseases related to ACh release such as Alzheimer's and myasthenia gravis.

The Comparison of Agonistic Behaviors in the Invasive Crayfish *O. virilis* and the Native Crayfish *P. acutus*

Presley Dickson and Megan Gibbons

In crayfish, individuals compete for life-sustaining resources through a series of agonistic behaviors. The amount of aggression exhibited by a particular crayfish can be dependent upon its species, chelae size, overall body size, gender, or weight, such that the larger features typically result in a competitive advantage. Therefore, in order for a non-native species of crayfish to successfully invade and dominate a new ecosystem, it would likely have to exhibit one or more of these larger features and/or show more aggressive behavior. In this study, a crayfish species invasive to Roebuck Springs in Birmingham, AL, and a native crayfish were paired interspecifically based on gender, body size, and weight. These assigned pairs participated in timed agonistic trials, during which the mean time each individual spent engaged in an agonistic behavior was noted. It was hypothesized that the invasive crayfish species would be more aggressive than their native counterparts due to their predicted larger size and greater aggressive tendencies. The study will improve upon the understanding of the relationships between invasive and native species, and, therefore, could increase the knowledge of how species distribution and declines in native populations can threaten an ecosystem.

Investigation of the Intracellular Pathway for Assembly of Cholinesterases by Cytosolic, Proline-rich Proteins

Abigail Dy and Leo Pezzementi

Soluble plasma tetrameric cholinesterases (ChEs) appear to be assembled by proline-rich fragments of cytoplasmic proteins. We examined the roles of proteasomal degradation and the TAP (transporters associated with antigen processing) pathway in cholinesterase tetramer formation induced by proline-rich cytoplasmic proteins. COS-7 cells transfected with nematode (*Dictyocaulus viviparus*) acetylcholinesterase (AChE) and RIAM (Rap-1-GTP-interacting adaptor molecule) were used as the model system to study the effects of proteasome and TAP inhibitors on the formation of ChE tetramers. The proteasome inhibitor MG132 produced a decrease in enzymatic activity in the presence and absence of RIAM and a decrease in tetramer formation in the presence of RIAM. These data suggest that proteasomal degradation of proline-rich cytosolic proteins could have liberated proline-rich fragments that assemble AChE tetramers. Experiments analyzing the effects of the TAP inhibitor BNLF2a, an Epstein-Barr virus (EBV) protein, produced a decrease in both cholinesterase activity and tetramer assembly in the presence of RIAM, specifically down to the basal level of tetramers produced in the absence of RIAM. Although BNLF2a did not affect tetramer formation in the absence of RIAM, the results suggest that proline-rich fragments of cytosolic proteins produced by proteasomal degradation are transported into the endoplasmic reticulum by the TAP pathway where they promote the assembly of ChE tetramers. This novel association of cytoplasmic proteins with secreted proteins could have broader implications for quaternary interactions in proteins. Furthermore, a better understanding of the assembly of soluble ChE tetramers could lead to the production of more stable ChEs that could be used to provide long-term protection against organophosphate toxicity.

The Iliac Spines of the Primates: Context for Bipedality

Chelsea Fernandez and Jason Heaton

As an indicator of bipedalism, the pelvis of the hominini beautifully illustrates the connection between form and function. As a reflection of this locomotor shift, the ilium, and more specifically the iliac spine, possesses a medio-lateral curve when compared to the great apes. The purpose of this study was to assess changes in the iliac curvature over evolutionary time by comparing bipedal species of hominins (*Australopithecus afarensis*, *A. africanus*, *Homo sapiens*) to their quadrupedal relatives (*Gorilla gorilla*, *G. berengei*, *Pan troglodytes*, *Papio anubis*, and *Papio ursinus*). In a total of 132 specimens from the National Museum of Natural History (Smithsonian Institution), the anterior superior iliac spine (ASIS), anterior inferior iliac spine (AIIS), posterior superior iliac spine (PSIS), and the posterior inferior iliac spine (PIIS) were measured for PSIS/PIIS distance and ASIS/AIIS distance, as well as os coxal breadth, and os coxal height. As a result, we found that the distance between the ASIS and AIIS was significantly greater in quadrupedal species than bipedal species when controlled for body size ($F(7, 125) = 179.80$ $p < 0.05$). Additionally, the PSIS and PIIS distance was significantly different between the quadrupedal and bipedal species ($F(7, 125) = 132.00$ $p < 0.05$). As a practical use to paleontologists, our results suggest that the shift in locomotion was accompanied by changes in ilial morphology related to muscle function that may be diagnosable in fragmentary fossil hominins.

Design and Synthesis of a Cyclic Citryl-Ornithine Analogue as a Novel Inhibitor for Staphyloferrin A Biosynthesis

Stephanie Gore, William Kittleman, and David Schedler

Staphylococcus aureus has been widely recognized as an important bacterium in human diseases. It is a dangerous pathogen that has developed a strong resistance to several commonly used antibiotics. The aim of the present study is to target the biosynthesis of Staphyloferrin A, one of two siderophores used by *S. aureus* to obtain essential iron. To accomplish this goal, a synthetic route of a cyclic citryl-ornithine analogue was developed. If this novel compound is effective, it would halt Staphyloferrin A biosynthesis leading to a potential therapeutic agent to battle *S. aureus* infections. The newly formed compound will be characterized by several techniques including ^1H - and ^{13}C -NMR, ^{13}C -DEPT, and infrared spectroscopy. Evaluation of the current product, along with progress to-date will be presented.

Exploring Mode of Action of a New Media for Expanded Cancer Stem Cells *In Vitro*

Paterson Graham, Pamela Hanson, and Steve McClellan

Most tumors contain a small population of cells known as cancer stem cells (CSC) that have many similarities to embryonic stem cells and differ dramatically from normal (bulk) tumor cells (BTC). CSCs exhibit slow growth and are both drug and radiation resistant. In addition, CSCs have the ability to differentiate into BTCs. CSCs have two specific modes of cell division: symmetric and asymmetric division. Unfortunately, long term *in vitro* culture and expansion of CSCs has proven difficult, making it hard for scientists to study these cells. Our lab has developed a new media formulation that allows for the expansion of CSC in culture, while maintaining them in an undifferentiated state. We hypothesize that this new media formulation is inhibiting asymmetric division of the CSCs, forcing them to divide symmetrically and increase their population. To test this hypothesis we transfected CSCs with a plasmid construct containing the human Oct4 promoter driving the expression of GFP. CSCs have green fluorescence, but once a daughter cell differentiates, it will turn off the expression of Oct4 and lose its green fluorescence. Video time-lapse microscopy was used to assess the fate of daughter cells. Using a second approach, we labeled CSCs and BTCs with different fluorescent quantum dots and monitored the cell growth using flow cytometry. Our data indicates that the new media does inhibit asymmetric division of CSCs. This will now allow researchers to accelerate studies using CSC, including the development of high throughput drug screening to discover new drugs to kill CSCs.

The Effect of Ephedrine on Crustacean Heart Rate and Ventilation Rate during Physical Activity.

Brendan Grondines and Andy Gannon

Ephedrine is a sympathomimetic agent that acts on both α and β adrenergic receptors and increases the release of norepinephrine from sympathetic neurons in vertebrates. Norepinephrine is a neurotransmitter released by the sympathetic nervous system to increase the “fight-or-flight” reactions of the body by increasing heart rate and ventilation rate among other things. Research has shown that many of the neurotransmitters present in the human nervous system are also present in the nervous systems of decapod crustaceans, suggesting that they may react similarly to ephedrine. However, one significant difference between vertebrates and decapod crustaceans is their heart. Decapod crustaceans have a neurogenic heart which means that the heartbeat is initiated by neurons in the pericardial ganglion rather than by pacemaker cells in the heart muscle itself. Previous ephedrine research has examined the effects of ephedrine on human athletes and determined that ephedrine increases ventilation rate and heart rate during exercise. In this study, we examined the effect of ephedrine on the heart rate and ventilation rate of the blue crab (*Callinectes sapidus*) while triggering its swimming instinct in order to mimic the structure of studies performed on human athletes. Surprisingly, our study found that ephedrine greatly decreases heart rate and slightly decreases ventilation rate during blue crabs’ physical activity. In conclusion, this study found that the effects of ephedrine are not evolutionarily conserved between vertebrates and invertebrates.

Investigating the Potential Association of Pollen and Particulates with Clinical Visits for Allergic Disorders

Heath Haggard and Wayne Shew

Asthma, allergic rhinitis, and allergic conjunctivitis are immune responses to aeroallergens that increase morbidity and reduce quality of life. This study seeks to determine if there is a correlation between patient visits to the Alabama Allergy and Asthma Center (AAAC) due to asthma, allergic rhinitis, and allergic conjunctivitis and daily pollen and airborne particulate counts in the Birmingham area. Daily pollen samples were collected at Birmingham-Southern College using a Burkard Volumetric Spore Trap during calendar years 2011 and 2012. The samples were examined microscopically to determine the number of elm, cedar, grass, and ragweed pollen grains/m³ of air. Daily particulate counts were accessed through the Jefferson County Department of Health. Patient data at AAAC was accessed using the clinic's *MedSym* electronic records software, and daily diagnoses of asthma, allergic rhinitis, and allergic conjunctivitis were recorded. Asthma and allergic reactions can be treated with drugs, but a more practical solution to limiting the symptoms of asthma, rhinitis, and conjunctivitis would be to avoid the asthma or allergy triggers by constructing a patient warning system. We believed a major benefit of this study could be to use the results to construct a patient warning system for the Birmingham area based on daily pollen and particulate counts. However, after initial data analysis there appears to be no correlation between the daily pollen and particulate counts and diagnoses and visits to AAAC.

Sea Surface Kinetics: Monitoring Ketyl Radical Anion Production from the Interaction of Carbonate and Sulfite Solutions with Triplet State 4-carboxybenzophenone

Nathan Haywood and Clyde Stanton

Photosensitized processes occurring at the air/sea interface play an important role in the chemistry of the sea surface microlayer. When light absorbing organics in this layer absorb photons and are excited to a higher energy level, they can undergo relaxation through several paths including reaction to form organic radicals. This study sought to determine the rate of ketyl radical anion formation during the non-radiative decay of the model compound 4-carboxybenzophenone in carbonate and sulfite solutions using the flash photolysis-laser absorption (FP-LA) technique. The measured rate constants of formation of the ketyl radical anion in carbonate was $1.38 \times 10^6 \text{ M}^{-1} \text{ s}^{-1}$ and in sulfite was $3.08 \times 10^8 \text{ M}^{-1} \text{ s}^{-1}$. These rates were slower than would be predicted in a diffusion-limited reaction ($k_D \approx 1 \times 10^{10} \text{ M}^{-1} \text{ s}^{-1}$). The rates of formation of the ketyl radical anion are in agreement with reported values of the decay rate of the triplet state suggesting that the formation of the ketyl radical anion is the primary relaxation pathway.

An Investigation of the Assembly of Cholinesterase through WAT-PRAD Interactions Involving Members of the MRL Protein Family

Lauren Nicholas Salazar Herrera and Leo Pezzementi

In this study, the assembly of cholinesterase (ChE) into its functional tetrameric form in the endoplasmic reticulum was investigated. The assembly is carried out through interactions between the tryptophan amphiphilic tetramerization domain (WAT) on the ChE subunit tail and proline-rich attachment domains (PRADs) on an organizing protein in which four catalytic subunits surround a PRAD to form the tetrameric unit. A previous study has sequenced the PRAD in butyrylcholinesterase (BChE) and found a fragment derived from lamellipodin, part of the MRL protein family, which also includes Rap1-GTP-interacting adapter molecule (RIAM) and Migration Protein-10 (MIG-10). An interaction between lamellipodin and ChE is unusual due to a lack of signal peptides in members of the MRL cytoskeletal protein family. To confirm this interaction is occurring, co-expression experiments were conducted between human BChE or nematode acetylcholinesterase (AChE) and members of the MRL protein family. It was found that co-expression with RIAM and Lamellipodin did induce assembly shown by the increase of tetramer proportion. MIG10 did not, and this difference was attributed to the length of the proline-rich regions in each protein. Co-expression of truncated constructs of RIAM with AChE was also conducted to determine which of two proline-rich regions of RIAM is responsible for the induction of tetramer assembly. It was found that the longer proline-rich region of RIAM was the responsible fragment. This insight gained into assembly of cholinesterase can be extended towards BChE and help in the determination of the function of BChE and its therapeutic impact.

The Bohr Shift and Effect of pH on Oxygen-binding Affinity of Hemocyanin in the Semi-terrestrial Crab *Ocypode quadrata*

Katie Hudgens, Andrew Gannon, and Scott Dorman

The semi-terrestrial crab *Ocypode quadrata* is a crab that conserves water in order to live on land. Because of reduced ventilation to conserve water, they have increased the amount of carbon dioxide in their hemolymph (blood), making it more acidic than aquatic crabs. Hemocyanin, the oxygen-binding protein in the hemolymph, is affected by the respiratory acidosis of *Ocypode quadrata*. The effect of pH on the oxygen-binding affinity of the hemocyanin will be observed because changes in pH should alter the hydrogen bonds which will affect oxygen affinity. The hemocyanin was extracted and purified from wild *Ocypode quadrata* and buffered at varying pH levels. The effect of pH was measured by using oxygen saturation curves and observing the partial pressure of oxygen at 50% saturation, or the P_{50} . Another examination of the effect of pH will be the Bohr shift. The Bohr shift occurs when there is a change in partial pressure of oxygen due to changes in pH. The Bohr shift will be measured with the Hill coefficient, which will be taken from the oxygen saturation curves. Results of the middle range pH levels exhibited similar partial pressures of oxygen at 50% saturation, which have similar Hill coefficients because the Hill coefficient involves the P_{50} value. The data collected could imply that the oxygen-binding protein is able to bind oxygen over a wide range of pH values, which could evolutionarily be beneficial for terrestriality in *Ocypode quadrata*.

The Effect of Temperature and Rainfall on Pollen Production and the Length of Pollen Seasons over Large Geographical Areas in the U.S.

Terri Kast and Wayne Shew

Climate changes have had an effect on many things around the world, including pollen production. Pollen production has been suggested to have increased over recent years because of the increase in temperature, based on observations over small, local areas. Also, the increase in local and regional temperatures has been suggested to increase the length of pollen seasons. An observed increase in the number of people that suffer from allergies and asthma symptoms has been reported in recent years; attributable by numerous authors to this increase in pollen production. We hypothesize that there will be an increase in pollen production as temperatures increase and that the pollen season will start earlier and last longer as temperatures increase over large geographical areas. Pollen counts from certified pollen collection stations were obtained from the National Allergy Bureau (NAB) for the following pollen types: *Ulmus*, Pinaceae, *Liquidambar*, Cupressaceae, and *Populus*. The counts were obtained for the past 10 years for the months of January to June. Also, pollen counts from the official Birmingham Pollen Station located on the BSC campus were examined for the past five years for the months of January to June. Temperature and precipitation data for the past 5-10 years for the months of January to June for each of the cities where the pollen stations are located were collected from the *National Oceanic and Atmospheric Administration* (NOAA). This data is being analyzed to determine if there is a significant increase in pollen production, and if there is a lengthening of pollen seasons as temperature increases.

The Ecology of Coontail (*Ceratophyllum demersum*), Plant Favored by the Watercress Darter (*Etheostoma nuchale*), Endangered fish Endemic to Jefferson County, AL.

Caroline King and Scot Duncan

Etheostoma nuchale, the watercress darter, is a federally endangered fish found in five springs in heavily urbanized Jefferson County, Alabama. Roebuck Spring has the largest population of darters. The darter uses the spring's dense aquatic vegetation for spawning, shelter, and foraging. Natural and unnatural disturbances to the spring are common and restoring vegetation in these locations could help recovery efforts.

Ceratophyllum demersum and *Fontinalis sp.* are two of the most favored habitats of the darters. Our goal was to characterize the stream environment of *Ceratophyllum*, while a concurrent study did the same for *Fontinalis*. At randomly chosen points in the spring and its run, stream width, water depth, current speed, and canopy cover were measured as was coverage of the plant along transects bisecting the stream. Productivity at each point was assessed by removing all vegetation in a fixed area and measuring its dry mass and ash free dry mass. Where *Ceratophyllum* was found, water depth averaged 23.2 ± 7.4 cm and current speed averaged 14.8 ± 12.3 cm/s. *Ceratophyllum* is found in shallower, faster water than that of *Fontinalis*. *Ceratophyllum* was found to be less productive than *Fontinalis*. It is hoped that our results will facilitate habitat restoration and creation for the watercress darter.

Plant Community Structure: As Determined by Abiotic Factors

Kevin Kirby and Peter Van Zandt

Plant community structure is the result of biotic and abiotic factors applying ecological pressures on a plant community. These pressures lead to competition within plant communities ultimately resulting in structural aspects such as species richness and percent vegetative cover. For this study, I focused primarily on the effects of water and light, which are the two major limiting factors for determining plant growth, vary the most over a local landscape. I hypothesized that soil moisture and light via their effect on species richness and percent vegetative cover, will drive understory plant community structural development in two sampling ranges within the Talladega National Forest. To more thoroughly understand interactions between abiotic factors and plant community development, I also took soil nutrient profiles for a subset of the study locations. Preliminary results show a strong correlation between soil moisture and plant species richness and also indicate a positive link between canopy openness and percent vegetative cover. These preliminary results are in line with the hypothesis that moisture and canopy density are the primary factors influencing species richness while soil nutrient availability is less influential. Though this study specifically focuses on the Talladega National Forest, the findings of this research can be applied to any forest of similar environment and could be used to produce prediction models for forestry management practices or understory conservation efforts.

The Effect of Rhizobial Bacteria on Induced and Constitutive Alkaloids of *Baptisia bracteata* and *B. tinctoria* (Fabaceae)

Elliot Kliossis and Peter A. Van Zandt

Plant defensive chemistry has been studied for many years and alkaloids have been shown to play a part in plant defense for various species of plants. Alkaloids are nitrogen-based compounds that are thought to defend many species of plants against herbivores. Legumes can form mutualistic relationships with rhizobial bacteria that make nitrogen available for plants in return for products of photosynthesis. It has been shown in previous research that elevated supplies of nitrogen lead to increased alkaloid concentrations in plants. Therefore, plants with mutualist rhizobia may have increased constitutive alkaloid concentrations and higher inducibility compared to plants grown without rhizobia. In this study, alkaloid induction rates were observed in *Baptisia bracteata* and *B. tinctoria* grown with and without rhizobia. In order to induce damage I had *Anticarsia gemmatalis* (velvet bean caterpillars) eat the plants to induce damage by consuming 10%-40% of total leaf tissue. I used acid-base extraction, followed by gas chromatography to measure the induced and constitutive concentrations of alkaloids in the plants grown with and without rhizobia. ANCOVA results showed that species did not differ in constitutive concentrations of alkaloids or in inducibility. Therefore, the addition of rhizobia did not impact plant defense for these species.

Characterization of the Role of *lvs1* in Endocytosis in Fission Yeast

Raeann Lamere and Melanie Styers

Chediak Higashi Syndrome (CHS) is a rare disease of the immune system that is caused by defects in the *LYST* gene. The diagnostic characteristics of CHS patients' cells are enlarged lysosomes and lysosome-derived organelles. The homolog of *LYST* in *S. pombe* fission yeast is *lvs1*. Mutant *lvs1* Δ cells exhibit defects similar to CHS patient cells, including enlarged vacuoles, the fission yeast equivalent of lysosomes. Our previous results qualitatively showed that uptake of FM4-64, a dye that is taken up via endocytosis, is altered in *lvs1* Δ cells compared to wild-type cells. We hypothesized that this difference in FM4-64 kinetics was either due to faster uptake, faster clearance, or both. Using flow cytometry to measure the mean fluorescence at each time point, we quantitatively determined that the rate of FM4-64 uptake was similar in wild-type cells compared to *lvs1* Δ cells. Washout of FM4-64 unexpectedly resulted in increased fluorescence over time in both *lvs1* Δ and wild-type cells, with *lvs1* Δ cells demonstrating decreased clearance. Comparison of mean initial fluorescence at the 0-min time points revealed decreased binding of FM4-64 in *lvs1* Δ cells in the uptake assay, but no significant difference in the washout assay. Cell cycle analysis confirmed that FM4-64 binding differences were not due to altered cell cycle progression in the mutant strain. Additional experiments with the Rab GTPase *ypt71p* suggested that *lvs1* overexpression rescues vacuolar defects of *ypt71* Δ cells. These studies suggest that clearance, but not endocytosis, is altered in *lvs1* Δ cells and implicate *ypt71p* in a pathway regulated by *ypt71p*.

Understanding the Mechanism of N-myc Interactor (Nmi)-induced Activation of Dickkopf-1 (Dkk1) in Breast Cancer

Kanika Manne, Pamela Hanson, and Rajeev Samant

Breast cancer causes the second leading cancer-related deaths among women in the United States. Previous studies in our laboratory have shown that expression levels of the nuclear protein, N-myc interactor (Nmi) are low in aggressive breast cancer cells. In constitutively Nmi expressing cells, the tumor suppressor protein Dickkopf-1 (Dkk1) was upregulated, which in turn inhibited the Wnt/ β -catenin pathway. Thus, reduced Nmi expression in aggressive breast cancer cells activated the oncogenic Wnt pathway. Prior work in our laboratory has also revealed that the region between -641 and -647 base pairs in the Dkk1 promoter potentially bares a transcriptional domain responsive to Nmi. In-silico searches revealed that this region may have an Enhancer box (E-box). Here, we explored the mechanism by which Nmi upregulates the expression of Dkk1 through the E-box. The effect of Nmi on E-box in the Dkk1 promoter was evaluated by conducting a luciferase reporter assay. The E-box region was inserted as three consecutive tandem repeats into a pGL3-promoter vector. Recombinant plasmids were transfected into MDA-MB-231 and MDA-MB-435 breast carcinoma cells. Luciferase activity from Nmi and non-Nmi expressing cells were compared. We observed a significant difference in the activity of the reporter between empty vector and its corresponding Nmi⁺ cell (one-tailed, $p=0.016$, $p=0.004$, $p=5.1 \cdot 10^{-5}$). Our attempts to generate a mutant E-box as a negative control serendipitously generated another canonical E-Box; thus, the mutant sequence was still responsive to Nmi. In conclusion, our work narrowed down on E-Box within the Dkk1 promoter as the Nmi responsive *cis*-regulatory DNA element.

Correlating Canine Tooth and Jaw Muscle Sizes in Predatory Felids and Canids

Shelby Moore and Jason Heaton

Understanding the relationship between tooth and jaw muscle size is key to grasping the mechanical limitations of predatory anatomy and their evolution. Dental and muscular anatomy are both relevant when considering bite force applied during the kill-bite of a predator; jaw muscles generate force and the canine teeth are the most important in the effectiveness of the kill-bite. Felids and canids utilize different kill-bites to obtain prey, potentially causing each family of predators to have a different relationship between tooth size and jaw muscle size. If muscle and tooth size are not proportional, excess force can cause failure of the canine teeth during the kill-bite and likely lead to death of the predator. During this analysis, the canine tooth was treated as a cone to determine volume while muscle size was calculated by measuring their depth using skeletal landmarks. Nineteen specimens of each family were measured in this study, including the grey fox, red fox, grey wolf, spotted hyena, bobcat, leopard, and African lion. The ratio of tooth width to tooth length appeared to be closer to one in felids than in canids, suggesting that the teeth of felids are built to withstand a stronger bite force in the kill-bite. Ultimately, this analysis may be used to generate a phylogeny to compare to molecular phylogenies and the prediction of fossil taxa based on elements of morphology.

Effect of KP1019 on the *Saccharomyces cerevisiae* Stress Response

Rowan W. Nailen, Pamela Hanson

Indazolium *trans*-[tetrachlorobis(1*H*-indazole)ruthenate(III)] (KP1019) has been shown to be effective in reducing the growth of solid state tumors through damaging DNA. KP1019 binds to DNA, interfering with and impeding or preventing replication. DNA damage initiates a variety of stress responses within the cell. Like other DNA damaging agents, KP1019 has been shown to evoke the environmental stress response (ESR) and cell death in the budding yeast *Saccharomyces cerevisiae*. *S. cerevisiae* makes a good model organism due to its similarity to a cancer cell; it grows best in acidic environments and replicates rapidly. The mitochondria within a cell house a number of environmental stress response (ESR) proteins. In this study the stress response protein Fmp16 has been shown to be induced by KP1019, but deletion of Fmp16 does not increase sensitivity to KP1019 on either fermentable or non-fermentable media. Previous studies have shown that Fmp16 is phosphorylated by the kinase Pkp2, suggesting that Pkp2 is a regulator of Fmp16. Much like deletion of Fmp16, deletion of Pkp2 did not affect sensitivity to KP1019.

Characterization of the effects of *gea1* haploinsufficiency on cell cycle progression and septation in *Schizosaccharomyces pombe*

Benjamin Perrin and Melanie Styers

Plus-strand RNA viruses cause many deadly diseases, such as polio, severe acute respiratory syndrome (SARS), and Ebola. Previous research has shown that plus-strand RNA viruses manipulate proteins in membrane trafficking pathways, including the human guanine nucleotide exchange factor GBF1, as a means of producing specific organelles for RNA replication. The *gea1p* protein, a fission yeast homolog of human GBF1, is thought to be responsible for initiating recruitment of coat proteins to membranes, resulting in vesicle formation. Like GBF1, *gea1p* is responsible for activating ARFs which facilitate vesicle formation by recruiting coat proteins to the membrane. In *S. pombe*, it has been shown that *gea1* haploinsufficiency causes defects in morphology of the septum, a specialized cell wall structure formed at the medial region prior to cell separation during cytokinesis. Vesicle-mediated secretion of the enzyme *bgs1* has been shown to be necessary for the formation of the primary septum. Therefore, based on the observed septation defects, we hypothesized that *gea1*^{+/-} cells would exhibit G2/M cell cycle arrest and mislocalization of *bgs1p*. To test these hypotheses, we used flow cytometry with propidium iodide staining to analyze cell cycle progression and fluorescence microscopy to assess localization of *bgs1*-GFP. Contrary to our hypotheses, our results suggest that *gea1*^{+/-} cells exhibit arrest in the G1 phase of the cell cycle. Furthermore, preliminary evidence suggests that *Bgs1* may localize correctly in *gea1*^{+/-} cells. These results suggest that *gea1* haploinsufficiency may cause previously unanticipated effects on cell cycle progression and *bgs1p* localization.

Examination of Selected Nocturnal Moth Species for Presence of Pollen on Mouth Parts and Proboscides: Do these Moths Play a Role in Pollination?

Brandon Perry, Wayne Shew, and Pete VanZandt

Animal pollinators are important in the reproductive success of many plant species. Much is known about diurnal pollinators, but little about the role that nocturnal species play in pollination of flowering plants. This study seeks to answer the question: Do nocturnal moths play a role in pollination? Research by Kathryn LeCroy in 2011 found several species of moths that had a significant number of pollen grains present on their mouth and body parts, an indicator of flower visitation. However, she only examined a small number of specimens of each species. This study examined multiple specimens of three species reported by LeCroy to have a significant number of pollen grains present on mouth and body parts, and two additional species not investigated by LeCroy but believed to play a role in pollination. The following species were examined: *Hypagyrtis esther*, *Elaphria grata*, *Atteva aurea*, *Macaria multilneata*, and *Chrysodeixis includens*. Pollen grains were collected from the moths and mounted in glycerin jelly containing fuchsin stain. The pollen was examined using light microscopy, and the pollen identified to the lowest plant taxon possible. If greater than fifty percent of examined specimens of a given species had pollen on their mouth parts/proboscides, the species was considered to be a regular plant visitor and possible pollinator. *Chrysodeixis includens* and *Atteva aurea* were determined to be regular flower visitors and to play a potential role in pollination. Additionally, length of the proboscis was measured for each species. No definitive correlation between length of proboscides and likelihood of flower visitation was found.

Ventilatory Responses to Short Term Changes in Ambient Osmolarity in the Crayfish, *Procambarus clarkii*

John Powers and Andrew Gannon

Several crayfish species have the ability to survive in both salt and fresh water and can migrate slowly between both extremes. Furthermore, crayfish osmoregulate, or maintain a constant hemolymph ion concentration, when acclimated to freshwater, but osmoconform, or maintain a hemolymph ion concentration approximately equal to the ambient ion concentration, in more brackish water. The point at which these physiological processes switch is known as the isosmotic point. The physiological process of osmoconforming or osmoregulating occurs at the gills, which have cells specifically adapted for either gas exchange or ion regulation. Species of fish that share similar gill cells and functionalities can experience what is known as an osmorepiratory compromise, where ion regulation in fish becomes less efficient to compensate for increased gas exchange in exercising fish. This paper attempts to determine if there is a similar relationship in the crayfish species *Procambarus clarkii*. It is hypothesized that inducing osmotic shock (e.g. introducing osmoconforming individuals to an osmoregulating medium) will cause a decrease in ventilation rate, sacrificing ventilatory efficiency to decrease the loss of ions through the gills. The isosmotic point for *P. clarkii*, n=17, was found to be 673.5 ± 2.65 mOsmols/L and the ventilation rates of osmotically shocked *P. clarkii* specimen will be recorded and compared to a control group to determine if the osmorepiratory compromise exists in crayfish.

Effects of Exterior Platform Angle on Flake Mass and Debitage

Avi Purohit and Jason Heaton

Archaeological sites in Africa contain primitive stone tools dating back to 2.6 million years ago that were created for utilitarian purposes, such as defleshing dead animals. Currently, analyses are mostly focused on the characterization of the stone tools and the flakes that are removed during flint knapping, the process of stone reduction. Recent research has touched on the relationship of exterior platform angles of a stone and masses of the flake. Using an apparatus to mimic human striking, we hit obsidian at varying exterior platform angles with a steel hammer and a constant force. The apparatus contained a wooden platform with a uniaxial hinge and an arm attached to both the spring and the steel hammer. The spring, which provides the force, and its attached arm were raised to a constant height. Upon release, the steel hammer would strike the obsidian at a prescribed platform depth (~ 8.7 mm). The mass of the removed flake and its debitage were weighed after each strike (n=100). No significant results were found between the range of angles (50-60, 61-70, 71-80, 81-90 degrees) and the mass of flake and debitage (all R^2 values = ~ 0). With an improved apparatus and a better hammer striking method, we can possibly obtain stronger results showing a relationship between the different variables tested.

Determining Bamboo Tool Efficiency Based on De-fleshing Time(s) during Butchery

Melinda Rogers and Jason Heaton

The hypothetical Movius line divides modern day East and Southeast Asia from India, Africa, and Europe based on the non-use and use of stone hand-axes by early hominins. Many hypotheses have been proposed to explain variation in stone tool use between these regions; hand-axes in the west and none in the east. A potential hypothesis states that the lack of hand-axe use in Eastern and Southeastern Asia is due to the use of bamboo tools instead. However, little is known about the efficiency of the bamboo tool-type. Thus, we focused on conducting tool efficiency comparisons between bamboo implements and stone hand-axes. We hypothesized a difference in efficiency between a bamboo knife and a stone hand-axe. Within prescribed amounts of time (10-40 minutes, task dependent) we performed four different de-fleshing tasks per specimen during the butcheries. For comparison, each task was performed with both stone flakes and bamboo knives; including the amount of time required to cut into the skin, remove the skin, remove the underlying tendons and ligaments, and to disarticulate the specimen's proximal or distal joints. Overall, the bamboo knives demonstrated significantly ($p < 0.001$, $n = 28$) slower de-fleshing times than the stone flakes, thus they are less efficient. The bamboo knives were difficult to use in all tasks, especially cutting into the skin. Difficulty in maneuvering a tool increases the time required to complete tasks, thus decreasing its efficiency. Consequently, bamboo would not have been used to the exclusion of stone tools.

Analysis of the Effects of *pik1* Overexpression in *Schizosaccharomyces pombe* *geal* +/- Cells

Kristie Searcy and Melanie Styers

The plus-strand RNA virus, Hepatitis C (HCV), requires essential membrane trafficking proteins in order to reorganize cellular membranous organelles for viral replication. GBF1 is necessary for both membrane trafficking and HCV replication due to its role in activation of ARF1 by catalyzing the exchange of GDP for GTP. PI4K phosphorylates phosphoinositides at the 4 position, forming the lipid product PI4P, which has been suggested to be required for GBF1 recruitment. The goal of this study was to use *Schizosaccharomyces pombe* as a model organism to study the pathway involved in membrane trafficking during viral replication. *S. pombe* strains carrying deletions or mutations in *geal* and *pik1* share similar phenotypes, and previous research shows that both are required for proper cell division and septation. Since *geal* and *pik1* are homologous to GBF1 and PI4K, respectively, we hypothesized that *pik1* phosphorylates lipids to recruit *geal* to the Golgi membrane and increase its activity. Because deletion of *S. pombe geal* causes lethality, we used the BFA-sensitive, haploinsufficient *geal* +/- strain as a model. To test our hypothesis, we analyzed the effects of *pik1p* overexpression on BFA sensitivity and assessed PI(4)P levels in wildtype and *geal* +/- cells. Results from a spot assay revealed that *pik1p* overexpression rescued growth of *geal* +/- cells on media containing BFA. In addition, total levels of cellular PI4P in *geal* +/- cells were 68% of that of wildtype cells. These results suggest that *pik1p* overexpression increases *geal* activity, and that decreased expression of *geal* decreases *pik1* activity in a feedback mechanism.

Reversibility of Clinical Signs of Equine Summer Pasture Recurrent Airway Obstruction

Priscilla Sharon Shaw, Andy Gannon, and Cyprianna Swiderski

Summer pasture recurrent airway obstruction (SPRAO) is an equine pulmonary disease that makes breathing difficult. Clinical signs include chronic cough, labored expiration, nasal discharge, flared nostrils, airway hyper-responsiveness, and reduced stamina. The clinical signs and characterization of SPRAO are similar to that of human asthma and chronic obstructive pulmonary disease (COPD). Horses and humans have the same beta-2 adrenergic receptors (β_2 -ARs) present in the lungs, which could allow horses to be used as naturally occurring models of human asthma. Continuous activation of β_2 -ARs is responsible for the airway hyper-responsiveness (AHR) of human asthma and possibly SPRAO. The reversibility of AHR in horses has been clinically observed, but not quantitatively documented. In this study, we measured pulmonary mechanics for the purpose of documenting the AHR in SPRAO horses to methacholine exposure and reversibility of symptoms with levalbuterol (Xopenex) rescue. AHR was determined as an increase in airway resistance due to bronchoconstriction. Significant increases in airway resistance were observed in SPRAO horses with higher doses of methacholine (mean percent change= 31.76%; p-values < 0.01; n=6) and significant decreases with levalbuterol (Xopenex) rescue (mean percent change= 48.37%; p-value= 0.0142). The airway resistance of the control horses was significantly lower (SPRAO mean= 2.01; control mean= 0.47; p-values <0.01; n=5-6) than that observed in SPRAO horses, except for that observed with Xopenex treatment. This research could prove useful in future SPRAO research to advance treatment of this disease, and could help advance research in human asthma and COPD.

Water Quality of Shades Creek Watershed near Agriculture Land

Jeffery Steele and Andrew Gannon

Agriculture runoff can have severe impacts on the bodies of water within a watershed. Shades Creek watershed contains areas zoned and used for agriculture purpose and therefore, several areas within its run were selected for water quality testing. Geographical Information Systems (GIS) were used to predict areas where agriculture land within 0.05 km of Shades Creek would have the most severe impact. Control samples were collected during a 7 day period of no rainfall. Experimental samples were collected within 24 hrs of rainfall. We hypothesized that watershed from farm land near Shades Creek, and its tributaries would contain increased levels of fecal contamination dissolved oxygen, turbidity, pH, nitrates and phosphates immediately after rainfall events, relative to the same areas at times with no rainfall. Preliminary results indicate that runoff from rainfall events increased fecal coliform levels, which was present at all time, and turbidity. Dissolved oxygen and pH varied greatly but did not change consistently or significantly with rainfall. Nitrate and phosphate levels were at or below detection levels at all times, thus no agricultural impact was observed on these parameters which are found in fertilizer and fecal contamination. The overall impact of agriculture land on Shades Creek and its tributaries was minor based on data collected.

Preferred Habitat of the Invasive Northern Crayfish (*Orconectes virilis*) in Roebuck Spring, a Critical Habitat for the Endangered Watercress Darter (*Etheostoma nuchale*)

Rachele Struthers and Scot Duncan

The Southeast has more aquatic species than anywhere else in the temperate world, yet many are endangered. *Etheostoma nuchale* (watercress darter) is a federally endangered species found in five springs in Jefferson County, one of the most urbanized counties in Alabama. A co-occurring non-native invasive crayfish species *Orconectes virilis* (northern crayfish) may be a threat to *Etheostoma nuchale* as a predator and competitor. To examine habitat use by *Orconectes virilis* and habitat use overlap with the darter, we trapped crayfish in the five most common aquatic habitats at Roebuck Spring, one of the fish's strongholds. A previous study (Rabbit and Duncan, 2012) found no differences among habitats for crayfish densities, and no correlation between darter densities (known from Duncan and Kuhajda, 2012) and crayfish densities across the habitats. However, this study used baited traps, and capture frequencies may have been artificially high. In the present study, we have found that unbaited minnow traps covered with opaque plastic yielded comparable numbers of crayfish as baited traps. We will set such traps in the five habitats >15 m apart for 48 hours. Species, body length, and sex will be recorded for each captured crayfish. Trapping is ongoing and results will be presented at the conference. Based on the previous study, we expect neither differences among habitats, nor any relationship between crayfish and darter densities across the five habitats. This study should help indicate the extent to which the crayfish is a threat to the darter.

Effect of 2DG and Catalase Overexpression on KP1019 Sensitivity

Blake Tennant and Pamela Hanson

Elevated levels of oxidative stress caused by H_2O_2 and oxygen radicals are common characteristics of cancer cells. Since this stress can lead to apoptosis, scientists are developing clinical methods of increasing oxidative stress and combating cellular methods of decreasing oxidative stress. Indazolium *trans*-[tetrachlorobis(1*H*-indazole)ruthenate(III) or KP1019 increases oxidative stress and leads to decreased cancer cell proliferation. However, increased glucose metabolism through the pentose phosphate pathway (PPP) and the enzyme catalase can alleviate oxidative stress. Thus, methods of inhibiting the PPP have become of great interest to cancer researchers. One method involves the glucose metabolism inhibitor 2-deoxy-D-glucose (2DG). Because of KP1019's ability to increase oxidative stress and 2DG's ability to inhibit the PPP, we sought to determine if a combined modality treatment involving both would lead to decreased cell survival. Also, because of catalase's ability to decrease oxidative stress, we sought to determine if cell sensitivity to KP1019 decreases when catalase expression is elevated. We used *Saccharomyces cerevisiae* as a model organism to analyze these effects. A high copy catalase plasmid was purchased and used to overexpress the cytosolic catalase Ctt1 in wild-type yeast. Also, a pre-stress NaCl treatment was used to overexpress catalase. Growth of Ctt1 overexpressing and control yeast was analyzed in the presence and absence of KP1019. A similar qualitative approach was used to assess yeast growth in the presence of 2DG and KP1019. We did not observe a conclusive change in KP1019 sensitivity with excess catalase. However, increased KP1019 sensitivity in the presence of 2DG was observed.

Determining the Effects of Intensive Trapping on Population Size, Sex Ratio, and Body Size in Invasive *Orconectes virilis* at Roebuck Springs

Jessica Thornton and Megan Gibbons

Invasive species are credited as the second greatest threat to biodiversity. Of the 950 species listed under the Endangered Species Act, 400 are primarily threatened by invasive species. *Orconectes virilis* is an invasive crayfish species inhabiting Roebuck Springs in Birmingham, AL. Invasive crayfish may negatively impact native species in several ways, including acting as predators on small native fish. This is of particular importance because the endangered Watercress Darter (*Etheostoma nuchale*) resides in Roebuck Springs. Previous studies indicate that intensive trapping of invasive crayfish may successfully reduce catch rates, suggesting that trapping can be used as a population control mechanism. Traps generally target the largest individuals first, leaving the smaller-sized individuals untrapped. However, this strategy remains the most common technique used for controlling invasive crayfish species. After a dam removal in 2008, the Darter suffered a significant population loss. Recovery efforts began, which included intensive trapping of *O. virilis*, a suspected predator. Traps were baited and set along five separate sites at the spring and checked every 3-4 days. Upon capture, invasive crayfish were transported to the laboratory and placed in a freezer for cyroeuthanasia. Body measurements and gender were recorded and statistical analyses were conducted to determine the effects of intensive trapping on catch rates, sex ratio, and body size in *O. virilis*. The results from this study will increase our understanding of population dynamics of invasive species, and hopefully inform future studies aimed to preserve biodiversity.

Stream Environment of Aquatic Moss (*Fontinalis* sp.): A Critical Habitat of the Endangered Watercress Darter (*Etheostoma nuchale*)

Kathryn Turner and Scot Duncan

Urbanization of Jefferson County, AL, has led to habitat loss and degradation for the watercress darter (*Etheostoma nuchale*). The 1992 Watercress Darter Recovery Plan initiated studies focused on the species' ecology. Initial studies showed the darter prefers deep, slow moving springs dense with aquatic vegetation. Previous research identified aquatic moss (*Fontinalis* sp.) and coon's tail (*Ceratophyllum demersum*) as aquatic plant species that support high densities of *E. nuchale*. Therefore, these plants may be used to create and restore habitat for *E. nuchale* within its current range. Before restoration project initiation, more knowledge about the ecological requirements of these aquatic plants is required. The first objective of this study was to characterize the stream environment in which *Fontinalis* was found and compare it with *Ceratophyllum*. Variables affecting plant distributions in streams were measured: stream width, water depth, water current speed, and canopy cover. At an average depth of 56.4 ± 20.4 cm and current speed of 1.6 ± 1.1 cm/s, *Fontinalis* occurred in deeper and slower moving water than *Ceratophyllum*. Second, plant samples were collected to determine the productivity of each species in terms of three biomass indicators: dry mass, ash free dry mass, and percent plant cover. *Fontinalis* was identified as more productive than *Ceratophyllum*. Last, the stream variables were related to the productivity of *Fontinalis* in the spring pool and run. No stream variable was identified as an indicator of productivity. Knowledge of the ecological requirements of favored aquatic vegetation will lead to more efficient habitat restoration and creation for *E. nuchale*.

Investigating Associations of *Alternaria* and *Cladosporium* Spores with Asthma Exacerbations in Birmingham, Alabama

Erin Vogt and Wayne Shew

Asthma is a chronic respiratory disease that affects many people worldwide. People that live with asthma find that certain triggers, such as exercise, pollutants, stress, and mold spores, can cause an asthma exacerbation. Symptoms of asthma attacks include chest tightening, wheezing, shortness of breath, and in extreme cases, suffocation. The two types of fungal spores most closely associated with causing asthma attacks are *Alternaria* and *Cladosporium*; which are present in both indoor and outdoor air. It has been found that the mold spores are the most numerous during the wet and hot months, May to October. We examined the periods May 1, 2010 to October 31, 2010 and May 1, 2012 to October 31, 2012; determined the daily spore counts for *Alternaria* and *Cladosporium* in outdoor air, and examined patient data of individuals reporting asthmatic symptoms such as coughing, shortness of breath, and allergic rhinitis, which were seen by physicians at Alabama Allergy and Asthma Center. In addition, we examined results of a spirometry test (FEV1), which measures possible inflammation of the bronchial pathways and is used to diagnose COPD. We expect there will be a lag time of about three days between high levels of *Alternaria* and *Cladosporium* spores in outdoor air and the time that patients complain of asthmatic symptoms; a finding reported in previous research studies. Our investigation seeks to determine if there is a statistically significant correlation between high numbers of *Alternaria* and *Cladosporium* spores and patients experiencing asthma exacerbations and allergic rhinitis.

Overexpression of *Geal* Rescues Brefeldin A Sensitivity in *Geal*^{+/-} Fission Yeast

Blaise White and Melanie Styers

Positive-strand RNA viruses, such as Hepatitis C, cause many serious health issues due to a lack of antiviral drugs. By characterizing a key protein involved in the viral replication cycle, GBF1, new antiviral targets may be identified. GBF1 is a guanine nucleotide exchange factor that regulates transport of proteins between the endoplasmic reticulum and the Golgi. Deletion of the fission yeast ortholog of GBF1, *geal*, is lethal. Therefore, to characterize this protein, we evaluated the heterozygotic *geal*^{+/-} strain. As expected, mutant cells showed decreased *geal* mRNA levels in comparison to wildtype cells. Quantification of mRNA levels revealed that expression of *geal* was 54% lower in mutant cells than in wildtype cells. To characterize *geal* function, wildtype, mutant (*geal*^{+/-}), and overexpression (*geal*^{+/-} + *geal*) strains were treated with Brefeldin A (BFA), a known GBF1 inhibitor. Spot assays and dose-response assays were used to evaluate the effects of BFA on these strains. The results showed that mutant cells are more sensitive to BFA than wildtype cells. In addition, overexpression of *geal* rescued the BFA sensitivity of mutant cells. This data supported the hypothesis that decreased expression of *geal* results in higher sensitivity to BFA, and that overexpression of *geal* leads to BFA resistance. By characterizing *geal*, conserved regulatory pathways can be explored, which may lead to the identification of novel antiviral targets. This study further supported the notion that *geal* is the yeast ortholog of *GBF1*, and also helped establish *S. pombe* as a model system to study this pathway.

Effect of Birmingham's Urban Heat Island on Moth Phenology

Grant Williams and Peter Van Zandt

Urbanization has a multitude of negative effects on natural ecosystems. One of these is the Urban Heat Island (UHI), which is characterized as a dome of hot air that forms over large cities due to the increased trapping of radiation in the vertical and horizontal man-made surfaces. This warm dome of air has been shown to advance spring phenology of plants, but its effect on invertebrates has not been examined. Since temperature has been shown to advance phenology of certain invertebrate ectotherms, the UHI should have an effect on phenology of these animals. Moths are the subject of this study, as they are an abundant species in the Southeastern United States and are a good indicator of how other invertebrates will respond to increased temperature from the UHI. This paper examines the effect of the UHI on moths captured from three sites with differing degrees of urbanization during the Summer of 2012: Turkey Creek Nature Preserve, Ruffner Mountain, and the BSC ecoscape. We have established that there is a temperature gradient between the three sites. We focused on species that were found at all sites, easily identifiable, and present in sufficient numbers for data analysis. We compared the flight phenologies of these focal species using a survival analysis. We found that in several species, moths at the more urbanized sites had significantly advanced phenology.

Effects of a Cancer Genetic Counseling Clinic Video on Anxiety, Perceived Risk, and Knowledge.

Anna Wilson and Pamela Hanson

Genetic counseling is a field of research and clinical practice, which aims to educate patients about the implications of genetic disease, prepare patients for testing, and guide patients through the process of analyzing and acting upon their results. Educational videos have often been used by genetic counselors as an effective tool for facilitating appointment time and giving patients the knowledge they need coming into a counseling session. Previous research has shown that these videos help ease the worries and perceptions of cancer risk that patients often feel before appointments begin. This project examines the effect of one such video from the University of Alabama at Birmingham's Department of Genetic Counseling on anxiety, perceived risk, and knowledge of students from Birmingham-Southern College. Pre-and post-surveys were used to examine the video's impact on anxiety and knowledge of cancer. Multivariate analysis will be used to determine whether the number of friends or family members with cancer impacts subject responses in these areas.