

College of Science

Poster Number 147: Taylor Bailey

“Recombinant approach to control *Listeria monocytogenes* infection in pregnant guinea pigs”

Listeria monocytogenes (LM) is a Gram-positive bacterium, ubiquitous in nature and is associated with foodborne illness transmitted by produce and processed meat and dairy products. Incidence rates of listeriosis are relatively low, however, the morbidity of the disease is disproportionately high in pregnant women and their fetuses often manifesting as meningoencephalitis or spontaneous abortion. In this study, we tested the protective capacity against LM infection of a bioengineered *Lactobacillus casei* expressing the *Listeria* Adhesion Protein (LAP) using a pregnant guinea pig model. Animals were divided into experimental groups with differential probiotic application and pathogen challenge. Microbial loads, serology and histopathology were determined upon sacrifice in feces and organs/tissues. Although preliminary examination demonstrated limited clinical or pathological evidence of infection, microbiological analyses suggest colonization potential of the probiotic correlated with increased or decreased shedding of the pathogen. Further analysis is to include interrogation of gut microbiome perturbation by application of the probiotics. As our understanding of the importance of the interplay between commensal microflora and the GI tract grows, probiotics are increasingly becoming a more desirable therapeutic vector. Such targeted approaches may offer pathogen-specific protection while offering non-specific improvements to mucosal immunity.

Poster Number 148: Shovik Bandyopadhyay

“Combinatorial Inhibition of Cholesterol Esterification and Bcr-Abl Synergistically Suppresses Proliferation of Chronic Myeloid Leukemia with Bcr-Abl Independent Imatinib Resistance”

Since the advent of tyrosine kinase inhibitors (TKIs) such as imatinib (IM), nilotinib, and dasatinib, chronic myeloid leukemia (CML) prognosis has improved greatly. However, 30-40% of patients resist imatinib therapy, and 40% of these patients display Bcr-Abl independent resistance. In these cases imatinib dose escalation is the commonly used treatment option, which is often ineffective. In our evaluation of CML cell lines through label-free Raman spectromicroscopy, we discovered an aberrant accumulation of cholesterol ester. Targeting cholesterol esterification with avasimibe, a potent inhibitor of acyl-CoA cholesterol acyltransferase 1 (ACAT-1), significantly suppressed CML cell proliferation and overcame imatinib resistance in Ba/F3 cells with the kinase domain T315I mutation and K-562-R cells with Bcr-Abl independent imatinib resistance. We also showed that altered cholesterol metabolism in CML is a cancer-specific target because normal cells do not accumulate cholesterol ester. Furthermore, we showed that combination of avasimibe and imatinib causes a profound synergistic inhibition of cell proliferation in K-562-R cells with Bcr-Abl independent resistance, but not in Ba/F3 T315I. Collectively, these data suggest a new avenue for overcoming Bcr-Abl independent TKI resistance in CML by targeting altered cholesterol metabolic pathways.

Poster Number 149: Dhruv Bole

“Conformational Changes of a Membrane Bound Protein--ABC Transporter”

The ATP-Binding Cassette, or ABC transporter, is a group of diverse membrane-bound proteins involved in numerous diseases including cystic fibrosis, cancer and multidrug resistant bacteria. Little is known about these proteins but the ribose transport complex in bacteria may serve as a model for how these transporters transport molecules too and from the cell. Knowledge of the conformational changes of these proteins may one day lead to an effective drug. The purpose of this study is to determine how ATP hydrolysis morphs the protein complex from an ‘unbound’ to ‘bound’ state. To determine the configuration of the proteins, ribose transport complexes associated with sequential stages of the transport cycle were isolated in the presence of different substrates. By adding strategic cysteine mutations, these complexes were studied using Electron Paramagnetic

Resonance (EPR) spectroscopy to observe how protein interaction affected their conformation. The results below show ribose interactions of the nucleotide-binding domain (NBD), RbsA, with different variations when Mg²⁺, vanadate, and ATP are added. These results suggest that the complex 'opens' up when those three components are added together. Future experiments include how ribose interactions of TMD, RbsC, associate with ribose-binding protein RbsB, which in turn interact with nucleotide binding-domain RbsA. This clinically relevant complex could give us further insight to how these ABC transporters transport molecules to and from the cell.

Poster Number 150: Melissa Casella

"Src-mediated phosphorylation of Aplysia cortactin"

Cortactin is an actin-binding multi-domain protein and substrate for Src tyrosine kinase with functions in cell migration, endocytosis, and tumor cell metastasis. The role of Src-mediated tyrosine phosphorylation of cortactin is not well understood in several of these actin-dependent processes. Recent work from our laboratory revealed that both Src2 and phosphorylated cortactin are critical for controlling actin organization and dynamics in Aplysia neuronal growth cones; however, we do not have any direct biochemical evidence that Src2 phosphorylates cortactin in Aplysia. We used cortactin co-immunoprecipitation and immunoblotting to address this problem. Using protein lysates from Aplysia central nervous system tissue, we were unable to demonstrate an interaction between Src2 and cortactin thus far. Furthermore, immunoblotting with an anti-phosphotyrosine antibody did not reveal any phosphorylated cortactin. It is possible that the level of tyrosine phosphorylation is relatively low in adult Aplysia neurons and therefore difficult to detect with our method. We currently use heterologous expression of cortactin and constitutive active Src2 in CHO cells in order to determine whether Src2 phosphorylates Aplysia cortactin. Future studies will identify which specific tyrosine is phosphorylated. This will enable us to design a phospho-cortactin-specific antibody, which will be an invaluable tool to investigate the function of cortactin phosphorylation in growth cone motility and guidance. /

Poster Number 151: Ariana Ciglar

“Determining Function of Proteins in Sindbis Virus via Fluorescent Tagging”

The functions of proteins E2 and NSP1 in Sindbis virus are not very well known. To better understand the function of these proteins at each step of viral entry and replication, red and yellow fluorescent protein genes were ligated to the E2 and NSP1 genes. This will result in fluorescently-tagged proteins. Cell cultures will then be incubated with the modified virus, allowing our group to track the movement of these proteins during each step of viral entry and replication using live imaging. This will help determine the function of these proteins.

Poster Number 152: Jessica Cleveland

“When the going gets tough do the tough get going?: Ramifications of drought on parasite populations.”

Climate change has become the topic of major concern, especially as we work to predict its impact on humanity. There is evidence that climate change will result in increased prevalence of disease in humans. Host parasite interactions in unfavorable conditions have become a significant field of study with the rising concerns generated by global warming. *Schistosoma mansoni* is a parasite that causes schistosomiasis, a disease that impacts over 230 million people. The parasite has a complex life cycle that uses the aquatic snail *Biomphalaria glabrata*, from which the infective stage to humans is released. Drought, a condition that is disadvantageous for *B. glabrata* snails host of *S. mansoni*, is an environmental condition that is considered to be worsening as global warming progresses. The goal of this study is to determine the effects of drought on *S. mansoni* development and transmission. Previous studies to identify the effects of drought on the parasite have not yet been carried out. Six hundred seventy two *B. glabrata* snails were divided into 4 treatment groups: Control (uninfected, no

drought), Stress-Control (uninfected, droughted), Infected-Control (infected, no drought), and Infected-Stress (infected, droughted). We measured parasite and host life history traits (time to infection patency, number of parasites shed, host growth, reproduction, and mortality) in hopes to shed light on how populations in high-risk areas may be affected by drought now and in the future.

Poster Number 153: Ehren Brant Coburn

“The Relations Between Stochastic Processes, the Temperley-Lieb Algebra and Quantum Spin Chains”

We examine a stochastic model known as the raise and peel model, which describes a surface growing by deposition of particles onto a surface. This includes a mechanism that peels portions of the surface by creating avalanches of desorbing particles. Stochastic models such as the raise and peel model can be written as a Markov process. The structure of the raise and peel model for one particular choice of parameters has been found to have an interesting connection to the Temperley-Lieb Algebra and XXZ quantum spin chains. The Temperley-Lieb Algebra is given by operators and relations which can be interpreted as the processes taking place in the raise and peel model. Therefore, the Hamiltonian for this system can be expressed in terms of the generators of the Temperley-Lieb Algebra which in turn have a representation as XXZ quantum spin chains. As an example, we show this explicitly for a spin chain of length $L=2$ and $L=4$. We conclude by describing our current investigation of the spectra of the cyclic representation of the periodic Temperley-Lieb Algebra in terms of combinations of XXZ quantum spin chains. The cyclic representation of the Temperley-Lieb Algebra can be described graphically by the wrapping of loops around a cylinder. Numerical studies have shown a complex Virasoro spectrum suggesting an underlying connection to a combination of XXZ spin chains that we plan to uncover.

Poster Number 154: Jenna DeSousa DeSousa

“Designing Testing Methodology for Developing a Bone Adhesive from a Biomimetic Polymer”

Injuries involving broken bones are currently repaired through an invasive technique involving the use of screws, plates and sutures as support which damage healthy bone and tissue. A surgical adhesive can provide a quick and easy alternative, which will minimize the risk of damaging healthy bone and tissue. A bone glue needs to be both high strength and wet setting in order to replace the use of plates and screws. Inspiration for such materials can be found by looking at marine mussels as they are able to stick to nearly any surface, even in wet environments. Marine mussels affix themselves to different surfaces using adhesive plaques consisting of various proteins. An unusual amino acid in these proteins, 3,4-dihydroxyphenylalanine, is key to high strength adhesion. To mimic the mussel adhesive, poly[(3,4-dihydroxystyrene)-co-styrene] was developed. The high bond strength and wet setting properties of this glue make it a promising option as a bone adhesive. In order to maximize adhesion strength, methods for consistent substrate preparation, bonding, and testing have been developed. Initial testing shows that with the right combination of conditions, this biomimetic polymer is a promising solution as a bone adhesive.

Poster Number 156: William Downing

“A Reanalysis of the 1974 Super Outbreak”

The so-called Super Outbreak of April 1974 produced the second most tornadoes during a 24 hr period, making this event one of the most destructive in American history. This outbreak is also noted for the unusually large number of strong, violent tornadoes (F4 or greater). The purpose of this study was to perform a thorough examination of the mesoscale environment of this historical event in order to gain a deeper understanding of the conditions necessary to produce violent tornadoes on such a large scale. This was accomplished by simulating the event using the Weather Research and Forecasting (WRF) model using data from the 20th Century Reanalysis Project as initial conditions. / To ensure that the simulation accurately reproduced the large-scale environment of the outbreak, results were compared with surface observations collected from the National Climatic Data Center (NCDC) for a comparison with WRF model output. Upper-air

observations were also collected for comparison to model results. . Preliminary findings demonstrate that the WRF simulation accurately reproduces many key aspects of the mesoscale environment. /

Poster Number 157: Stephenie Droll

“Molecular Mapping of a Gene for Resistance against a Fungal Pathogen in Wheat”

Genetic analysis and mapping of a gene for resistance to fungal disease Septoria tritici blotch in wheat, using molecular markers to refine a map location for the gene. Used disease inoculation, DNA extractions, and PCR followed by a computer analysis of the results.

Poster Number 158: Huan Fang

“Geographical analysis of the sources of NO_x that affect Tucson, AZ”

The airborne pollutants such as nitrogen oxides (NO_x) associated with urbanization have obvious effects on its downstream ecosystems. The high value of atmospheric deposition of NO_x will potentially cause shifts in plant and microbial biodiversity, declines in sensitive organisms, soil acidification, eutrophication of coastal water and estuaries, and degradation of surface water and groundwater. The stable isotope of nitrate, $\delta^{15}\text{N}$, is used to trace the relative importance of different NO_x sources. The research area, Tucson, AZ, located in a semi-arid basin in the southwestern United States, is affected by emissions from the major nearby cities. The atmospheric deposition data of the year 2006 indicates the seasonal change of $\delta^{15}\text{N}$, with significant increase during the winter season. With the constant local emission throughout the year, the possible reasons for this trend are the lower boundary layer height during winter, which prohibits the vertical mixing; and the more active frontal passages during the winter season, which transport the pollutants from major cities nearby. On this poster, the geographical analysis of how these sources of NO_x affect the study

area in different seasons is presented. The Hysplit atmospheric trajectory model, MetCor modeling software, and ArcGIS were used to assess if any particular geographical region contributed to high nitrate $\delta^{15}\text{N}$ values observed in Tucson. The research concluded that no external NO_x sources were likely important and that local NO_x emitted within the Tucson region dictated the $\delta^{15}\text{N}$ values.

Poster Number 159: Elizabeth Fernander

“Examining role of SOX9 in pancreatic cancer development”

Pancreatic ductal adenocarcinoma (PDAC) is among the leading causes for cancer related deaths in the US. Research is being conducted to gain a better understanding of the genetic and cellular changes that occur within pancreatic acinar cells, from which PDAC originates. Thus discovering new biomarkers and drug targets which can improve the early detection and treatment methods of this disease. The transcription factor SOX9 is believed to play a critical role in the development of PDAC. SOX9 is typically only expressed in ductal cells, and is absent in acinar cells. However, in both early initiating events in PDAC pathogenesis and in fully formed PDAC tumors, SOX9 expression is clearly detected in acinar cells. Recent studies involving SOX9 have shown that acinar-specific deletion of this transcription factor prevents the development of precancerous lesions, which eventually give rise to PDAC. Despite the significance of SOX9 in the development of PDAC, little is understood about its specific gene targets and the exact role it plays in producing cancerous phenotypes. Target sequences for SOX9 binding have been identified, and candidate gene targets within pancreatic acinar cells have been proposed by RNA-seq. To test the regulation of these targets, gene promoter luciferase assays will be completed and verified by chromatin immunoprecipitation analyses. pcDNA3 plasmids containing SOX9 and a truncated D206-SOX9, will be transfected into HeLa cells along with SOX9 control reporter plasmids. These plasmids have been fully sequenced and tested for functionality, and will serve as positive and negative controls for testing our candidate SOX9 gene targets. In addition to testing the binding and regulation of SOX9 target sequences, further studies involving SOX9

will focus on CRISPR-Cas9 dependent deletion of the gene in PDAC cell lines and looking for variations in gene expression and cell growth.

Poster Number 160: Rebekah Figueroa

“Characterization of Biomass-relevant Traits in the C4 Grass Species *Setaria*”

There is a growing need to more completely understand the genetic composition of the C4 grass species, the main crop grown as biomass feed stocks, in order to develop the most efficient means for biofuel production. The compact size, short life cycle, large seed production, and close genetic synteny with major bioenergy crops, such as maize, sorghum, switch grass, and *Miscanthus* make *Setaria italica* (foxtail millet) an ideal genetic model to investigate C4 bioenergy grasses. Gene discovery of important biomass relevant traits in *Setaria italica* are directly translatable to improving the use of energy feed stocks. Toward this goal, we are classifying into large, multi-gene families cell wall related genes in *Setaria italica* using rice, sorghum, *Arabidopsis*, barley, *brachypodium*, and maize as backbone sequences. In addition, 200 recombinant inbred lines of the parent plants *Setaria italica* with *Setaria viridis* were crossed and given to us in order to map relevant biomass traits using Quantitative Trait Locus (QTL) analysis. Pyrolysis molecular beam mass spectroscopy (PyMBMs) will be used to chart relative lignin abundances in this population. A saccharification assay will be performed in order to better understand the digestibility of the population. This investigation found that comparisons with the Phenylpropanoid, Csl, and CesA maize gene families show numerous orthologs with *Setaria italica*. Preliminary findings from this study show *Setaria italica* may be a valuable model for biomass relevant traits in C4 grasses.

Poster Number 161: Jianing Fu

“Structural virology-viral protein study”

(Since the project is not finished yet, this abstract is not completed. I will write a new abstract for presentation.) / Rubella, which is also known as German measles or three-day measles, is a disease caused by Rubella virus (RV). The RV replicase P90 protein plays an important role in viral infection and replication, but the

underlying mechanisms of P90 is not known, as well as the protein structure. Here, the main focus is p90's protein structure. Molecular cloning and protein purification will be done. Furthermore, we will focus on the crystallization on the purified protein.

Poster Number 162: Ryan Golkowski

“Exploring the Capable Energy Transitions of Lanthanide Terpyridine Complexes”

The McMillin group is investigating the photophysical behavior of lanthanide-ligand complexes. The bound ligands act as antenna chromophores that sensitize emission from the Laporte-forbidden f-f excited states of the central metal. These antenna chromophores may be tuned by changing the substituent group on the terpyridine ligand. The complexes that were used have the formula $\text{Ln}(\text{X-T})(\text{NO}_3)_3$, where X-T denotes a tridentate, 4'-substituted 2,2':6,2''-terpyridine ligand. With this design, it is possible to change the substituent X as well as the metal center. When the metal ion is La(III), Lu(III), or Gd(III), one can monitor the flow of energy amidst ligand-based orbitals. On the other hand, incorporating Eu(III) or Tb(III) introduces f-f states into the picture. terpyridine ligands of interest are 4'-(pyrrolidin-1-yl)-2,2':6',2''-terpyridine (pyrr-T), 4'-phenyl-2,2':6',2''-terpyridine (ph-T), 4'-chloro-2,2':6,2''-terpyridine due to the existence of novel, low-lying intraligand-charge-transfer (ILCT) and $\pi \Rightarrow \pi^*$ states. The presentation focuses on understanding the results of absorbance, emission, and emission lifetime studies.

Poster Number 163: Sarah Harris-Kober, Alyssa Fanara

“Levels of Cytochrome C Oxidase in the Inferior Colliculus of Young and Aged Animals”

Age related hearing loss occurs across species and involves changes in the ability to detect and properly process sounds, specifically high frequency sounds. It is known that changes in mitochondrial function and oxidative stress compromise cochlear function; however, it is unclear whether these changes occur in auditory brain regions, which could contribute to a loss of perception of high frequency

sounds. We are examining the levels of Cytochrome C Oxidase (COX) in high and low frequency responsive regions of the inferior colliculi (IC) of young and aged rats. Since aging and neurodegeneration impacts ATP synthesis in other brain regions, we hypothesize that there will be an age-related difference in the levels of COX and that high frequency regions are affected more than low frequency regions. Digital images of COX-stained ventral and dorsal IC tissue sections were analyzed using ImageJ software to examine difference in COX protein levels with relative optical density (ROD) measurements. We found no consistent statistically significant difference ($p > 0.05$, two-tailed unpaired t-test) in COX concentrations between dorsal and ventral regions and across age groups. The average ROD values were 21.16 ± 4.94 and 19.22 ± 6.61 for dorsal and ventral respectively and 18.69 ± 3.99 and 21.57 ± 7.81 for the two different age groups. We are conducting further characterization to draw more definite conclusions as to the neurodegenerative aging effects on hearing. /

Poster Number 165: Adam Horin

“Interactions of 2-amino-1-methyl-6-phenylimidazo [4, 5-b] pyridine (PhIP) in the pathogenesis of Parkinson’s Disease”

Parkinson’s disease is the second most common neurodegenerative disease. It is characterized by the aggregation of the protein α -synuclein and formation of Lewy bodies, leading to the loss of dopaminergic neurons in the substantia nigra pars compacta and depletion of dopamine in the striatum of the brain. In this study we are looking at 2-Amino-1-methyl-6-phenylimidazo(4,5-b)pyridine (PhIP), a heterocyclic amine produced in a pyrolysis reaction from cooking meat at high temperatures, and its potential role as a neurotoxin involved in the pathogenesis of Parkinson’s disease. Previous studies from our group using primary midbrain

cultures have shown that PhIP causes dopaminergic cell death. In this study we use rat models to demonstrate a potential in vivo model of PD using PhIP. We analyzed the striatal terminal density in the brains of rats from acute and sub-acute studies. Based on previous evidence we are expecting to see a loss of dopaminergic neuron terminals in the treated animals. /

Poster Number 166: Elizabeth Claire Hosinski

“Changes in Visual Attention in Relation to Conspecifics in Starlings”

Animals focus on two activities: foraging and scanning for predators. There are two proposed mechanisms for temporally modifying patterns of foraging and scanning. One mechanism is temporal synchrony, whereby two individuals are more likely to be both scanning with their head up or both foraging with their head down more often than expected by chance. The second strategy is temporal coordination, whereby an individual is more likely to be scanning while their neighbor is foraging, and vice versa, more often than expected by chance. / In our study, we focused on the spatial patterns of scanning. Spatial scanning can also be either coordinated or synchronized between individuals. While both animals are scanning, they may spatially coordinate their scans by focusing their visual attention in different locations. Similarly, animals may spatially synchronize their scans by focusing their visual attention toward the same location. / We hypothesized that increasing spatial synchrony can compensate for temporal gaps in scanning associated with temporal synchrony. Since starlings tend to temporally synchronize their scanning patterns, we predicted that starlings would spatially coordinate their attention. Contrary to our predictions, starlings do not spatially coordinate their spatial attention. However, starlings are more likely to spatially change the location of their attention when their neighbor does sooner than is expected by chance. This result suggests that starlings may “mimic” the level of vigilance of their neighbor, which could serve as a mechanism to transmit information about perceived risk throughout a flock. /

Poster Number 167: Wan Jiang, Yao Tang

“The Impact of Patient Self-Management Interventions on Health and Healthcare Outcomes”

Nowadays, a significant amount of research articles documented health-related interventions with the aim of improving patient self-management of healthcare needs, especially in context of chronic diseases. The term of patient self-management, sometimes referred to as “patient empowerment”, is often operationalized as “self-efficacy” or “patient activation”. It has been noticed that patient empowerment is associated with patient awareness of their own ability and motivation to effectively take care of their condition. Therefore, empowerment, in most cases, is considered as a factor between interventions and outcomes such as behavior change and healthcare costs, and is listed as a dependent variable to study self-management interventions. However, this is no obvious evident about what kinds of interventions can best improve patient empowerment. Under this circumstance, we are working on a large-scale meta-analysis of these types of interventions to identify factors associated with the effectiveness of such interventions across a variety of health issues and chronic conditions. Interventions to improve self-management vary widely in content (education programs, individualized counseling, etc.) and format (online, face-to-face, group, etc.), such that there is no clear consensus about what types of interventions best improve patient self-management with different chronic conditions. /

Poster Number 168: Austin Klasa

“Password Coping Mechanisms”

Passwords are the most common means of authenticating users, and the number of passwords a user must remember is increasing. This leads to the need to classify and study password coping mechanisms: any method used to cope with the large number of passwords a user must remember for multiple accounts. After a literature review and analysis of past research, a pattern of password coping mechanisms emerged. These findings present a map of past research and were utilized to classify password coping mechanisms and to create a password coping mechanism taxonomy.

Poster Number 169: Ashlynn Kokaska

“Assessing the role of Fic (filamentation induced by cAMP) proteins in E. coli”

Fic proteins are evolutionarily conserved from bacteria to humans, and are characterized by an Fic amino acid motif. Several bacterial Fic proteins act as virulence factors or toxins that post-translationally modify host proteins leading to cell death, a mechanism pathogenic bacteria exploit to evade immune defenses. Fic proteins are inter- or intra-molecularly regulated and can be classified into three toxin/anti-toxin groups with the Therefore, Fic proteins have been classified as toxin/anti-toxin modules. Fic proteins were originally identified in *Escherichia coli*, where a mutation in the gene encoding the *E. coli* Fic protein (EcFic) resulted in aberrant cell division. Consequently, *E. coli* developed a filamentation phenotype in response to heat shock and cAMP, thus coining the name Fic (filamentation induced by cAMP). Despite the advances in understanding Fic proteins from pathogenic bacteria, there is a lack of a basic understanding pertaining to the role of Fic proteins during the life cycle of non-pathogenic bacteria such as *E. coli*. Our goal is to understand the role of EcFic in regulating cell division in *E. coli* and why its aberrant function causes filamentation. To this end, we aim to study the *E. coli* toxin/anti-toxin complex comprised of EcFic and its putative inhibitor, YhfG. By co-expressing affinity tagged versions of EcFic and YhfG, we aim to identify protein targets that the EcFic-YhfG complex interacts with. These protein targets will be identified by mass spectrometry, and then be validated and assessed for Fic-mediated modifications. having the characteristic motif of (S/T) XXXE (G/N) within the Fic protein or as a separate protein. *Escherichia coli* is a simple bacterium containing anti-toxin/toxin protein complexes. One understudied complex is the Fic/YhfG complex where Fic and YhfG are the predicted toxin/antitoxin complex, respectively. We predict some of these interacting proteins may be involved in cell division pathway.

Poster Number 170: Dayoon Kwon

“Imaging hydrogen peroxide in live *Aplysia* neuronal growth cones using biosensor”

Hydrogen peroxide (H₂O₂) is a reactive oxygen species (ROS) that has emerged as an important signaling molecule controlling a number of cellular processes including cell migration, differentiation, and apoptosis. We have recently shown that ROS are also critical for neurite outgrowth and actin dynamics in neuronal growth cones, which are highly motile structures at the tips of neurites. In order to fully understand the role of ROS in growth cone motility, we need to be able to image and quantify specific ROS with high spatial and temporal resolution. To achieve this goal, we have cloned two different variants of the genetically encoded H₂O₂ biosensor HyPer into a vector suitable for expression in cultured Aplysia neurons. The HyPer2 cytosolic variant will allow us to monitor and quantify cytosolic H₂O₂, whereas the plasma membrane variant HyPer-PM detects H₂O₂ close to the cell membrane. Next, we will express these biosensors Aplysia neurons via microinjection of mRNA and validate them by ratiometric fluorescence imaging while manipulating H₂O₂ levels in growth cones. Quantifying temporal and local H₂O₂ changes in neuronal growth cones will be critical to gain a better understanding of how these highly reactive and diffusible signaling molecules control neuronal development and regeneration.

Poster Number 171: Vivien Lai

“Aberrant Migration of Neuroblasts in the Subventricular Zone Following Intranasal Manganese Exposure”

Exposure to manganese (Mn) causes clinical syndromes similar to Parkinson's disease. Our earlier studies show that Mn increases cell proliferation in the subventricular zone (SVZ) and migration towards the olfactory bulb (OB) along the rostral migratory stream (RMS). Cell migration following solvent exposure shows that these cells migrate to other areas of the brain rather than following the RMS to the OB. However, the question as to whether exposure to Mn caused aberrant migration remained unknown. This study was designed to test the hypothesis that intranasal (IN) exposure to Mn disrupted the migration of neural cells in RMS,

which contributes to Mn-induced neurodegenerative injury. Rats received intranasal dose of Mn for 14 days. The low dose group received 0.2 mg Mn/kg while the high dose group received 0.8 mg Mn/kg and the control dose group received saline. During the last 4 days, animals received 100 mg BrdU/kg to trace the cell proliferation. Immunocytochemical studies were performed to co-localize BrdU and DCX, a marker of neuroblasts. Confocal quantification of regions of interest near the SVZ revealed significant differences in BrdU signals between low and high dose groups (437.4 ± 168.8 SD and 914.1 ± 371.2 , respectively; $n= 3-8$; $p < 0.05$) and DCX (243.1 ± 89.7 and 463.2 ± 128.0 , respectively; $n= 3-8$; $p < 0.05$) at 4X magnification. Additionally, quantification at 10X magnification indicates a significant lower BrdU expression in the low dose animals (256.5 ± 32.8) than that of controls (542.9 ± 235.6) ($n= 4-6$; $p < 0.05$) at the superior lateral aspect of the SVZ. Our work indicates that the low dose intranasal Mn exposure, compared to controls, greatly reduces migration of neuroblasts from the SVZ to OB. Continued Mn exposure appears to increase aberrant migration from SVZ into the corpus callosum. Whether intranasal Mn exposure affects cell proliferation, differentiation and/or migration deserves further investigation.

Poster Number 172: Qingling Li

“The difference between male and female directed songs in Brown-headed cowbirds”

Brown-headed cowbirds (*Molothrus ater*) are a good example of a songbird that evolved songs via inter- and intra-sexual selection; indeed, song can signal multiple pieces of information, including courtship and aggressive intentions. A previous study assumed that there is no difference between female and male directed songs within this species. However, Morton’s Motivational Structural Rules hypothesis suggest that physical structure of sound has a relationship with the motivation underlying its use. Therefore, we predicted male cowbirds will sing higher frequency and more tonal sounds when directed towards a female, but

lower frequency and wider bandwidth when directed to a male. Using a cross-correlation analysis, we found that pairs of songs are more dissimilar if they are directed to different sexes compared to songs directed to the same sex. Using Sound Analysis Pro, we found that these differences are caused in part by significant differences in fundamental frequency and entropy in male versus female songs and that our results supported the Motivational Structural Rules hypothesis. These findings suggest that in highly social species, male birds may modify their songs to direct their signals to a specific receiver.

Poster Number 173: Chen Lin

“ab Initio Study of Hydrogen Migration across 3-hydroxy-2-propenal”

The hydrogen migration within 3-hydroxy-2-propenal and radicals on each carbon are investigated by high level ab initio calculations. The aim of this project is to determine reaction enthalpies, and activation energies of the hydrogen migration across the molecule (S1), central carbon radical (S2), hydroxyl side radical (S3) and carbonyl radical (S4). All calculations during this investigation are performed using Gaussian 09 programs. The calculations for all reactants, products and transition state species are carried out using Brueckner Double. The calculation shows that as the symmetric structure S1 and S2, the electronic clouds are well delocalized within two carbons and hydroxyl hydrogen migrated between two oxygen atoms during its transition state. As the asymmetric structure S3 and S4, the hydroxyl hydrogen always migrates to carbonyl, transferred as S3 structure. We investigate this special occasion by curing the potential energy of S3 to S4 with fixed O-H distance. The curve derived indicate the lower energy of S3 is.

Poster Number 174: Donald Little, Samuel Schafer

“HIV Chromatin is a Preferred Target for Drugs that Bind in the Minor Groove”

The genome of human immunodeficiency virus type 1 (HIV-1) displays an unusual single-stranded bias being rich in A but not U and deficient in C but not G. This genomic bias controls HIV phenotype by dictating the unusual composition of essentially all HIV proteins. Since drugs that bind in the DNA minor groove disrupt nucleosomes on sequences that contain closely-spaced oligo-A tracts, which are

prevalent in HIV, it was of interest to determine if these drugs exert this selective inhibitory effect on HIV chromatin. Previous results have shown that minor groove binding drugs (MGBDs) inhibit the assembly of nucleosomes onto five HIV-1 genome segments in a manner proportional to the A-bias. In order to test the effects of MGBDs on previously assembled chromatin, HIV-1 pol DNA was reconstituted onto nucleosomes at physiological salt concentration, which were then subjected to drug treatment. DAPI, a stronger drug, and berenil, which is currently used in the clinic to treat various infections and sleeping sickness, were applied to separate samples of nucleosomes. These samples were then digested, and mononucleosomal DNA was recovered. High-throughput sequencing will be utilized to compare reads of treated and untreated nucleosomal DNA to determine an observable nucleosome shift in the presence of MGBDs. Results may provide insight into selectively targeting the A-bias of lentiviruses with MGBDs in the HIV-1 phenotype.

Poster Number 175: Linjia Liu

“Mechanistic Insight into Receptor Specific Gene Delivery by Cationic- β -Cyclodextrin:Hyaluronic Acid- Adamantane Host:Guest pDNA Nanoparticles”

Targeted delivery is a key element for improving the efficiency and safety of non-viral vectors for gene therapy. We have recently developed a CD44 receptor targeted, hyaluronic acid-based pendant polymer system (HA-Ad), capable of forming complexes with cationic β -cyclodextrins (CD⁺) and pDNA. Complexes formed using these compounds (HA-Ad:CD⁺:pDNA) have shown high water solubility, promising transfection efficiency and cell viability. Herein, we have also studied their target specificity, the detailed mechanistic aspects of the transfection process, such as cellular localization, interaction with endosomes/lysosomes and escape, and intracellular transfection. Confocal microscopy and multicolor flow-cytometry techniques were used for the spatial and dynamic tracking of transfection complexes in vitro. We have demonstrated the CD44 receptor specific enhanced cellular uptake and transfection efficiency of HA-Ad:CD⁺:pDNA complexes.

**Poster Number 176: Weichuan Luo, Tiange Dong, Tianzhao Wu, Tianmu Hu,
Ruifeng Ji, Andrew Walden, Eric Petit, Hyun Dong Lee**

**“Analyzing biology research trend through research articles of biology
databases”**

There are many biological databases constructed every year. At the beginning of every year, the scientific research journal Nucleic Acid Research (NAR) publishes a database issue containing over 100 papers on newly released databases and updates to existing databases. Since the content of the database issue reflects the topics of focus in biological research at the time of publication, we hypothesized that analyzing the databases included in the yearly NAR database issue can highlight and capture the change of research trend over the years. To begin with, we have manually analyzed 185 database papers in NAR Volume 42 Issue D1 published on January 1, 2014. Information such as the kind of data archived, keywords, classification, whether or not the website is functional, and the last update date of each database are included in our research. Based on the information gathered from the databases listed and generalize the types of data being researched and inquired about. This process provides classifications that serve our purpose more effectively than those provided by the database issue. For the automatically analysis, we have created a basic program in Python to capture keywords based on the frequency appearing in an article and assign the paper to the group featured for the similar keywords. As a future work, we are going to generate a program able to study from the basic computational outputs and the manual results on the 2014 issue D1, and deduce an optimum literature algorithm which can be applied to the NAR issues from previous years to identify trends in biological research. /

Poster Number 177: Sarah Mace

**“Does Genetics Affect the Response of Lumbar Spine to Dietary Calcium
Restriction?”**

Serum calcium (Ca) levels are tightly regulated by a three tissue axis of intestine, kidney, and bone. The actions of these organs serve to maintain whole-body Ca homeostasis by increasing intestinal Ca absorption efficiency, renal reabsorption, and bone resorption when dietary Ca intake is low. The purpose of this study was to determine the role of genetics in the lumbar spine response to dietary Ca restriction. We studied the spines of male mice from 51 BXD recombinant inbred lines and fed them either a basal Ca diet (0.5%) or a low Ca diet (0.25%) from 4 to 12 weeks of age. Using medium resolution micro-CT, we analyzed the trabecular bone parameters: bone volume fraction (BV/TV), trabecular number (Tb.N), trabecular thickness (Tb.Th), and trabecular separation (Tb.Sp). After correcting for confounding effects of body size, we conducted ANOVA to determine significant main effects (line/diet) and line-by-diet interactions, and heritability estimates. We performed analysis for each phenotype, for each diet, and for our calculated parameter reflecting the response to Ca restriction (RCR). For each phenotype, narrow sense heritability estimates (h^2) ranged from 0.60-0.35 in the basal and low Ca diets. This indicates that there remains a percentage of the phenotypic variation that is not explained by genetics. On the other hand, the RCR h^2 were modest and ranged from 0.22-0.32. All parameters showed significant genotype and diet main effects ($p < 0.001$), however, only Tb.Sp. showed a significant gene-by-diet interaction ($p = 0.013$). Interestingly, for every parameter, the RCR was significantly affected by line ($p < 0.01$), indicating that the genetic makeup affects the variation in the bone responses to Ca restriction. Our data reveal the existence of gene-by-diet interaction affecting lumbar spine, and this work provides a framework for further characterization of the genes influencing the responses of bone under controlled dietary conditions.

Poster Number 178: Amanda Mark, Faith Gooding

“Dendritic Complexity of Golgi-Stained Neurons in the Inferior Colliculus of Young and Aged Rats”

Presbycusis, or age-related hearing loss, is associated with the loss of ability to process high frequency sounds. It is a product of physical and chemical changes within the inner ear and in the neurons of the ascending auditory pathway.

Neuronal dendrites have been shown to undergo a reduction in complexity with age, which will have an impact on neuronal function. However, whether this occurs within the ascending auditory pathway is unknown. We used 3-D anatomical reconstruction and complexity measurements to test the hypothesis that a reduction in neuronal complexity occurs with age in the inferior colliculus, an auditory nuclei. Analysis of the 3-D reconstructed Golgi- stained neurons focused on the changes in dendritic structure and showed that there was no difference in number of primary dendrites and no difference in the number of branching tips with age. The preliminary data suggest that age is not a factor in correlation to the number of dendrites and branching tips. We plan to continue collecting and analyzing data to see if our results change, due to an increased sample size, and to investigate possible correlations of neuronal structure with measures of hearing function.

Poster Number 179: Connor Moore

**“Phenacite; The Magic in Science
. Uses in Physics and Metaphysics”**

Phenacite (also known as Phenakite) is a beryllium silicate (Be_2SiO_4). Phenacite is found in high-temperature pegmatite veins and in mica-schist located in Asia, Europe, and the Americas. The phenacite used for this experiment was found in Brazil. Phenacite has a curious reputation as a metaphysical substance. According to popular opinion, the mineral enjoys a reputation as the highest “energy” crystal and is used to stimulate the seven centers of spiritual powers in the human body. By contrast, when employed for scientific experimentation, phenacite is extremely useful as a source of pure beryllium. The pure beryllium is used by scientists around the world who employ cosmogenic nuclide dating in the fields of geology and geophysics, astrophysics, and environmental science. Our phenacite crystals contain trace elements of calcium, potassium, iron, and aluminum and requires physical and chemical processing to remove these impurities. Our poster details the process from phenacite crystal to pure beryllium. /

Poster Number 180: Ishra Noor

“Evacuation Behavior of 2011 Earthquake and Tsunami Survivors”

After the March 11th, 2011 Tōhoku Earthquake and Tsunami, parts of the coast of Japan near the small town of Watari suffered. At Magnitude 9.0, this earthquake remains the largest recorded earthquake to have ever hit Japan, a horrific surprise to the unprepared residents. Despite various warnings, the residents Watari responded in ways that often strayed from official expectations. Some remained behind; others were rescued or they fled based on a variety of variables. Since the 2011 disaster, Watari town officials revamped their emergency plan in the case of another large tsunami. The purpose of this study is to identify the most influential variables, and to see if the town’s new evacuation plan addresses them. Given Japan’s location in the infamously active Pacific Ring of Fire and the potential effects of global climate change, these hazardous events may intensify. Thus, It is crucial to understanding evacuation behavior in order to implement effective safety procedures in the future. After gathering information from personal interviews conducted from some 60 Watari survivors, extracting GPS coordinates from their individual evacuation route maps, observing post-event soil moisture via Google Earth Historical Imagery, and locating the tsunami’s inundation extent via Harvard’s Interactive JapanMap, the initial results of our analysis indicate that distance from the coast did not play as large role in the immediacy of evacuation as other factors. Through further data analysis I seek to gain a better understanding of the evacuation patterns during the tsunami.

Poster Number 181: Ilyas Orazbek

““Big Data” in GIS: Evaluation of Data Handling libraries.”

In the age of "Big Data", Geographic Information Systems (GIS) are consuming ever-larger data sets. A current GIS project uses several data sets simultaneously which each comprise 17 billion points. Commercial software (ArcGIS) is overwhelmed by this and new approaches are needed. Both disk access and computational processes are excruciatingly slow. For this poster, Python libraries and some inventive approaches are investigated. The new tool is designed to

access the new gSSURGO soil database to create raster layers from 31 million tabular attributes .

Poster Number 182: McKeith Pearson

“The Endocytic Proteins, Epsin and Sla2 cooperate for the regulation of cell division in *Saccharomyces Cerevisiae*”

Huntington’s disease is one of the several neurodegenerative disorders caused by expansion of the number of glutamines (Q) present in the protein huntingtin. Research has extensively focused on the toxic gain-of-function phenotypes acquired by the Q-expanded huntingtin. However, loss-of-function effects (inability to fulfill biological functions) that also result from Q expansion lead to neurodegeneration. The purpose of this project is to address the question of how the polyQ in huntingtin function to mediate protein-protein interactions. Although yeast does not have a huntingtin homolog, Q-rich regions are present in the endocytic protein epsin and the Ent2 paralog is crucial for the regulation of cell division. Importantly, the yeast homolog of the huntingtin binding partner HIP1 (Huntingtin Interacting Protein 1), known as Sla2, binds epsin. This further supports the idea that epsin’s Q-rich regions may functionally replace huntingtin Q stretches in yeast. Using microscopy and extensive image analysis, here we show that Ent2 dominant negative (E2DN) constructs (lacking C-terminal determinants) induce cell division defects in a Sla2-dependent manner. Conversely, truncations of the C-terminus of Sla2 suppress the E2DN-dependent phenotype. Further, our data suggest that Q-rich regions of Ent2 and the second coiled coil domain (CC2) of Sla2 is necessary for this regulation of cell division. To summarize, we have discovered the first physiological function of Q regions in endocytic proteins. We believe that this research will provide important insights into the function of Q that are disrupted upon expansion.

Poster Number 183: Matthew Prather

“Fundamentals of LaTeX Typesetting With R- and SAS-Generated Statistical Graphics”

Knowledge of LaTeX, the universal, standard program for scientific typesetting, and of R and SAS, software ubiquitous in statistical analysis and data science, is undoubtedly valuable to students in mathematics, statistics, and actuarial science, who in required courses must often use one or more of these tools. But acquiring reasonably comprehensive and lasting proficiency in complex software is difficult, especially for the casual user. Despite the utility in being able to produce - faster than by alternative means and typeset to the highest standard - all types of coursework (assignments, projects, labs, notes, study guides), as well as presentations and documents for internship or job contexts, into which program code, tables, graphics, and other data may easily be incorporated, the LaTeX learning curve is steep and the documentation daunting. Moreover, there doesn't appear to exist a resource describing how to use LaTeX in conjunction with either R or SAS, even while their graphics output is very often destined for a LaTeX document. / / These observations gave rise to the endeavor of creating a printed, handbook-style guide, which satisfies the following goals: / / 1) Provide a comprehensive, example-based reference for how to typeset in LaTeX the variety of documents that students in mathematics, statistics, and actuarial science routinely write, and for how to create elementary statistical graphics of high technical and aesthetic quality, optimized for inclusion in LaTeX documents, using both R and SAS; / / 2) Ensure deep enough treatment of fundamental software capabilities where necessary in order that the "look and feel" of documents and graphics may be determined according to the user's needs, judgment, and taste, rather than constrained by a more ad hoc approach; and / / 3) Include an abundant selection of topics and examples which promote and embody principles of good writing, graphic and information design, and mathematical notation.

Poster Number 184: Bryan Rainey

"PageRank Computation on a Raspberry Pi"

Google's PageRank algorithm evaluates the importance of webpages based on the links between them. More generally, the PageRank vector of an arbitrary graph measures the importance of each node in the graph. Using the common power iteration method, we implement PageRank on a Raspberry Pi, a \$35 computer the

size of a credit card. Additionally, we utilize sequential updating, a refinement of the power iteration method, to reduce the number of iterations required to compute the PageRank vector. We empirically analyze the performance of our implementation on graphs of networks with millions of nodes, including a 2010 crawl of Twitter with over 41 million nodes. Prior work on PageRank computation has used computer clusters with hundreds of cores. We demonstrate that a low-power computer such as the Raspberry Pi can compute the PageRank vector for these graphs in a matter of hours. As people continue to apply PageRank to problems in fields ranging from physics to neuroscience, we suggest that efficient PageRank computation does not always require sophisticated systems or hardware.

Poster Number 185: Shreeya Raman

“Affects of Diet on BDNF Levels in Mice”

The purpose of the project is to see the affect that different diets have on brain-derived neurotrophic factor (BDNF) levels in mice. Low levels of BDNF have been linked to obesity in rodents and in humans, therefore seeing how diets affect the levels of BDNF may shed light whether diet affects obesity. This research can give us an idea of how diets might affect obesity and food intake in humans. The different diets included in this project are high-fat/high-sugar diet, fasting diet, and a control diet. It is expected that a high-fat diet and fasting will decrease BDNF levels in the brain compared to the control. The seventeen mice were all fed the control diet until the experimental period, when they were split into three groups and given different diets. Seven mice were fed the high-fat diet, five were fed the fasting diet, and the remaining five were fed the control diet. All mice had no statistically significant difference in body weights and food intake prior to the experimental period. After the experimental period, the mice brains were harvested and protein levels in the brain were found using western blots. Samples were taken from the hypothalamus, the cortex, the hippocampus, and the dorsal vagal complex. The protein samples from the mice were loaded on an SDS-PAGE gel, run, then transferred onto a membrane, which was blotted using

primary and secondary antibodies. They were blotted for BDNF, then stripped and re-blotted for actin, which acted as the control.

Poster Number 186: Meng She

“Effects of extrinsic triiodothyronine on visual behavior of wildtype zebrafish”

Thyroid hormone (TH) plays an important role in regulating the development of retina. Many studies done in vertebrates have shown that the regulation includes the control of gene expression in one of the photoreceptors--cones in retina. However, it has not been examined if the effects of TH on genetic level can influence visual behaviors. Our study was performed to determine if extrinsic TH exerts effects on visual behavior of wildtype zebrafish during early development. We focused on triiodothyronine (T3), one of the main forms of TH in vertebrates. Both time range and concentration of T3 treatment were manipulated. T3 was applied either 1-3 days post fertilization (dpf) or 3-5 dpf, and each treatment time interval was with both 10nM and 50nM. Visual behavior of the larvae was quantified by measuring the optokinetic response (OKR) and the visual motor response (VMR) at 5 dpf. The OKR is the eye movement generated by the larvae due to the moving image of the surroundings to help stabilize the image on the retina and therefore generate a high-resolution vision. The VMR is the spike of motor activity in response of sudden light-on or light-off stimuli. We found that at lower concentration, 10nM, of T3, neither OKR nor VMR of the 2 treatment time intervals showed significant difference from the control group. However, with 50nM of T3, the OKR of both time intervals, and the VMR of 3-5 dpf treatment were significantly lower than control group. Our study indicates that 50nM of TH treatment from 3 to 5 dpf can affect visual behavior of wildtype zebrafish during the early development. Similar effects may exist in humans because of high level of conservation of retinal organization and developmental mechanisms among vertebrates. Thus, it may be helpful to look for treatments for visual malfunction in human by manipulating parts of the thyroid hormone pathway.

Poster Number 187: Xingyu Shen

“Using transitional metal to make beta haloketone”

Beta haloketone is a common motif which exists in a broad range of bioactive molecules and important synthetic intermediates. Synthetic methodology for synthesis of beta-carbonyl compounds usually involved the conjugate addition of alpha, beta unsaturated ketone via Michael addition. Herein, we reported a novel method to synthesis the beta-bromoketones through the transitional metal catalyzed cyclopropanol ring-opening reaction.

Poster Number 188: Thomas Shriver, Lauren Myers

“An Analysis of the Electronic and Vibronic Properties of Benzyl Phenylacetate Using Laser Based Spectroscopy”

The driving force behind this research project is the overwhelming interest in developing alternative fuel sources instead of relying upon traditional hydrocarbon fuel sources. Biofuels have become an emerging subfield of alternative fuels, but one of the struggles in biofuel development is overcoming the strong lignin structures within plant cells that box in the sugars required for fuel. Lignin is a heteroaromatic biopolymer that is made up of o-methoxyphenol monomers and is one of the three main components that make up the cell walls along with cellulose and hemicellulose. One of the main goals in lignin research for biofuels is understanding how to cleave the complex lignin structure in such a way that the sugars within the cells can be reached and also so that the lignin residues can be used for fuels also. Currently, the fuel capacity for lignins is about four percent, which is equivalent to that of coal, and thus the cleaving of these lignins in hopes of increasing the fuel capacity is of great interest. An important step in understanding how to better cleave these lignin structures is understanding how chromophores communicate to each other within large, heteroaromatic structures. Previous research has been done in our lab group on the subject of symmetrically bridged bichromophores and the ways in which the phenyl rings communicate to each other via electronic and vibronic energy levels. Our research has focused on an asymmetrically bridged bichromophore as a step up from the less complex interactions of the symmetric chromophores.

Poster Number 189: Selena Staun

“Oxidative Addition at Uranium with a 'Redox-Innocent' triamine ligand”

Unlike many transition metals, uranium is generally unable to perform two-electron processes such as oxidative addition and reductive elimination because of its low redox potentials. One way to overcome this barrier is by storing electron density in a Redox-Active ligand to assist in oxidative addition. Recently, the pyridine(diimine) (PDI) ligand was shown by our lab to promote two-electron oxidative addition at uranium. The goal of this research is to replace the ‘Redox-Active’ pyridine(diimine) with a ‘Redox-Innocent’ triamine (RITA) ligand. The hypothesis behind this research is that oxidative addition will either a) not proceed; or b) proceed with electrons from the metal center. Current studies are focused on the preparation of a uranium(IV) complex bearing a RITA ligand. Additionally, a variety of oxidative addition test substrates have been prepared.

Poster Number 190: Jonathan Stelzleni

“Cosmic Ray Activity Due to Solar Maximum”

Cosmic rays are immensely high-energy radiation, originating inside and outside the Solar System. They may produce showers of secondary particles that penetrate and impact the Earth's atmosphere and sometimes even reach the surface. They are composed primarily of high-energy protons and atomic nuclei. When cosmic rays enter the Earth's atmosphere they collide with molecules, mainly oxygen and nitrogen. The interaction produces a cascade of lighter particles including x-rays, muons, protons, alpha particles, pions, electrons, and neutrons. This experiment focuses on detecting charged particles like muons and electrons using scintillation detectors and checking to see if cosmic ray events coincide with solar activity. A triple coincidence in multiple detectors at the same time is used in order to demand a minimum shower energy, which is set by the separation distance of the counter. The triple coincidence is also an indication that all of the particles came from one event in the upper atmosphere.

Poster Number 191: Hannah Stewart

“Symbiotic Effects on Caste Differentiation in *Reticulitermes flavipes*”

The eastern subterranean termite, *Reticulitermes flavipes*, is important for various reasons, ranging from pest control, to creating alternative fuel sources. *R. flavipes* has different castes that include workers, soldiers and reproductive, and also hosts protist and bacterial symbionts in its gut. If a worker termite is treated with Juvenile Hormone (JH), it will be induced to transition to an intermediate pre-soldier stage, with differentiation usually occurring 10-14 days after treatment. It is known that when a worker differentiates into a pre-soldier, its gut protist count decreases dramatically. However, how symbionts might affect the differentiation process is not known. My hypothesis was that JH-treated worker termites with their symbionts removed would differentiate sooner than those with their symbionts intact. To test this, four treatments were performed on termites: untreated control, antibiotic control, JH control, and an antibiotic and JH treatment. Termites were then counted for survivorship over time, and the days at which pre-soldier differentiation occurred. There was no differentiation in the untreated control or the antibiotic control. There was differentiation in the JH control and the JH and antibiotic treatment, but my hypothesis was refuted as termites differentiated around the same time. However, most termites did not survive the differentiating process in the antibiotic and JH combined treatment, whereas in the other treatments mortality was less than 10-20%. These results suggest that protists do play a role in caste differentiation, possibly by buffering deleterious impacts of excess JH.

Poster Number 192: Devang Thanki

“TPD521L1 expression during development and time point-specific alterations of an atrazine exposure with the zebrafish model”

Atrazine is a commonly used herbicide in the Midwestern United States; its purpose is to prevent broadleaf and grassy weeds in crops such as corn. Currently, Indiana uses about 26 percent of its land to grow corn, and atrazine is used in ample amounts, resulting in runoff that leads to contamination of drinking water.

The Environmental Protection Agency (EPA) has set the Maximum Contaminant Level (MCL) at 3 parts per billion (ppb) in drinking water but the herbicide is often found at higher levels. However, data suggests that atrazine can be harmful even at 3ppb. Previous studies from our laboratory have shown atrazine alters gene expression associated with neuroendocrine and reproductive system function, carcinogenesis, and cell cycle regulation following developmental atrazine exposure at 0.3, 3, or 30 ppb. From these studies, it was shown that at 72 hours post fertilization (hpf), atrazine elicits alterations of the gene, tumor protein D52 (TPD52L1) in the zebrafish. Previous studies have identified TPD52L1 in cell proliferation and calcium signaling, along with regulating expression at the G2-M transition in breast cancer cells. The goal of this project was to characterize the expression of TPD52L1 during development of the zebrafish, as well as determine genetic alterations caused by developmental atrazine exposure. To characterize the expression of TPD52L1 throughout embryogenesis, zebrafish embryos were bred and embryos were collected at 24, 36, 48, 60, and 72 hpf. In addition, alteration in TDP52L1 gene expression following atrazine exposure was assessed at the same developmental time points. Analysis showed consistent levels of gene expression throughout embryonic development ($p=0.0714$). Atrazine exposure showed a significant increase at 36 hpf in the 0.3 and 3 ppb treatments ($p=0.0253$), but no changes at 24 ($p=0.2360$) or 48 hpf ($p=0.3040$). Analysis is currently being completed for 60 and 72 hpf to determine developmental windows of sensitivity.

Poster Number 193: Bruce Tharp

“Nitrogen Stable Isotope ($\delta^{15}\text{N}$) Composition of Fossil Fuel Combustion Sources”

The nitrogen stable isotope ratio of NO_x ($\delta^{15}\text{N-NO}_x$) has been suggested as a regional indicator for NO_x source partitioning; however, there is large uncertainty in the $\delta^{15}\text{N}$ values for fossil-fuel combustion sources other than vehicles. This

study aims to provide a detailed analysis of several NO_x producing machines and their $\delta^{15}\text{N}$ -NO_x ratios. To accomplish this, several fossil-fuel combustion sources were sampled and analyzed for their $\delta^{15}\text{N}$ -NO_x ratio that included lawn and utility equipment, tractors, buses, and airplanes. A modification of a NO_x collection method used by the United States Environmental Protection Agency was used to determine $\delta^{15}\text{N}$ -NO_x. A relatively large range of $\delta^{15}\text{N}$ -NO_x values were measured from -20.89 to -1.67‰ with cold started diesel-electric buses contributing on average the lowest $\delta^{15}\text{N}$ values at -20.89‰, and warm-started diesel-electric buses contributing on average the highest values of -1.67‰. It was found that there is a negative correlation between NO_x concentrations and $\delta^{15}\text{N}$ -NO_x values though the linear regression varies between NO_x sources. This suggests that the catalytic reduction of NO_x may have an influence on $\delta^{15}\text{N}$ -NO_x values. Since fossil-fuel combustion represents a significant portion of all emitted NO_x, this data will be helpful for others attempting to model the regional $\delta^{15}\text{N}$ -NO_x.

Poster Number 194: Jessica Uhler

“Transposable Element Dynamics of *Schistosoma mansoni* Inter-Strain Crosses”

Schistosoma mansoni is a trematode parasite that causes schistosomiasis, a neglected tropical disease affecting over 200 million people worldwide. The genome of *S. mansoni* consists largely of transposable elements (TEs), mobile DNA sequences with the inherent ability to proliferate and move to new loci in the genome. Proliferation of TEs can be induced under times of genomic stress, like hybridization events, due to breakdown of the normal TE repression systems. Such proliferations could provide adaptive advantages to the genome by innovating changing gene expression patterns. The aim of this project was to investigate this TE proliferation in *S. mansoni* by creating inter-strain crosses. We hypothesized that as compared to the parental strains, these inter-strain crosses would show an increased TE copy number. This could result in increased virulence on the intermediate snail host, resulting in slower snail growth rate, slower snail egg production, and increased cercariae production. We quantified TE copy numbers in the schistosome genome using a SYBR Green qPCR assay. When we

used two Schistosoma strains originating from Puerto Rico, the parasite strain was not a significant factor in the virulence of the parasite, not supporting the hypothesis. However, the snail strain was a significant factor in both snail growth and production of cercariae. The parental parasites had significantly more TEs present than the cross strains in two of the genes tested, also not supporting the hypothesis. Further research was done using parasite strains from different geographical origins.

Poster Number 195: Aditya Vaidyam

“Distributed Cluster Computing in Computational Proteomics”

As computational algorithms become more and more prevalent in proteomics, and processing power becomes more readily accessible, efficiency and high scalability of algorithms becomes a force to consider optimizing. An algorithm must be concurrent and able to execute in parallel, and where concurrency can be difficult to implement within the algorithm itself, distributed and parallel systems can deliver a higher performance throughput without modifying the algorithm at all. On a heterogeneous computing platform, distribution of computational workload - the algorithm - can be modeled as actors. Originally designed for artificial intelligence in parallel and distributed systems, the actor model is capable at designing highly resilient, fault tolerant distributed systems. Two such computational proteomic algorithms are PFP, a sequence similarity-based protein function prediction algorithm that predicts GO annotations for an input sequence, providing far more information than can be found in a conventional database like BLAST, and ESG, a sequence similarity-based protein function prediction algorithm, that employs PSI-BLAST iteratively and selects consistent GO annotations. By applying this framework to PFP and ESG, given N nodes in a heterogeneous cluster, we achieve N-fold or more computational performance, and without modifying the original source. With a minimal overhead, simply deploy PFP and/or ESG, and an elastic scheduler will orchestrate the nodes.

Poster Number 196: Alexander Wade, Sam Higginbotham

“Wire Bond Encapsulation for the CMS Forward Pixel Upgrade”

The Phase 1 upgrade of the pixel tracker for the CMS / experiment will require the assembly of approximately 1000 modules consisting of / pixel sensors bump bonded to readout chips. Electrical connections between the / custom readout chips and support ASIC's that constitute the front-end of the pixel / data acquisition system are made via wire bonds to a thin printed circuit board. / Part of the assembly process carried out at Purdue University includes the partial / encapsulation of the wire bonds for mechanical protection, prevention of electrolytic / corrosion, and to damp oscillations due to Lorentz forces from transient current / pulses in large magnetic elds. We present the details of the robotic assembly / process which allows the deposition of the viscous encapsulant compound with 100 / micron precision.

Poster Number 197: Xinran Wei

“Identification of Biased Language in Native Advertising”

Advertising is the business model for many services offering online content. Traditionally, the distinction between editorial content and ads was clear, however this distinction is becoming increasingly blurred. Native advertising, similar in concept to a traditional advertorial, is a form of paid media placement designed to resemble an article in form and function. From the readers' perceptive, it's not favorable to get fooled into believing they are reading a real article. From an Artificial Intelligence perspective, we want to see if a machine can tell the difference between these articles. So, we began to use machine learning techniques to achieve this. / / Since this is a machine learning task, a classifier is the first thing to implement. Support Vector Machine is a learning algorithm where we can input datasets of articles tagged as native-ad or editorial content, and train a model to automatically classify new (previously unseen) articles, as native advertisements or editorial articles. / / To collect enough data to train the model, I ran a web crawler and crawled 300 native ads and 300 unsponsored editorial articles from online media such as Forbes, The Atlantic and Wall Street Journal. Then I used Stanford CoreNLP library to tokenize the text and generate datasets, and ran SVMlight to perform training and testing. / / Our initial results

are encouraging, however there are false positive decisions made by the classifier (i.e., it sometimes identifies editorial articles as native ads). In order to improve it, we still have to crawl more articles of less difference in length, and perform a deeper analysis on editorial articles.

Poster Number 198: Darcy White, Jake Ramsey

“Neuropharmacology”

The purpose of this project is to use a screening assay to discover whether or not roughly 300 synthesized compounds inhibit the activity of type V adenylyl cyclase in the cell. Though this experiment is still in its preliminary stages, the main experiment will involve quantifying the amount of cAMP in cells activated with forskalin and saturated with synthetic compound. There is no way to determine at this point exactly which compounds will inhibit the activity of the adenylyl cyclase.

Poster Number 199: Maggie Wigren

“Food Availability and Spore Production in Daphnia-Metschnikowia Interactions”

It is widely known that parasites can severely harm a host population, and identifying the factors that can enhance or inhibit diseases is crucial for the survival of the host species. *Metschnikowia bicuspidata* is a species of yeast that commonly infects the water flea *Daphnia dentifera*, and is extremely lethal to them. The disease can alter many factors in the ecology of *Daphnia*, such as susceptibility to predation or environmental stressors. Also, the environment can potentially alter *Daphnia-Metschnikowia* interactions. The main goal of this study is to determine how food availability for the host influences spore production of the pathogen. In this study, we exposed young *Daphnia* (neonates) to *Metschnikowia* and gave them various feeding treatments with increasing amounts of algal cells per milliliter of water. We monitored mortality throughout the duration of the experiment, as well as body size and spore production at the end. We predicted that a lower amount of food that is available to the *Daphnia* would decrease its immune function, which would make it more susceptible to disease. A higher amount of food available to them would increase immune

function, while at the same time providing excellent resources for the *Metschnikowia* to grow inside of the *Daphnia*. Further implications of this study could reveal more information about food limitations in *Daphnia*-*Metschnikowia* interactions, and could help predict when outbreaks of the disease may occur and the various ecological repercussions, and new methods for disease management.

Poster Number 200: ChanMi Youn

“Selective Stabilization of a Partially Unfolded Protein with the vary of Nucleotide”

Escherichia coli glyceraldehyde-3-phosphate dehydrogenase (GAPDH) is known as not binding with ATP in the native condition. In previous lab study, GAPDH has recovered to destabilize in the presence of ATP. Also, it recovered that equilibrium unfolding protein in urea showed that partially unfolded equilibrium intermediate when ATP present, and ATP accelerates the unfolding rate of GAPDH. These result analyzed by thermodynamics and kinetics of folding and unfolding of GAPDH in the presence of ATP. With that, we were curious whether other type of nucleotide also works similar as ATP with GAPDH or not. With the same technique, this experiment ran with different types of ligand as AMP, dAMP, GMP, and ADP with the same concentration to compare.

Poster Number 201: Ruiyu Zeng

“Experience-dependent mate choice in female brown headed cowbirds”

Individual variation in animal mate choice can be attributed to factors inherent in both signal senders and receivers. For example, different experiences between receivers (typically females) during the mating process (i.e. exposure to high or low quality mates) could lead to differences in mate-choice. The mate assurance hypothesis posits that receivers balance the benefits and costs of mating by maximizing the probability of finding a mate when mates are rare, but optimizing mating quality when mates are common. Therefore, females become less choosy when preferred males are rare or absent, but they become choosier when preferred males are abundant. In the current study, we tested this hypothesis with brown headed cowbirds (*Molothrus ater*) using duration and latency of the

copulation solicitation display (CSD) as a measure of females' motivation in mating. Brown headed cowbirds are a great model system in mate choice studies because of their large social network, and abundant research has shown that experience can modulate their behavior. We used 12 different male displays that could be broken into four different categories with varying song potency and visual display intensity. The song potency was determined based on the extent to which the songs consistently elicit CSD response from female birds, and the visual display intensity was determined by the presence or absence of bows. We predicted that the higher number of high-potency songs the female cowbirds have heard, the shorter the duration of CSD they give. Our data support the mate assurance hypothesis: there is a negative correlation between the CSD duration and number of high-potency songs the females have heard ($P < 0.001$); Additionally, we found there is a significant positive correlation between the number of high-potency songs and the latency to give a CSD ($P < 0.001$)—meaning that the female cowbirds are more reluctant to give a CSD when the number of high-potency songs they hear increases.