Showcase of Undergraduate Scholars

April 29, 2015
3-6PM
Student Center Ballrooms
2013 Showcase of Undergraduate Scholars
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Ninth Annual Showcase of Undergraduate Scholars

Wednesday April 29, 2015
Student Center Ballrooms
3:00-6:00 pm

3:00pm …………………Opening Remarks and Moderator
Sarah Whelan, SPUR President

3:05 pm ……………… Welcome from Dr. Diane Snow
Director of the Office of Undergraduate Research

3:10 pm……………… Remarks by Lisa A Cassis
Vice President of Research

3:15 pm ……………… Keynote Speaker
Lesley Mann Lynch

3:30 pm ……………… Presentation of Seventh Annual Faculty Mentor of the Year Awards
Sarah Whelan

3:35 pm ……………… Performance by The UK Theatre’s Dance Minor Program

3:45pm ……………… Reception Begins

3:45-6:00pm …………… Poster and Oral Presentations
Welcome to the 2015 Showcase of Undergraduate Scholars!!

“Tell me, and I’ll forget
Show me, and I’ll remember
Involve me, and I’ll understand”

- Chinese proverb

To honor the remarkable achievements of our undergraduate researchers and the unswerving dedication of their UK mentors, The Office of Undergraduate Research and all supporting partners welcome you to the 2015 Showcase of Undergraduate Scholars.

At this year’s Showcase of Undergraduate Scholars students, faculty, staff, and guests will have the honor of meeting UK’s undergraduate researchers, who will present the results of their scholarly research and creative activities in poster, table, and oral formats. Attendees will also hear from administrators associated with research campus-wide; enjoy a presentation from a former UK student and researcher, Mrs. Lesley Mann Lynch, about the benefits of engaging in undergraduate research; learn about the 2015 Oswald Award winners (see www.uky.edu/academy/Oswald); enjoy a special performance by Liza Bustle and dance team members, and enjoy the interactions with colleagues and friends. We are sure that you, like us, will be amazed and intrigued by the diversity, and depth and breadth of research projects, by the professional accomplishments of our students, and by the superb mentorship provided by our devoted faculty and staff.

While the students are indeed dedicated and talented, of course their success is highly dependent on other factors. First, the devotion and mastery of their faculty mentors, who work side by side with these gifted undergraduates to prepare them for the rigors of their chosen careers, and who also work with the Office of Undergraduate Research to help to facilitate our many research programs. Congratulations to this year’s recipients of the Excellent Undergraduate Research Mentor Awards, and to ALL mentors, who promote student success. Second, to the hard-working and talented staff of the First Scholars Program, The Chellgren Center for Undergraduate Excellence, The Gaines Center, Office of Undergraduate Research, the Robinson Scholars Program, the UK Honors Program, Nationally Competitive Awards, and all across the UK campus and beyond, who work tirelessly to promote undergraduates and their research endeavors. My sincere appreciation for their efforts!

Please join me in welcoming and congratulating all the undergraduate student presenters at this year’s Showcase of Undergraduate Scholars, who will highlight for you what engaging in undergraduate research and scholarly activities is all about!

With admiration and appreciation,

Diane M. Snow, PhD
Director, Office of Undergraduate Research
Director (Interim), UK Honors Program
UK Professor of Neuroscience and Endowed Chair, Spinal Cord and Brain Injury Research Center; and Dept. of Anatomy and Neurobiology
Welcome from the Society for the Promotion of Undergraduate Research

Welcome to the 2015 Showcase of Undergraduate Scholars! We appreciate you taking the time to come out and support all the student researchers on campus. For the past nine years, this Showcase has played an important role for the students who engage in undergraduate research at the University of Kentucky, and for the community. For the students at UK, it allows them an opportunity to professionally present their research that they have worked hard on. For the University of Kentucky, this event showcases the discovery, knowledge, and collaboration that makes UK a leading research university.

Of course, this Showcase would not be possible without the hard work of several hundred people. First, I would like to thank all the student researchers for all the hours of research they put in this past year; without their dedication, none of us would be here. Second, I would like to thank the faculty advisors for all the guidance they have given our researchers. Finally, I would like to thank everyone who helped organize this Showcase, especially the Office of Undergraduate Research, the Chellgren Center, the Society for the Promotion of Undergraduate Research, and the Student Outreach Team.

I hope everyone attending tonight enjoys the evening. Please, have some of the food prepared by Aramark Catering. Our opening performance will be a collaboration of art and science minded students in the form of a choreographed dance. And finally, I would encourage everyone to take advantage of the broad array of research presented tonight by connecting with student researchers from multiple disciplines.

Thank you,

Sarah Whelan
President of SPUR
**Keynote Speaker: Lesley Mann Lynch**

Lesley Mann Lynch is a native of Calhoun, Kentucky and graduate of the UK Agricultural Biotechnology program. While at UK, Lesley contributed to Dr. Christopher Schardl’s research on Endophytes in Grasses, including her Arnold A. Beckman Fellowship research that centered on Gene Expression of Endophytic Fungi. As President of the Society for the Promotion of Undergraduate Research (SPUR) from 2009-2010, she helped shape the Showcase for Undergraduate Scholars during its inaugural years.

Lesley holds a Master’s in Bioscience Enterprise from the University of Cambridge as a Gates-Cambridge Scholar. After her time in England, she moved to Dallas to work as Research Editor for D Magazine, one of the most widely distributed city and regional magazines in the country. She now works as an Innovation Leader for Humana, helping develop new approaches to solving age-old healthcare challenges. Lesley also co-founded Charlie’s Compost, a boutique organic compost company based on her family farm in western Kentucky.

**UK Department of Theatre and Dance presents Interdisciplinary choreography by dance minor Liza Bustle**

**A Production on the Production of Cortisol: Glucocorticoids Made Personal**

Liza Bustle, Choreographer & Undergraduate Researcher
Performers: Noell Conley, Bethany Denny, Olivia Grothaus, Kaitlin Lemaster, Marie Noell, Tolu Odukoya, Kaitlyn Senay
Mentor: Professor Susie Thiel
Department of Theatre and Dance

The sciences and arts are historically polarizing fields that intersect at the point of creativity. According to Smith (1959) “Creation excites creation: perceptive poetry stimulates the scientist, and a keen scientific insight into nature stimulates the poet.” The goal of this research study is to further explore the collaborative products resulting from this amalgamation of science and art, particularly in the biological and dance realms. This study visualizes the physiological impacts of stress and cortisol on the human body through choreography set on students with science majors, showing both the internal and external effects of these hormone pathways. The research methods for this study include collaboration with the dancers, beginning with discussion on stress and its physical, mental, and emotional impacts. The physiological production of the stress hormone cortisol was then examined before starting improvisational movement. This movement was then pieced into choreography that reflected both the production of cortisol along with its direct correlation with the human body and mind in response to stressful encounters. The final product of this choreographic study demonstrates kinesthetic learning in an abstract manner, while also analyzing the effects of stress, particularly on the college student. The performance of this study has engaged a diverse audience from both the science and art realms, sparking discussion on the content, execution, and creative process of this interdisciplinary work. This intersection between biology and dance has impacted society by breaking the traditional molds of how scientists and artists should function and enlightening colleagues in each field with knowledge and differing perspectives. This connection unites the mind, body, and movement while allowing the opposing disciplines to coexist harmoniously, fueling creation in each area.
2013 Faculty Mentor Award Recipients

Dr. Richard Smith, Psychology

Dr. Richard Smith is a social psychologist in the Psychology Department at UK. He teaches undergraduate and graduate courses, and advises undergraduate and graduate students on research involving social emotions such as envy, shame, and schadenfreude. Dr. Smith has been an excellent advocate of undergraduate research, and continues to aid his students in their search for knowledge.

Dr. J. Zach Hilt, Chemical Engineering

Dr. J. Zach Hilt is an Associate Professor of Chemical Engineering in the Department of Chemical and Materials Engineering at the University of Kentucky. In particular, he is interested in the development of composite nanoparticles for the remote controlled delivery of drug, heat, and combination therapies to cancer. He has taken an active role when it comes to undergraduate research.
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The Fast and the Furious or the Slow and the Curious: Differential Foraging Strategies in *Passer domesticus*

The ways animals gather information about their surroundings influences their further actions and successes. Some individuals explore rapidly while others explore more slowly. These exploratory behaviors, known respectively as fast and slow, are repeatable within an individual. Fast and slow explorers differ in their responses to environmental change as exhibited by their success in associative learning. One possible facet of this is the speed and accuracy in which an individual finds food. Some individuals may visit more locations quickly while making many errors, while others may be slower and more accurate. We were interested to see if these two styles were present in house sparrows (*Passer domesticus*), and if they had an effect on the success of the individual in finding food. To answer this question, we created an associative foraging task in which individuals were presented with cups with colored lids containing either a food reward or no food reward. Four out of the eighteen cups had food, reducing the probability that a bird would discover a correct cup by chance. We predicted that individuals would differ in their styles of solving the task and that these different styles would have an effect on their success at solving the task. Thus far, we have found that individuals differed in their number of incorrect choices across trials and the average time they spent at wells. Additionally, we found that individuals did not significantly differ in the time they spent solving the task overall. This suggests that individuals may use different strategies to successfully find food. Multiple styles to problem solving could in part explain the house sparrow’s success as an invasive species.

Cytokines and Psychosocial Properties Throughout Early Pregnancy in African American Women

Psychosocial factors such as stress, anxiety, and depression have been associated with increased rates of preterm birth (PTB). These factors have been used to explain the racial differences of African American (AA) women being more prone to PTB. In a previous multiethnic study we found that AA women had the highest levels of stress, and that there was an inverse correlation between psychosocial stress and the anti-inflammatory response in pregnancy. Studies suggest that increased inflammatory activity during pregnancy creates the potential to precipitate PTB. Recent data demonstrates different biomarker associations with PTB and different associations of these cytokines for African Americans and Caucasians. The purpose of this study is to examine the relationship between prenatal psychosocial factors (stress and anxiety) and inflammatory cytokines, (IL (interleukin)-1a, IL-1b, IL-8, IL-10, CRP and TNFA in the early pregnancy of AA women). This is a secondary analysis from a prospective multicenter study of pregnant AA women (n= 72) with repeated measures designed. Maternal serum was collected at the same time of survey administration each trimester. Cytokines were measured using a multiplex beadlyte Luminex IS-100 assay. Stress and anxiety were measured using the stress and anxiety component of the Depression Anxiety and Stress Scale In the first trimester, prenatal stress scores were significantly associated with IL-1a (P=.02). In the second trimester, prenatal stress was associated with
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IL-1b (P=.02) and IL-10 (P=.04). Prenatal anxiety was associated with IL-10 (P=.04) in the second trimester. There was no association between prenatal stress and anxiety with IL-8, CRP, and TNFA in either the first or second trimester. In early pregnancy, the stress scores were significantly associated with both a pro-inflammatory and anti-inflammatory immune response.

Elizabeth Lampert
Agricultural Economics
Mentor: Jill Stowe

The Effects of Economic Conditions on the Sport Horse Industry in Kentucky and Nationally

The horse industry in Kentucky is larger than thoroughbreds and racing. Sport horses are an increasingly popular form of riding and showing in the bluegrass and nationwide. Unknown to many, sport horse disciplines include dressage, eventing, and hunter-jumper horses. In Kentucky, sport horse enthusiasts are fortunate enough to be home to the Kentucky Horse Park, a park known worldwide for its shows and courses. In 2010, the park hosted the World Equestrian Games, marking the first time that the World Equestrian Games had been held outside of Europe. Focusing mainly on the Lexington area, the effects of the 2008 recession and the World Equestrian Games on the sport horse industry were studied extensively. This study seeks to show that the recession did have an impact on people involved in the sport horse market, including trainers, competitors, and owners, as well as later a boost to the local and national sport horse industry in the years following the World Equestrian Games.

Yanxi Li
Mathematics
Mentor: Adib Bagh

Approximating Pure Strategy Nash Equilibria by Discretization

The Cournot Competition is an economic model that assumes firms compete in quantities and choose quantities simultaneously to maximize profits. In the Cournot Competition, solving for pure strategy Nash Equilibria analytically is often not possible when the marginal costs are not linear. Therefore, we develop a numerical method to approximate the pure strategy Nash Equilibria for such games. We discretize the continuous quantity interval into discrete quantities with equally-divided sub-intervals. By decreasing the size of the discretized sub-intervals, we construct a sequence of games with finite moves. We find the Nash equilibrium for each element in this sequence, and then show that the resulting sequence of Nash equilibria actually converges to the Nash equilibrium of the original Cournot game. The Bertrand Competition is another economic model that assumes firms compete in prices instead of quantities. We use our discretization approach to approximate the pure strategy Nash Equilibria of the Bertrand Games with convex costs.
Oral Abstracts

Meredith Miles
Biology
Mentor: Vincent Cassone, Clifford Harpole

*The Role of Melatonin in the Photoperiodic Control of Bird Song Frequency and Repertoire in the House Sparrow, Passer Domesticus*

Melatonin, a peptide hormone secreted by the pineal gland, is an important factor in regulation of circadian rhythms in birds as its expression is inhibited by light and therefore limited to the night. In the seasonally breeding house sparrow (Passer domesticus) melatonin has a circannual effect on secondary sexual characteristics including song production. The song control nuclei responsible for song acquisition in juveniles has been shown by our lab to be stimulated by the pineal during increased photoperiod (daylight). Under these conditions birds exhibited calls and song with an increase in both rate and diversity. Conversely, the shortened photoperiods accompanying winter-like conditions result in suppressed proliferation of the song control nuclei in these birds. Our goal now is to determine if short durations of melatonin alone (in the absence of the pineal gland) are sufficient in producing the observed increases in song frequency and complexity that coincide with a spring-like photoperiod. Twenty-four male house sparrows were pinealectomized and allowed to recover in winter photoperiod conditions (10:14, light:dark, L:D). Three groups were each given one of a control (no melatonin), short-duration (simulating spring), and long-duration (simulating winter) melatonin treatment. Conditions were then modified to simulate equinoctial photoperiod (12:12 L:D) while melatonin administration remained unchanged. Vocalization, locomotor activity, and beak darkness (an indicator of circulating testosterone) were all monitored for the length of the experiment. We expect to see a persisting suppression of song production and diversity in the long-duration melatonin group despite the stimulation of increased photoperiod along with a lack of expansion in the song control nuclei of these birds. In the short-duration group we predict song behavior and song control nuclei size to coincide with that which is observed naturally in male house sparrows during the spring.

Haden Pike
Computer Science
Mentor: Jerzy Jaromczyk

*Universal Interfaces: Providing Equal Access to Software for Blind and Vision Impaired Users*

A significant amount of time in the application design process concerns the visual appeal of the product. Due to the proliferation of graphics and custom User Interface elements, the level of access to these interfaces for the Blind and Vision impaired ranges from difficult to impossible. Assistive technologies rely on the user interface to convey information about the state of its elements. The controls provided by the Operating System provide these capabilities by default; custom controls delegate this responsibility to the programmer. Through a series of examples, we discuss methods for restoring access to these applications.
Oral Abstracts

Zack Storms
Economics
Mentor: Christopher Bollinger


Despite being considered the leader of the free world, no other nation imprisons more of its citizens than the United States of America, which has unintended consequences for the labor market. Within the United States, the variation in incarceration rate by state varies from one tenth of a percent to nearly one percent of the state’s population. Incarcerating more citizens may reduce crime in the short run, yet the long term implications are far less certain. This analysis explores the effect that economic and social factors, specifically the incarceration rate, have on the level of unemployment in the United States, at the state level. The effectiveness of three strikes laws and mandatory sentencing guidelines are also called into question in this study. With astounding levels of recidivism, careful analysis is warranted in how the revolving door of prisons relates to labor market conditions in the United States of America. In the United States, criminal justice policy allows for substantial state intervention, which provides a large market reallocation of labor that has significant effects on employment trends. Whether or not incarceration increases or decreases the level of unemployment in individual states remains a debated topic.

Shelley Zhou
History
Mentor: Karen Petrone

* Revolutionary Successors: The Political Education of Chinese Youth during the Great Proletarian Cultural Revolution *

In 1966, Mao Zedong, Chairman of the Chinese Communist Party, launched the Great Proletarian Cultural Revolution to strengthen his own authority while purging society of “bourgeois intellectuals,” “capitalist-roaders,” and other “class enemies.” The socio-political campaign exploded into a tumultuous populist movement, which lasted until Mao’s death in 1976. Schools stopped classes from August 1966 to late 1968. Senior high school students organized under the name, hóngwèibīng or Red Guards, and university students soon followed their example. Some of these Red Guards even waged “class struggle” to the death. When classes resumed after the initial chaos, primary and junior school students began to study an intensely ideological curriculum. On the other hand, many older students, including Red Guards, did not return to school. Mao sent them “down to the countryside and up to the mountains” to receive re-education from peasants. This paper uses thirteen personal interviews, memoirs, and secondary sources to examine the effect of the Cultural Revolution on Chinese education at the time. It also particularly focuses on the ways in which children and teenagers of that period absorbed and reacted to their political education.
Table Abstracts

David Cole

English
Mentor: Frank Walker

*The Wind is Waylon: The Forgotten Legacy of Waylon Jennings*

Country music once stood for something. There was an element to this style of music that echoed a proud American tradition. Waylon Jennings was an integral voice in the evolution and cultural relevance of country music, helping to usher in the Outlaw Country movement and put the style on the map. Waylon was a part of Wanted! The Outlaws, which became the first country album to go platinum, and released the incredibly influential albums *Lonesome, On’ry and Mean* and *Honky Tonk Heroes* (among others) as a solo act. David Cole’s poetry collection *The Wind is Waylon: The Forgotten Legacy of Waylon Jennings* attempts to highlight not only the seminal moments from the singer-songwriter’s career, but also expose the greater narrative of his life to a wider audience. Waylon’s story is full of triumph and loss, overcoming insurmountable odds, and plain old good luck—all of the essential elements of a good epic. The poems here represent a selection from the final collection, looking at Waylon’s life in a three-act progression: the first from his childhood up to the death of friend and mentor Buddy Holly, the second his return to music and wild success, and the third his undefeated attitude in the face of commercial and medical decline. These poems have been the subject of workshop sessions between David and his faculty mentor, Frank X Walker, and are presented in their proposed final draft state.

Nathan Petrie

English
Mentor: Frank Walker

*Shadow of the Bat: Poems for the Dark Knight*

This year, pop culture fans celebrated the seventy-fifth anniversary of Batman’s first appearance in Detective Comics #27 (May 1939). The character’s immediate success has continued across all mediums for generations. Batman appeared in monthly magazines; live-action and animated television; radio shows; records, cassettes, and CDs; and only Superman has stared in as many feature length films. His most recent appearance on the silver screen, Christopher Nolan’s Dark Knight Trilogy, grossed more money per film than any other movie-franchise in history. Batman is an integral part of American culture. He’s also become an international icon. At this past summer’s World Cup, while United States supporters used Batman as a national icon, a Brazilian protestor dressed as Batman to protest the injustice of centralized wealth in his country. The Dark Knight has become more than just a character, he’s become an idea. I set out to create a collection of poems: Batman, as a symbol of individualism, justice, and the American Dream, deserved. After studying graphic novels, the 1966 Batman television show, ten Batman films, and poetry collections such as Multiverse: An Anthology of Superhero Poetry of Superhuman Proportions edited by Rob Sturma and Ryk McIntyre and Missing You Metropolis by Gary Jackson, I wrote this collection of persona poems to celebrate, and challenge Batman’s prominence in American society.
Poster Abstracts

Anatomy and Neurobiology

1. Evelyn Beckert
Other Authors: Juan Wang
Mentors: Edward D. Hall, Rachel Hill

Temporal Evolution of Brain Oxidative Damage, Mitochondrial Dysfunction and Cytoskeletal Degradation Following Controlled Cortical Impact in Male Rats

Much of the neurological damage following traumatic brain injury (TBI) is caused by secondary injuries, one of which is oxygen radical-induced membrane lipid peroxidation (LP). It has been found that the LP-mediated oxidative damage is caused principally by the reactive nitrogen species (RNS) peroxynitrite (PN). This damage usually occurs during the first hours and days and leads to dysfunction of the mitochondrial respiration and calcium (Ca++) buffering. The resulting overload of intracellular Ca++ causes neuronal cytoskeletal degradation, neurodegeneration, and neurological impairment. Previously, we have used the rat cortical controlled impact traumatic brain injury model (CCI-TBI) to examine the degree of mitochondrial respiration dysfunction and neuronal cytoskeletal degradation. This data was then used to determine a time course of the LP-mediated oxidative damage in the brain caused by TBI. The peak damage was found to occur at 72 hours post-injury for all outcome measures. This study is among the first to define the temporal relationship of oxidative damage, mitochondrial dysfunction, and neuronal cytoskeletal degradation following CCI-TBI in rats. Moreover, the coincident time course of these secondary injury mechanisms will be used to guide future studies of potential neuroprotective pharmacological agents and the therapeutic window for their efficacy.

2. Sabita Dumre
Other Authors: Jessica Gambrel
Mentor: Luke Bradley

Screening of a Peptide Library for a Neuroprotective Binding Target

Emerging evidence has shown that the well-known glycolytic enzyme, glyceraldehyde-3-phosphate dehydrogenase (GAPDH), interacts with numerous binding partners in the cell to perform a wide range of functions, including the mediation of cell apoptosis. The subsequent identification of small molecules that inhibit apoptosis and provide neuroprotection in cell culture and animal models, through their binding interaction with GAPDH, suggests that this protein may be a potential target for the treatment of neurodegenerative disorders. With the emergence of combinatorial library design and screening strategies, peptides provide an attractive scaffold to select individual sequences in the laboratory with desired interactions with a defined target, from a large collection of candidate sequences. In this project, we utilized phage display to screen trillions of unique peptide sequences for interactions to GAPDH. Multiple rounds of biopanning and amplification enriched the library over 10 billion-fold for binders to GAPDH. Preliminary analysis of selected peptide sequences has identified members known to interact with GAPDH, as well as novel sequences which could elucidate other cellular interactions as well as possibly be considered candidates for future cellular neuroprotective studies.
3. Dakota Halbert  
Mentor: Andrew Deane

*Incisor Crown Morphology and Fossil Ape and Early Human Diet: A New 2D and 3D Approach to Incisor Crown Wedging and Orientation*

Diet is one of the most basic and fundamental ecological parameters defining living primate species. Although field studies readily identify the diets of living primates, fossil primate diets must be inferred indirectly from dental morphology, allometry, and wear. Any detailed understanding of the ecology and evolution of fossil primates relies on the accuracy of dietary reconstructions of fossil taxa. The more accurate the interpretations of a taxon’s diet and feeding adaptation, the greater will be the potential for that information to contribute answers to research questions about why these taxa evolved, what made them successful in some cases and extinct in others, and the connection between diet and the origins of the lineages of living primates. Although incisor variation with respect to linear dimensions (mesidistal width, labiolingual breadth) and crown curvature (mesiodistal and cervico-incisal curvature of the labial surface) is well understood, little is known about the functional correlates of incisor wedging (i.e. the angle formed by the labial and lingual crown surfaces). Given that the congruence of these two surfaces forms the incisal (i.e. biting) surface, it is reasonable to predict that this angle will vary according to the mechanical properties of preferred foods. Here we test the hypothesis that incisor apex angles will vary with respect to the mechanical properties of food and that hard and/or tough foods will require an increased apex angle. Results from the analysis of a mixed species anthropoid sample (n=115) confirm that soft-object frugivore anthropoids have the smallest apex angles and that hard-object frugivore and folivorous anthropoids have larger apex angles. These results will contribute to a growing body of correlative data linking incisor morphology to function and will increase the resolution with which we can reconstruct fossil anthropoid diets.

4. Kristi McIntosh  
Other Authors: Anna Bostrom  
Mentor: Andrew Deane

*Rethinking Manual Phalangeal Shaft Curvature Variability across the Digital Ray: A New Way to Look at Old Fingers*

Among mammals, primates represent a greater diversity of locomotor adaptations than any other order. This group represents a variety of distinct locomotor adaptations, each one associated with a unique hand posture and characteristic pattern of mechanical loading (i.e. digitigrady, palmigrady, knucklewalking, fistwalking, quadrumanus suspension, ricochetal brachiation, tail-assisted brachiation, bipedalism). Although it has long been established that phalangeal shaft length and curvature are adaptive responses to the habitual stresses of locomotion and that more pronounced phalangeal curvature and increased length are associated with a greater reliance on arboreal substrates and suspensory postures, relatively little is known about phalangeal shaft curvature variation across the digital ray (i.e. proximal vs. intermediate phalangeal shaft curvature). This study employs 2D curvature quantification to test the hypothesis that proximal and intermediate phalangeal shaft curvature is closely correlated and increases uniformly in response to arboreality. A taxonomically diverse sample of anthropoids with varied locomotor adaptations (n=301) was analysed using high-resolution polynomial curve fitting (HRPCF). Results indicate that anthropoids with a greater reliance on arboreal substrates and hooked grasping postures (i.e. Pongo, Symphalangus) have significantly greater proximal phalangeal shaft curvature relative to intermediate
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phalangeal shaft curvature whereas more terrestrial species (i.e. Papio, Gorilla) have similar proximal and intermediate phalangeal shaft curvature. These results suggest that morphological responses to increased mechanical loading associated with arboreal, and more specifically suspensory, locomotor activities are primarily focused on the proximal phalanx. The results of this study further demonstrate that the combined locomotor signal for proximal and intermediate phalanges can discriminate between differing locomotor adaptations with far greater resolution than analyses of one or the other phalanx in isolation. This represents a promising and viable new approach to reconstructing locomotor adaptations in fossil anthropoids and, by extension, may provide new insights into the complex evolution of anthropoid locomotor adaptations and positional behaviour.

5. Julio Narbaiza
Other Authors: Liza Bustle, Cynthia Fieseler, J. Tyler Smith, Farhana Mueez, Saadia Mueez
Mentors: Marilyn Duncan, Sandra Legan

Physiological and Metabolic Effects of Ad-Libitum or Time-Restricted High-Fat, Diets in Middle-Aged Mice

High-fat diets have many deleterious health effects including obesity and glucose intolerance, which are risk factors for heart disease. Recent studies on young mice showed that time restriction of a high fat diet lessened these negative effects. Because obesity is also a concern in middle-aged adults, we tested whether time restriction would ameliorate the deleterious effects of high fat feeding in middle-aged mice. Three groups of male mice (18 months; n=15/each) were studied: 1) high-fat diet (60% fat) ad-libitum (HF-AL), 2) high-fat diet, time-restricted feeding (HF-TRF), and 3) low-fat diet (10% fat) ad-libitum (LF-AL). Mice in the HF-TRF group had daily access to food from ZT13-ZT21 (ZT12= lights off) during their active phase. All mice were kept in light:dark cycle conditions (12L:12D) for 25 weeks. Body weight gain differed among the groups (p<0.0001): HF-TRF gained significantly less weight than HF-AL (~20% vs 55%, respectively) while LF-AL did not gain weight. Caloric intake between HF-TRF and HF-AL differed only at weeks 3 and 5, and thus did not account for these changes in body weight. After 16 weeks of treatment, a glucose tolerance test was conducted. For this, mice were fasted from ZT 21 to ZT 13 the next day, and then they were injected with glucose (2g/kg BW, i.p.). Blood samples were collected from a tail vein at 0, 15, 30, 60, and 120 minutes after injection. Glucose tolerance expressed as incremental area under the curve (iAUC) differed among the groups (p<0.0001). HF-TRF was different from HF-AL (p<0.02) but not from LF-AL. After euthanasia, livers were dissected and weighed. HF-TRF livers weighed less than HF-AL livers (p<0.0001), but did not differ from LF-AL livers. In conclusion, restricting the time of consumption of a high-fat diet caused an overall improvement in body weight, liver weight, and glucose tolerance.

6. Michelle Rueff
Mentor: Andrew Deane

Growing Up Woolly: The Ontogenetic Development of Masticatory Musculature in Humboldt’s Woolly Monkey (Lagothrix lagotricha)

Diet is one of the most basic and fundamental ecological parameters defining living ape species. Similarly, our understanding of the evolution and ecology of fossil apes relies on the accuracy of dietary reconstructions for those species. Dietary information is most often obtained from morphometric analyses of the dental and gnathic anatomy preserved in the fossil record. However, these hard tissue structures are often influenced by phylogenetic relationships, premortem macrowear, and post-depositional
deformation. Although it has been shown that the fiber architecture of masticatory muscular anatomy is strongly correlated with diet and feeding adaptations, and more specifically the mechanical properties of preferred foods, muscular anatomy is not preserved for fossil species and must be inferred indirectly from extant models. Given that living apes are a taxonomically deprived group, non-ape anthropoids (Old and New World monkeys) are often used to model fossil ape diets. Humboldt’s woolly monkey (Lagothrix lagotricha) is a large-bodied new world monkey in the sub-family Atellinae. It is predominantly frugivorous and prefers soft-object foods that are neither hard nor tough. Here we present new data describing the ontogenetic development of relative muscle mass (MM) distribution and relative physiological cross section area (PCSA) of the masticatory musculature of Lagothrix lagotricha (n=5 adults, n=2 infants). Although there is a general increase in both relative muscle mass and PCSA from infancy to adulthood, infants are characterized by higher than expected MM and PCSA values demonstrating that the functional demands of soft-object frugivory are influencing the musculoskeletal masticatory anatomy within the first year of life and prior to the conclusion of the weaning process. These results will contribute significantly to a growing body of information detailing the ontogeny of the interaction between dietary mechanical loading and masticatory anatomy and will serve as a model for future ontogenetic analyses of fossil ape diets

7. Danielle Stephens
Other Authors: François Pomerleau
Mentor: Greg Gerhardt

The Use of Ceramic-Based Microelectrode Arrays to Test Oxygen Levels in the Brain

Measuring O2 levels in biological fluids has been around since the mid 50’s when Dr. Clark developed an electrode using a platinum wire and applying a negative voltage to reduce O2 and measure the resulting generated currents. However, accurate measurements of O2 levels directly in the brain during normal and dysfunctional processes (e.g. seizures) remains elusive. Recent trials of using ceramic-based microelectrodes arrays (MEAs) have been geared toward specifically testing oxygen levels in brain tissue. The goal of this project is to later observe oxygen behavior in the brain during status epilepticus. In order to achieve this, ceramic electrodes from former measurements have been observed in the development of calibration measurements. The design of the MEAs used in initial observations employ a R2 type where the 4 platinum recording sites (50x150 µm) are placed in a row and separated by 100 µm. With the use of amperometry (-0.7 V vs. Ag/AgCl), these microelectrodes are submerged in a deoxygenated PBS solution, in which the oxygen has been removed via the bubbling of nitrogen gas. Following this, the solution is then titrated with 40 µL or 400 µL of oxygenated PBS (0.2 mM of O2). The results show that the titration of 400 µL of analyte has proven to be most effective when observing electrode sensitivity, with a slope average of -18.1537336 nA/µM (SEM of slope= 0.848858072) and a Limit of Detection (LOD; S/N = 3) of 0.03421205 nM (SEM of LOD= 0.002575073). However, we also observed that repeated use of an electrode may lead to steady decline in selectivity and slope. These results support that the MEAs can be used for O2 measurements and future studies will look at preventing fouling of the MEA upon multiple use.
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Animal and Food Sciences

8. Alexis Thompson
Mentors: Jeffrey Bewley, Donna Amaral-Phillips

Effect of a Probiotic on Dairy Calf Diarrhea and Growth Rate

The objective was to observe the effects of a probiotic (Protect, Provita Animal Health, Northern Ireland) on calf diarrhea incidence and average daily gain. This study was conducted at the UK Dairy during the winter of 2014 and 2015. All Holstein calves were enrolled at birth, fed a colostrum-replacer (Bovine IgG Colostrum-Replacer, Land O’Lakes, MN, US), and did not receive vaccinations. Calves were housed in individual sawdust-bedded hutches with ad libitum water and starter for 8 weeks. Calves were fed a 20:20 milk-replacer (total 0.71 kg powder daily) twice daily. Calves were randomly assigned to one of three treatments: 10 g liquid oral probiotics at birth (O, n = 10), 10 g liquid oral probiotics at birth plus 1 g powder probiotic once daily incorporated in morning milk from day 2 to 14 (O+P, n = 9), and a negative control (CON, n = 9). Calves were weighed once weekly using a scale (Digital HSDC Series, Cardinal Scale Mfg., MO). Feces were scored once weekly, where 1 represented firm feces, 2 feces which did not hold form well, 3 feces that readily spread, and 4 liquid feces which indicated diarrhea. The GLM and FREQ procedures of SAS Version 9.3 (SAS Institute Inc., NC) were used to analyze data. The incidence of an episode of diarrhea was 80% for O, 75% for O+P, and 88% for CON (P = 0.79). Mean fecal scores from birth to weaning were 2.18 ± 0.55 for O, 2.18 ± 0.35 for O+P, and 2.28 ± 0.52 for CON (P = 0.73). Average daily gain during the study was 0.47 ± 0.10 kg/d for O, 0.52 ± 0.10 kg/d for O+P, and 0.56 ± 0.10 kg/d for CON (P = 0.42). No significant differences were observed among treatments for average daily gain, fecal score, or incidence of calf diarrhea.

Anthropology

9. Bobby Jenkins II
Mentor: Monica Udvardy

Social Organization are Kinships Too

This paper analyzes the organization of the National Basketball Association (NBA) using concepts learned through cultural, anthropological analysis of different ethnic groups’ social organization of the NBA parallels to that of East African age-set kinship systems. In the latter, an age-set is “a group of persons [usually male] of similar age and the same sex whom move through some or all of life’s stages together” (Ember and Ember 2014). They pass through a series of age grades, each of which is marked by ritual or rites of passage. The NBA age-set system starts at the McDonald’s All-American game. Thereafter, the players are initiated into College basketball; this is where age-set are formed, for example, Michigan Fab-Five or Kentucky Fab-Five 2.0. After this, they pass onto the NBA Combine and, next, to the NBA Draft. Then, they are onto their rookie years, where they perform “rookie baggage carrying duties”, after which some go into sports analysis or coaching. Finally, as senior elders, they become General Managers or Owners. As Players transcend through the age grades, they often form bonds that only become stronger as they gain more and more control, and finally, they may even own their own team.
10. Lacey Lansaw  
Other Authors: Matthew Davidson  
Mentor: Renee Bonzani  

*Botanical Analysis of Hardin Village: A Series of Fort Ancient Villages Along the Ohio River In Greenup County, KY*

Located in Northeastern Kentucky along the Ohio River in Greenup County is the Hardin Village site. Hardin Village is a late prehistoric site included in the cultural area known as Fort Ancient that dominated the middle Ohio Valley from A.D. 1000 to A.D. 1750. The location of this specific site experiences the full range of environmental seasons. Plant species in this area include but are not limited to walnut, chestnut, hickory, red cedar, maple, oak, and pine trees. Various types of animals are also present such as raccoon, rabbit, squirrel, deer, box turtles, and a plethora of fish species. Hardin Village contains multiple components within its boundaries. This paper discusses research at three distinct overlapping circular villages at the site dating from AD 1200-1400 (Middle Fort Ancient), AD 1400-1500 (early Late Fort Ancient) and AD 1500-1635 (late Late Fort Ancient). The people who inhabited the middle Ohio Valley during this time period were village-based horticulturalists and would have depended largely on agricultural and hunting practices as their subsistence strategy. Recovered botanical remains from these three villages will be discussed and analyzed in terms of change in diet over time and in selection practices by the agriculturalists in this area. Through the analysis of recovered seeds and seed parts, Hardin Village exhibits plant selection practices most often found among other Fort Ancient sites. Furthermore, the findings of this analysis have resulted in the indication that variety in plants utilized through time decreased through later occupations. Future work in the area may concentrate on earlier occupations of the site for a better understanding of the changes in diet as the people in the area became more sedentary and concentrated on maize agriculture.

11. Rebecca Schladt  
Mentor: George Crothers  

*Re-engineering the War of 1812 Saltpeter Works at Mammoth Cave from Archaeological Remains and the Historical Record*

The purpose of this research is to investigate the process of saltpeter production in Mammoth Cave during the War of 1812. Mammoth Cave in south central Kentucky was a primary source for saltpeter, a key ingredient to gunpowder, during the early 1800s. However, the operation was abandoned shortly after the war ended, and the remains of the production line were left to decay underground. Using information collected from the site by members of a team from the William S. Webb Museum of Anthropology, a 3D image of the saltpeter works and pipelines found within the caves was created in AutoCAD which displays the process as it may have operated in its prime. From there, the in situ pipes and topographical information was used to predict a pathway for the two sets of pipelines running through the caves and other specifications of the materials needed for the operation. In the future, these maps and images have the potential to guide archaeologists towards areas of the cave where more pipes or artifacts are likely to be buried.
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12. Claiborne Sea
Mentors: George Crothers, David Pollack

Stylistic Variation and Temporal Trends in Non-handle Fort Ancient Appendages

This research involves an analysis of Fort Ancient (A.D. 1000-1750) ceramic lugs and nodes. Lugs tend to be wider than they are thick and nodes tend to be more circular. Through an analysis of non-handle appendages recovered from Fox Farm, a large Fort Ancient village located in northeastern Kentucky, this study refined existing lug and node typologies for the region, and identified temporal trends in their production and use. Towards this end, multiple criteria, including shape, thickness, width, and location on the vessel, were considered. It is hoped that the results of this study will serve as a foundation for future research on non-handle Fort Ancient appendages.

Architecture

13. Sarah Daley
Mentor: Patrick Lucas

Making the Past Present: An Archaeology Center for Kentucky

The Ohio River Valley has a rich archaeological heritage of human occupation from prehistoric times to present day. As an independent center of agricultural development and home to the largest ancient architectural remains in North America north of Mexico, the region boasts a vast array of artifacts and evidence of human life. Unfortunately, Kentucky lacks an outlet for showcasing this story, and as my undergraduate thesis for the Gaines Center for the Humanities I aim to fill this void with an educational center that appeals to a wide range of audiences. For this research project, I will design an archaeology museum and several interactive exhibits, as well as organizing the archaeological information to tell the story of Kentucky’s first inhabitants. The design methodology, following the norms for architecture studio projects, begins with background research, involves the development of a program and design concept, transitions into design development, and culminates in a full site model and architectural drawings of the facility. Thus, my research project will be presented in poster form. As my central research question, I hope to create a building whose appearance and spaces effectively use architecture and design to tell Kentucky’s archaeological story, expressing the dynamic relationship between history, time, and space, and creating a place of knowledge that people will want to return to time and again.
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**Biology**

Other Authors: Natalie C. Bryant, Madeline A. Davis, Shane P. D'Souza, Alicia L. Gifford, Shannon J. Hinds, Sharzaud A. Karimi, Umang Khandpur, Regan B. Lee, Kathryn A. Martini, Madeline C. Penna, David V. Pierce II, Austin D. Renton  
Mentor: Randal Voss

**Inhibition of TGFB Signaling Blocks Salamander Tail Regeneration**

An understanding of mechanisms that allow highly regenerative salamanders to reform missing body parts could lead to the development of therapies for inducing tissue repair and regeneration after human injury. The TGFB signaling pathway is required for many developmental processes in vertebrates, including frog tail and fish fin regeneration. In this study we investigated the requirement of TGFB signaling on tail regeneration using the Mexican axolotl (Ambystoma mexicanum). Developmental stage 40 Mexican axolotls were obtained from the Ambystoma Genetic Stock Center at the University of Kentucky. These approximately 1 cm long embryos were manually hatched and anesthetized, and then a sterile blade was used to amputate 2 mm of their distal tail tips. Embryos were reared in microtiter plates that were filled with water (control) or water with 5 uM SB505124 (treatment), a chemical inhibitor of type I transforming growth factor receptors AVCR1B, AVCR1C, and TGFBR1. We observed that SB505124 completely blocked tail regeneration when embryos were treated immediately after amputation. We repeated the experiment and collected tissue from the tail tips of control and treated embryos during regeneration. RNA was isolated and microarray analysis was performed to identify genes that were expressed differently in response to SB505124 treatment. We identified changes in the expression of key developmental genes, with considerably more significant genes identified at later time points. Our results show that TGFB signaling is required for normal axolotl tail regeneration. Additionally, we identified target genes for a regeneration-specific transcriptional network that is activated downstream of TGFB signaling. Our study enriches understanding of signaling network dynamics that underlie natural regeneration.

15. Andrew Boling  
Other Authors: Conner Appelman, Michelle Giedt  
Mentor: Douglas Harrison

**Morphological Characterization of Male Reproductive Aging in Drosophila melanogaster**

As organisms age, a multitude of factors can affect deterioration in cellular function. Examining the process of spermatogenesis in the fruit fly, Drosophila melanogaster, is useful for modeling this progressive cellular deterioration as well as the unique morphological changes associated with each step in the aging process. By utilizing the Drosophila Genetic Reference Panel (DGRP), a collection of naturally-derived, genetically diverse, and highly inbred lines, it is possible to examine the genetic contribution to the progression of age-induced sterility. Preliminary results suggest that reproductive senescence can occur via a variety of paths that differ based on quantitative genetic contributions. By comparing testes and seminal vesicles extracted from males of selected DGRP lines at specific time points during the course of the reproductive lifespan with one another and wild-type males, structural abnormalities, such as loss of stem cells or impaired differentiation, can be analyzed using cell-specific antibody markers. Differing quantities of sperm have been observed in seminal vesicles dissected from DGRP and wild-type males. Changes in the distribution of somatic and germ-line stem cells at different stages of development have also been found in each line and show distinct differences from the wild-type
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strain. These changes in morphology can provide further insight into possible mechanisms of loss of function in male gonads. Morphological analysis of several DGRP fly lines with different senescence phenotypes will be presented. In the future, this analysis will be examined alongside data from reproductive lifespan assays to characterize cellular pathways that act in the onset of sterility.

16. Brianna Campos
Other Authors: Cody Durham, Morgan Inks, Nicole Mitchell
Mentor: Edmund Rucker

Expression profiling of autophagy genes in the murine ovary by PCR

Autophagy is an essential, self-sustaining process which is necessary to maintain cell energy and homeostasis. It is responsive to nutrient stress for the turnover of organelles and long-lived proteins, and is a companion system to the ubiquitin-proteasome system. Material to be degraded is enveloped in structures known as autophagosomes, which are routed to lysosomes for degradation to occur. In the context of human health, several diseases have been linked and correlated to changing alterations of autophagy including cancer, heart disease and neurodegenerative diseases such as Alzheimer’s and Parkinson’s. By analyzing the role of autophagy in the primary functions of reproduction, researchers have established that this cellular process is crucial to the success of male and female reproduction. Furthermore, autophagy’s role in the hormonal, follicular, and placental stages of pregnancy is a relatively new field of study within cellular biology. Mouse models have relayed that in both the ovary and sperm, autophagy is responsible for regulating the follicle pool as well as paternal mitochondrial DNA degradation. Beclin1 (Becn1), an important autophagy gene, is closely associated with female fertility. Specifically, the absence of Becn1 in ovarian granulosa cells causes a deficiency in progesterone production in pregnant female mice, resulting in a preterm birth phenotype. Due to the necessity of progesterone in mammalian reproduction, this suggests that autophagy may be important in human reproduction. To establish a broader role in the female ovary, it is important to initially determine the expression of autophagy and autophagy-related transcripts. Ovaries were collected from C57BL6 females between 5-6 weeks of age for isolation of mRNA. Messenger RNA was subjected to a first-strand synthesis reaction and subsequent polymerase chain reaction (PCR). Expression profiling was performed on genes that encode for autophagy or autophagy-related proteins, and PCR reactions were resolved by gel electrophoresis for comparison to housekeeping control genes.

17. Thomas Daley
Mentor: Edmund Rucker

The Role of Apoptosis and Autophagy in Reproductive Cell Tissues

This research aimed to ascertain the role that autophagy and apoptosis plays in cells, specifically cells in the tissue types of reproductive organs. Autophagy and apoptosis are both types of programmed cell death, and occurs in reproductive cells at certain periods during development. This research focused on the ovaries, testes, and mammary glands of mice. Autophagy was manipulated through the controlled expression of the gene Beclin1. Beclin1 is a key autophagy regulation gene, and by turning it off and on, one can see the effects on reproductive cells in both the presence and absence of autophagy. This research went about this by manipulating the Beclin1 gene in tissues from mice. Some effects of lack of autophagy have been found to include the failure to remove damaged germ-line cells in the testis, failure of lactation and mistakes in cell type transitions in the mammary gland, and multiple issues in the ovaries, including loss of fertility. This research was meant to continue to monitor the effects of the lack of autophagy.
through the manipulation of Beclin1. This research has implications in cancer research, infertility research, and pre-term birth research, as well as any future research in the role of programmed cell death.

18. Jacob Dietz  
Other Authors: Blake Chandler, Kerri Peters  
Mentors: Bruce O’Hara, Shreyas Joshi

Time of Day Effects on Reaction Time Performance following Meditation

Previous research has supported multiple effects of meditation on brain activity including both short term and longer term changes. Additional studies have found improvements in reaction time immediately following meditation. In these studies, reaction time and alertness were measured using a Psychomotor Vigilance Test (PVT), which is done by requiring the subject to push a button at the moment they see an LED screen begin to count time. PVT performance is known to be sensitive to sleepiness, which is influenced both by prior sleep and by time of day (circadian factors). Therefore, in this study, we have investigated whether the post-meditation improvement in PVT may also be influenced by time of day by testing subjects at three different times (morning, afternoon, and evening). Meditation was done with eyes closed and focused breathing for 20 minutes, with EEG measurements to assess brain activity, depth of meditation, and any signs of sleep. All subjects were undergraduate students at the University of Kentucky. Results for PVT performance before and after meditation will be compared at each time of day. EEG recordings will be assessed for short bursts of delta waves, which are associated with sleep. These short bursts of sleep or microsleeps, can often result in sleep inertia and slower reaction time. Because sleep inertia is undesirable, the most beneficial forms of meditation will not contain delta waves, and have high levels of alpha waves with or without theta wave bursts. The hypothesis we plan to test in this study is that the times of day that correspond to increased sleepiness (mid-afternoon) will be less effective times for meditation, consistent with the observation that most individuals prefer to meditate in the morning or evening as opposed to midday. This study is currently underway, and all results will be presented.

19. Connor English  
Other Authors: Cole Malloy, Jessica Hill, Wen-Hui Wu  
Mentor: Robin Cooper

Cholinergic System Regulation of Behavior in Drosophila melanogaster Larvae

We investigated the role of acetylcholine in the Drosophila melanogaster larval central nervous system (CNS) to identify how this neuromodulator regulates locomotion and feeding behaviors. We combined pharmacological and genetic approaches in order to deduce the cholinergic receptor subtypes that play a role in mediating these behaviors and to gain a better understanding of the pharmacological profile in this model. Genomic screens have revealed that there are ten receptors in Drosophila that are similar to the nicotinic acetylcholine receptors (nAchRs) of mammals. In Drosophila, acetylcholine is a neurotransmitter within the CNS and is the neurotransmitter for sensory neurons but not motor neurons, as in mammals. A distinctive advantage of Drosophila larvae is the short developmental time (~4 days) in which the development of the CNS can be investigated. The alteration in neural activity related to circuits is particularly important during neural development for formation and stabilization of neural connections. In addition, the proposed experimental design allows for a multitude of options for future experimentation including investigation of regulation of olfaction and response to light upon altering the cholinergic system. All of these are testable for proof of concept and will provide the degree of inhibition in sensory
responses. This study will help to establish the role of acetylcholine in regulating simple motor behaviors and will help to identify the functional role of specific receptor subtypes within the larval CNS.

20. Zachary Fortenbery
Mentor: Jeremiah Smith

*Understanding Programmed Genome Rearrangement Events in Early Lamprey Development*

Through his line of research, Dr. Jeramiah Smith is concentrated on the programmed genome rearrangement (PGR) events that take place in early sea lamprey (Petromyzon marinus) development. Studies in the lab have demonstrated that genes are reproducibly eliminated from somatic cells around day 2.5 after fertilization, during the mid-blastula transition. This tightly-controlled deletion of approximately 20 percent of the genome has been thought to eliminate a few thousand somatic cell genes that are critical to the development and maintenance of germ cells, but when misexpressed are likely to contribute to the development of cancers or other diseases. Accordingly, programmed rearrangements result in a vast difference in genome structure and gene content between the somatic and germline cell lineages. Although these deletions from the somatic cell lineage are consistent and reproducible, very little is known about the molecular mechanisms regulating this large-scale loss of genes in sea lamprey. In order to gather more knowledge on this incredible event, it is required to optimize methods aimed at purifying and identifying the proteins that are mechanistically involved in eliminating DNA. We present the results from several preliminary experiments aimed at identifying these proteins via chromatin immunoprecipitations involving known specific epigenetic modifications associated with eliminated chromatin (5-methylcytosine as well as H3K9me3) coupled with subsequent sequencing through mass spectrometry.

21. Slavina Goleva
Other Authors: Megan K Rhoads
Mentor: Jeffrey Osborn

*Renal Specific Upregulation of Mitochondrial Genes in a Translational Primate Model of Spontaneous Hypertension*

Mitochondrial gene expression in African Green Monkeys (Chlorocebus aethiops sabaeus common name, vervet) may importantly influence renal function and long-term blood pressure control. Vervets share over 90% of their genome with humans and exhibit heritable, spontaneous hypertension. We hypothesized that altered renal mitochondrial gene expression in hypertensive vervets may be associated with arterial hypertension. Vervets were phenotyped as normotensive (NT, systolic blood pressure (SBP) <120 mmHg) or hypertensive (HT, SBP > 140 mmHg). RNA was extracted from kidney cortex and liver tissues from 18 HT (mean SBP 166±7 mmHg) and 18 NT animals (mean SBP 98±3 mmHg). Gene expression was determined using semi-quantitative RT-PCR. In renal cortical tissue of HT vervets, COX 3 (Complex IV) and Cyt B (Complex III) were upregulated by 1.6-fold (p=0.03) and 1.4-fold (p=0.05) respectively, while NADH4 (Complex I) and ATP8 (Complex V) expression were unchanged. In contrast, liver COX 3 expression was decreased in HT monkeys (1.9-fold; p=0.04), 1.6-fold for ATP8 (p=0.03), and 2.0-fold for CYTB (p=0.01). Gene expression of nuclear encoded subunits in the oxidative phosphorylation chain SDH (Complex II) and COX4 (Complex IV) were not different in both kidneys and liver of HT vs. NT vervets. Selected mitochondrial genes are upregulated in renal cortex of hypertensive vervets and may be associated with excess reactive oxygen species. Mitochondrial gene downregulation in the liver may result from the systemic hypertension.
22. Elizabeth Grau  
Other Authors: Kelly Sovacool, Anna Bradtmueller  
Mentor: Bruce O’Hara, Shreyas Joshi

*Effect of Meditation Duration on Performance*

Focused attention (FA) meditation has been widely used across many cultures as a method of focusing the mind. Previous research has shown significant improvement in short term performance measures after meditation in both novice and experienced meditators. The use of electroencephalogram (EEG) while subjects are meditating allows monitoring of brainwave activity. The fact that meditative states are associated with high alpha and theta wave activity in the EEG has been well documented for several decades. However, what effect, if any, this has on performance is unknown. The aim of this study is to investigate the efficacy of meditation for longer (20 minutes) and shorter (5 minutes) durations in novice meditators. Meditation was done with eyes closed and focused breathing for 20 minutes, with EEG measurements to assess brain activity, depth of meditation, and any signs of sleep. All subjects were undergraduate students at the University of Kentucky. Psychomotor Vigilance Tests (PVT) were performed by all subjects before and after meditation. PVT involves the subject responding to a light or sound stimulus by clicking a button on a monitor. The results are recorded as reaction time (RT) in milliseconds (ms). All subjects were novice meditators with limited or no exposure to the practice. Changes in the strength of alpha to delta ratios from EEG data can provide insight into the level of focus versus sleepiness with higher alpha suggesting better meditation. The hypothesis being tested here is that novice meditators have difficulty to maintain higher alpha power and may have better performance following shorter rather than longer meditation bouts. The study is currently underway and all PVT and EEG results will be presented.

23. Hannah Harris  
Mentor: Robin Cooper

*Effects of Diet on Development, Behavior Neural-muscular Function*

It is well established from plants to animals that various types of nutrition affects growth, survivability and reproduction. Types of diet can alter behavior in animals from transit to long term changes. Drosophila melanogaster is a commonly used model organism to examine the effects of various diets on growth and longevity due to the rapid growth and relatively short life span. We have also developed educational modules for middle and high school students as well as beginning college courses (see lab web pages). Many of the diets provided for culturing D. melanogaster contain a paste of cornmeal, water, amino acids, sugars, and heat inactivated yeast. Diet restriction is also known to prolong life in D. melanogaster as in other animals. However, the effects on neural-muscular development and function while prolonging life have not fully been addressed. Restricting diets slows development and results in smaller larvae as well as smaller adults. The purpose of our study is to examine which essential amino acids and sugars are necessary for normal growth compared to enriched food. In addition, we noted that feeding larvae only glucose and water delayed development to the pupal stages from the normal 5 days to as long as 14 days. When these nutrient deprived larvae are fed high level of nutrients on day 7 or later they quickly develop into pupa. This is an indication of altered hormonal production and/or responsiveness for progressing to a pupa with the poor diet. Another goal of this study is to address the result of poor diet on the development and function of the neural-muscular system. We have just began these studies but intend to examine behaviors which would indicate fatigue as well as direct measures with electrophysiology of synaptic transmission. We also plan to examine the anatomical development of
the neural-muscular system to examine synaptic homeostasis. These studies are significant to understand the effects of nutrition on neural-muscular function and the plasticity as well as maintenance of the system.

24. Robert Horn
Other Authors: Matt Endicott, Heather Campbell
Mentor: Kay Shenoy

The Effects of Sub-Level Doses of Sodium Nitrate on Growth and Survival in Northern Leopard Tadpoles

Agrochemicals, in recent years, have been an integral part of crop production and crop yield amongst modern farming techniques. Although agrochemicals are important to feed the people of the world, these chemicals have had an impact on local wildlife around these farms. The addition of nitrates, sulfates, and other toxic substances to the water of local streams can seriously have a negative impact on the wildlife in the ecosystem. In this experiment, we used Northern Leopard tadpoles (Rana pipiens) to examine how nitrates, a commonly used fertilizer affected larval growth and survival. In this experiment, we randomly assigned each tadpole to one of three groups. The first group was the control and had no nitrates added to the water. The second group was given a sub-lethal concentration of 5 mg/L of NaNO3 per tadpole. The last group was exposed to a sub-lethal concentration of 30 mg/L of NaNO3 per tadpole. Tadpoles were continuously exposed to these treatments for 51 days. Our ultimate goal was to see whether a higher concentration of nitrates would have a major effect on survival and size of tadpoles’ during larval development. These effects can have significant impacts on adult survival of amphibians, which in turn can alter the structure of the food chain causing the higher consumers to experience declines in population and mortality rates, ultimately affecting the entire ecosystem.

25. Laura Issac
Other Authors: Anisa Moore, David Whitaker, Ciara Pickering, Kaitlyn Schuster
Mentor: Nicholas McLetchie

Absorption of Nutrients in Local Areas of Corn Leaves

Whole plants have various mechanisms of responding to the environment, but how various parts of the same plant can respond is of general interest. Sometimes variation in the environment occurs at a scale smaller than the whole plant. For example, different parts of a leaf can be exposed to different levels of light depending on the distance from the stem. The goal of this project is to determine whether or not changes can occur among and within leaves of the same plant. To test this idea, an experiment was set up to determine if leaves can absorb various nutrients only in areas where they have been applied. Overall, fifty plants were grown in four hydroponic Hoagland solutions. Three of the solutions being deprived of a single nutrient (nitrogen, magnesium, or iron) and the fourth being a control. Plants deficient of one of the nutrients will result in a discoloration of the leaf. A solution of the missing nutrients was made and administered to localized areas within a leaf. The Hoagland solutions were replaced on a weekly basis. It is predicted that the nutrients are absorbed solely in the location that they are applied, resulting in a greener region of the leaf. The green region would be faded towards the stem and more abrupt towards the tip of the leaf. The experiment is still in progress and results will be reported once it is completed.
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26. Grace Jenkins
Other Authors: Tom Jester, Andrew Moloney, Sandhya Paudel
Mentors: Ling Yuan, Keith Allen

Production and Detection of a Plant-made Industrial Protein

Plants play a significant role in the well-being of mankind by providing foods, shelters and medicines. In the past decades, significant biotechnological efforts have been made by researchers to use plants as a “vehicle” or “platform” for the production of industrial proteins/enzymes, vaccines and other pharmaceutical compounds. Considerable progress has been made in genetically modifying plants by introducing a single or multiple genes encoding proteins of interest. Tobacco is being used for the production of a number of industrial proteins and vaccines. The objective of our project was to analyze transgenic tobacco plants that produce an industrial protein. We optimized methods for total protein extraction in different transgenic tobacco plants and detection of the protein using Western blotting. We generated two gene expression vectors and transformed them into tobacco plants. Eight independent transgenic lines were created for each transgene construct. We collected leaf samples from the transgenic tobacco plants and extracted the total soluble proteins. To compare production levels of the recombinant protein, we performed Western blotting using specific antibodies, followed by quantification using densitometry measurement of the protein bands. We also evaluated the expression of the transgene in different transgenic tobacco plants using quantitative polymerase chain reaction (qPCR). In conclusion, tobacco is an excellent platform for the production of useful proteins, and approaches demonstrated here can be used to evaluate and detect lines producing higher amounts of desired protein.

27. Chelsea N Lawson
Other Authors: Megan K Rhoads
Mentor: Jeffrey L Osborn

Elevated Heart Rate and Left Ventricular Hypertrophy in Spontaneously Hypertensive African Green Monkeys

Chlorocebus aethiops sabaueus, the African Green Monkey (AGM), is a highly translational model of human disease due to its similar genomic sequence and close evolutionary relationship. Blood pressures were measured using forearm plethysmography under light ketamine sedation (15mg/kg). Monkeys were categorized as: hypertensive (HT) with systolic blood pressure (SBP) greater than 140 mmHg; normotensive (NT) with SBP less than 120mmHg; or, borderline hypertensive with SBP between 120 and 140mmHg. 47% of 300 phenotyped adult monkeys categorized were NT (average SBP 98.30 mmHg), 20% were BHT (average SBP 130.34 mmHg) and 33% were HT (average SBP 169.47 mmHg). HT animals had significantly increased heart rates when compared to NT animals (134.3±2.1 bpm vs. 121.6±1.9 bpm, p<0.05). HT animals also exhibited significant left ventricular hypertrophy with increased cardiomyocyte cross-sectional area (1658.4±194.7 μm² vs. 791.0±168.9 μm²; p<0.05, n=8). Elevated heart rates and left ventricular hypertrophy in HT animals suggests that hypertension in this model is driven by increased sympathetic nerve activity, similar to human essential hypertension.
28. Danielle Middleton  
Other Authors: K. Zeidler-Watters, D. Johnson, S. Mayo  
Mentor: Robin Cooper, R. M. Krall  

*The Healthy Flea Model: Public Health Education with 7-12 Grades*

In preparation for implementing the Next Generation Science Standards (NGSS) in Kentucky, many middle and high school science teachers are examining ways to meet these new standards for teaching. The new standards seek to address applicable problems in society while challenging students to approach the problems in various ways (i.e., physical and computation models, literature survey, hands on activities, problem-based learning) with the objective of stimulating inquiry by the students. We work with many teachers across the state to prepare them for the NGSS and have helped to develop various classroom modules. We are now focusing module projects on numerous health issues (COPD, obesity, nutrition, oral health, importance of exercise for skeletal muscle health leading to whole body health, various disease states as muscular dystrophy and imaging in biological systems). The culminating module event for the participating students is presenting their work and research in an interactive public forum that will help students recognize the importance of their academic efforts outside the classroom environment. Demographics show that many Kentucky students reside in rural counties with health departments that lack the resources for annual health fairs that provide the public with free screening and information. Our goal is to provide these populations with a viable alternative that utilizes an established and popular rural community staple, the weekly flea markets (or swap meets). The idea is to have the students take on the role of scientists as they explore health problems and present findings from their classroom projects at the Healthy Flea Showcase, an annual health fair that will be hosted at local flea markets. The Healthy Flea showcase will be held in partnership with local health departments and/or health entities that can provide screening as well as work alongside middle and high school students.

29. Joshua Morgan  
Other Authors: Emily Greene, F. Pomferleau, P. Huettl, G. Gerhardt  
Mentor: Robin Cooper  

*Measures of Serotonin and Dopamine Dynamics within Intact Animals Using In Vivo Electrochemistry*

Modulators, such as serotonin (5-HT) and dopamine (DA), are known to be present in crustacean (e.g. crayfish) and insect (e.g. Drosophila) hemolymph and are well established to alter behavior and physiological function. Various behavioral responses in crustaceans are assumed to be due to release of modulators into the hemolymph as behavior can be correlated with injections of the same compounds. However, it has been challenging to obtain measures of these modulators in intact animals without stressing the animal to withdraw hemolymph; thus, in vivo levels of DA and 5-HT associated with behaviors remain relatively unknown. We propose to use in vivo electrochemistry (chronoamperometry) to measure endogenous DA and 5-HT within intact crayfish and drosophilae. A recording electrodes consisting of 30 µm carbon fiber coated with nafion™ and a reference electrode (Ag/AgCl) are placed just under the cuticle over the heart and glued in place in the crayfish. For Drosophila larvae, the recording electrode will be placed within the larvae and the reference electrode placed on a saline soaked filter paper on which the larvae are placed. Square-wave pulses (200 ms) from 0.0 to +0.55 V are applied vs. an Ag/AgCl reference electrode at a rate of 1 Hz, and the resulting currents (oxidation, reduction) are digitized using a FAST16 system (Quanteon LLC). Using this approach, we proposed to study various behavior and physiology (e.g. movement, response to stimuli, heart rate) and examine endogenous release...
of the DA and/or 5-HT directly in the hemolymph. These studies will help us further our understanding of the role of these substances within the hemolymph in crustaceans and insects.

30. Rachel Potter
Other Authors: Samuel Potter, Wen Hui Wu
Mentor: Robin Cooper

*Role of cAMP in Synaptic Vesicle Recruitment to Synapses at High and Low Output Neuromuscular Junctions*

Synaptic efficacy among neurons communicating to other neurons or to targets, such as skeletal muscle, is a dynamic process throughout development and for established synapses. The ability of synaptic function to increase or decrease in regulating the appropriate range of synaptic transmission is important in maintaining correct neural responses. Subtle changes in synaptic modulation can have pronounced acute and chronic effects. Vesicles are distributed inside a nerve terminal as a readily releasable pool (RRP) and a reserve pool (RP). The ability to mobilize the RP is known to be regulated by various second messengers (i.e. cAMP, IP3, PKA) depending on the type of preparation. Few studies have examined the differences in mobilizing the RP by cAMP following synaptic depression induced by high frequency stimulation; the same goes for synapses which are deemed high or low in synaptic efficacy. The hypotheses I am testing at the crayfish and larval Drosophila neuromuscular junctions (NMJs) are: (1) Low output synapses will show a greater degree of synaptic enhancement due to activation of cAMP as compared to high output synapses; (2) after induction of high frequency evoked depression, little recruitment of RP vesicle will occur in either synapse type; and (3) enhancing the cAMP production will lead to enhanced synaptic depression in the low output synapses as compared to high output synapses.

Activation of cAMP by application of forskolin, an activator of adenylate cyclase, was used. Low output NMJs increased by 127.8% with prior 1hr incubation and only 36.16% without incubation of forskolin (N=5, P< 0.05). A 56.29% (n = 5) increase occurred after depression without incubation. Studies are underway with high output crayfish and Drosophila NMJs. These studies are significant as the results will inform us which types of synapses may be modulated by pharmacological agents for therapeutic targets.

31. Samuel Potter
Other Authors: Rachel Potter, Sandra L.E. Blümich
Mentor: Robin Cooper

*Acute and Chronic Effects of Inhibiting mTOR by Rapamycin on Development, Behavior, and Physiology in Drosophila*

Rapamycin is a compound that can specifically block mTOR signaling and is therefore used in experimental biology. It is being utilized clinically as an immunomodulator after transplantation procedures and treatment for some forms of cancer. Due to its many possible effects on different molecular pathways, it could have any number of impacts on synaptic transmission. This issue has not, however, been addressed in a developing system. We hope to address it by feeding second and third instar Drosophila larvae varying concentrations of Rapamycin and monitoring larval stages, pupation, and survival. Typical larval behavioral assays being examined are mouth hook movement while eating and body wall movement while crawling on apple juice agar plates. Behaviors in the adults fed Rapamycin include climbing, righting response, and movement assays. The results to date suggest 2nd instar larvae are more susceptible to Rapamycin as compared to 3rd instar, based on a higher death rate. Adults fed
Rapamycin climb less over time and tend to fall off the wall when climbing. Dose-response studies are being established. This study is significant as we are starting to address the acute and long-term action of inhibiting the mTOR pathway on neuronal function and potential mechanisms to account for altered physiological function.

32. Claudia Prevost  
Other Authors: LaShay Byrd, Leslie Hancock, Chloe Robertson, Michael Heifner, Matthew Westling  
Mentors: Bruce O’Hara, Shreyas Joshi

**Effect of Meditation on Reaction Time Performance**

For centuries now, Yogis from India, Buddhists monks from Indo-china, and many other spiritual practitioners from across the world, have reported the beneficial effects of meditation. The stress relieving and relaxational properties have already been documented by many workers, especially those studying the effects of Transcendental meditation on meditators as opposed to non-meditators. But the area of interaction between meditation and objective performance is largely untouched, despite the many claim benefits for almost all forms of meditation. The aim of this study is to study the effect of meditation on short-term performance. Psychomotor Vigilance Task (PVT) recordings were done on subjects (n=11) before and after 20 minute bouts of focused attention meditation with closed eyes. All subjects were undergraduate students at University of Kentucky. PVT involves the subject responding to a light or sound stimulus by clicking a button on a monitor. PVT-192 monitors manufactured by Ambulatory Monitoring Inc. were used in this study. The results are recorded as reaction time (RT) in milliseconds (ms). All subjects were novice meditators with limited or no exposure to the practice. The reaction time measures recorded before and after meditation bouts will be compared using appropriate statistical approaches. This study investigates the hypothesis that meditation improves PVT performance, perhaps by allowing the brain to reset and refocus on new tasks. The study is currently underway and all results will be presented.

33. Madison Sanden  
Other Authors: Rebecca M. Krall, A. S. Cooper  
Mentor: Robin Cooper

**Stereology in a biological context with the integration of mathematics, design and modeling**

Application of knowledge to real life problems in authentic scientific inquiry with active learning process along with construction of various types of models is a focus for the Next Generation Science Standards (NGSS). When researchers are examining mutations in proteins or biochemical processes which alter ultrastructure of cellular organelles or proximity of structures, such as location of synaptic vesicles within nerve terminals, knowing the error in measurements is important to know if structural differences can account for altered function. The educational modules presented help to allow students to take stereological measurements using models made of readily accessible materials. The students can use the values they obtain to calculate a theoretical area or volume of objects, such as a triangle or triangular prism. Once they observe the actual 3D object for themselves they then can determine the potential error in estimations of area or volume from modeling with 2D images as compared a true area or volume. The modules are designed as an inquiry and problem based learning experience for the students. Physical models students can make will provide help in understanding the various concepts and provide useful objects for aid in classroom discussions. In addition, the use of the freeware “Sketch up” offers the use of some computational interaction and computer design to help illustrate various points the students may
wish to discuss while providing a rapid means of altering structures and rotating them in 3D space with no cost of supplies. Students learn on their own accord through inquiry, model building and discussion which depending on the structure and the number of sections with errors in measurement can vary greatly and that the concepts are important in authentic scientific investigations.

34. Michael Schultz
Other Authors: S.L.E. Blümich, Z. R. Majeed, C. Malloy, R.W. Putnam
Mentor: Robin Cooper

*Synaptic transmission: Effects of intracellular and intravacuolar pH*

This project addresses two issues: (1) the influence of pH on vesicular packaging of neurotransmitter; (2) response of glutamate receptors on postsynaptic targets with altering extracellular and intracellular pH. These two projects are interrelated as transmission at glutamatergic synapses is retarded in the presence of CO2 which cannot be fully accounted for by a reduced pH within the presynaptic nerve terminal or within the postsynaptic muscle fiber since rebound acidification with NH4Cl the EPSPs increase in amplitude. A rebound acidification after alkalization of the presynaptic terminals in the two model preparations enhances evoked synaptic transmission. High (40 mM) propionic acid acidifies both the pre- and post-synaptic cells. When used, the frequency and amplitude of minis increases despite a slight depolarization. However, evoked transmission is blocked. The use of high [CO2] containing saline blocks evoked and mini’s as well as the sensitivity of glutamate receptors. These investigations are being addressed at the model crayfish and Drosophila neuromuscular junctions (NMJs). These NMJs are glutamatergic and the evoked (non-spiking) synaptic potentials and spontaneous (quantal) events are readily measured. Addressing the mechanisms underlying these observed phenomenon may help in understanding synaptic depression after high frequency stimulation and feedback process in synaptic transmission. These studies tackle fundamental principles which are likely present in glutamatergic neurons for all animals.

35. Katie Thacker
Other Authors: Annie Baker, Sarah Milian, Swagata Ghosh
Mentor: Brian Rymond, Doug Harrison

*The dSERF Gene Function in Aging in Drosophila melanogaster*

Altered protein homeostasis is a common feature of aging and many age-associated neurodegenerative diseases. SERF1, a phylogenetically conserved gene first identified as a potential genetic modifier of SMA, was found to be deleted in more than 90% of type 1 SMA patients (Scharf et.al, 1998). It has also been shown to promote aggregation of amyloid proteins in C. elegans neurodegenerative disease models (Van Ham et.al, 2010); however, the natural biological function of SERF1 is not known in any organism. Here we investigate the natural function of SERF1 gene in Drosophila melanogaster. We hypothesize that the dSERF gene is required for normal protein homeostasis and thereby impacts aging. With our dSERF deletion and UAS-GAL4 based dSERF c-DNA overexpression lines here we show that altered level of dSERF protein alters normal life span in Drosophila. Loss of dSERF reduces life span while ubiquitous overexpression throughout development and adulthood extends life span. To refine our understanding, we performed tissue specific and temporally restricted (adult tissue specific) dSERF overexpression using neuronal and muscle specific as well as geneswitch GAL4 drivers. We present our data showing that increased dSERF level in a subset of tissues is sufficient to impart lifespan extension. Our study for the first time identifies dSERF’s biological role in fruit fly aging and hence its possible connection with neuromuscular and age-related diseases.
36. Ashwatha Thenappen
Other Authors: E. Burns, E.E. Dupont-Versteegden
Mentor: Robin Cooper

An Undergraduate Education Module Based on a Research Question: The Effects of Muscle Injury on Synaptic Transmission, Axon Conduction and Muscle Physiology in Relation to Deep Tissue Injury

This laboratory exercise is to determine the consequences of damage muscle influencing healthy muscle and neuronal function. Students can develop variations to the experimental models presented in this laboratory exercise. The preparations presented are of multiple motor units and muscle fiber types (slow and fast) as well as a sensory-CNS-motor nerve circuit. These preparations are well known for student neurophysiology experimentation but novel to use for investigating an injury topic on muscle and CNS. In addition, this module lends itself for inquiry, team discussion, self-paced learning and focuses on authentic scientific research. These approaches are hallmarks in student retention and understanding of novel concepts. Student feedback from use of this teaching exercise will be presented. The research questions on this topic are based on understanding the physiological problems with deep tissue injury of skeletal muscle and/or neurons. Primary skeletal muscle damage can produce secondary effects, which can increase the spread of the damage zone. This can be caused by the additive effects of intracellular contents, particularly the ion K+, released from crushed muscle cells. Consideration in the exposure time and effects of restoring normal [K+]o on the health of skeletal muscle and synaptic transmission has not been fully addressed. The synaptic responses return slower than recovery of skeletal muscle potential. At present we are conducting further investigations on the crayfish opener muscle and Drosophila larval body wall muscles as models for effects on synaptic transmission with muscle injury. It appears the axon becomes blocked in conduction with raised [K+]o, which is likely due to the inactivation of the NaV channels. Thus, a nerve close to a site of injury may not necessarily be physically injured but conduction of electrical signals may be hampered, due to a localized raised [K+]o. The goal of these research studies is to use these findings to help establish rodent models and development of experimental paradigms, which may lead to better treatment and assessment of DTIs in urgent care centers for humans.

37. Anna Townsend
Mentor: David Weisrock

De Novo Assembly of Salamander Genomes

De novo RNA-sequence assembly is utilized to study transcriptomes without a comparative reference transcriptome or genome. This project aims to perform de novo assembly of transcriptomes from multiple species of salamandrid salamanders. A range of computational biology tools will be utilized for analyzing genomic data constructed using next-generation sequencing (NGS). These include software for sequence data quality filtering and merging, and Trinity, an assembler that processes Illumina NGS data to reconstruct a transcriptome. As a first step, RNA libraries and sequence data were processed for a single species, Cynops cyanuras. Sequencing libraries and data were generated at genomics facilities at the University of Georgia and Florida State University. The raw data, nearly 40 Gb, were transferred back to the University of Kentucky and transcriptome assemblies are underway, relying on sequence arrangement and orientation, coverage, and quality of the RNA-sequence data. Utilizing transcriptome data will provide information about expressed genes in the Cynops genome, as well as their isoforms, or variations of the same protein as a result of post-transcriptional processing. Ultimately, these data are to be used to search for areas of the genome that have been subjected to episodes of positive selection, or other molecular evolutionary forces, and will be used to study species diversity and diversification within the
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salamandrid family. Implications of this larger research project will provide the groundwork for understanding the basis of genetic variation and divergence within and between species, and provide new insights for how NGS data can be used in phylogenetic reconstruction.

38. Henry Uradu
Mentor: Robin Cooper

*Acute & chronic effects of cold on Drosophila larval heart rates*

During low temperatures (~10°C), Drosophila melanogaster larvae and many other ectotherms enter a cold state in which internal processes slow down a significant amount. During this “cold coma,” the larvae are subject to substantial reductions in cardiac function. The purpose of this study is to examine the influence of various modulators, such as serotonin and octopamine, on the heart of semi-intact larvae during cold adaptation as well as during acute cold shock. Cardiac function was recorded and compared with controls at room temperature. The hypothesis is that acute and cold adapted larvae will be more sensitive to excitatory modulators than room temperature larvae. Preliminary experiments revealed that serotonin resulted in a 52.3% increase in heart rate at 10°C, much lower than the 96% percentage increase at room temperature. This implies that cardiac response to modulators is reduced in conjunction with colder temperatures. Future experiments will include the use of other modulators as well as diverse cocktails with different temperatures and various stages during the larval growth period. By manipulating an assortment of factors that impact the larval heart in cold environments, we hope to address the influence of modulators on cardiac function during acute and cold adaptation. This work is significant in understanding the role of modulators in various environmental conditions which insects experience.

39. Gareth Voss
Other Authors: Naomi Hayes, Kevin D. Kump, Jessica E. Spiewak, David M. Parichy
Mentor: Randa Voss

*Using TALEN and Tol2 to Manipulate Gene Functions in a Regeneration Model (Axolotl)*

Several transgenic approaches have been developed in recent years that can be applied to any organism, including non-genetic model organisms that are used in regenerative biology. Here we report on the efficiency of two transgenic approaches in the Mexican axolotl - TALEN-mediated targeted mutagenesis and transgene insertion using the Tol2 transposition system. We designed a TALEN to target exon 1 of kit, a gene that is expressed in developing vertebrate somites and limbs, and neural crest progenitors that give rise to pigment cells. We predicted that knockdown of kit would yield observable changes in pigment and morphology. We injected 75 single-cell stage embryos, grew these to the neurula stage, and created 10 groups of five embryos for DNA isolation. DNA template from each group was amplified by PCR using primers that flanked left and right TALEN binding sites. Gel electrophoresis of the resulting amplified products showed that every pool contained at least one insertion/deletion kit polymorphism, indicating a high rate of mutagenesis. Also, kit mutants exhibited pigment and morphological defects. To test the Tol2 system, we microinjected Tol2 edn3-v2a-venus constructs under zebrafish krt5 and actb promoters into 186 single-cell stage embryos that were homozygous for white, a Mendelian pigment phenotype. We predicted that by over-expressing a candidate gene for white, we would rescue the wild-type coloration. Indeed, the number and distribution of melanophores along the flank of rescue and wild-type embryos were similar and differed significantly from white. Moreover, some rescue axolotls exhibited pigmentation that very closely approximated wild-type coloration. Taken together, these
analyses indicate the correspondence of edn3 and the white locus, and showcase the renewed utility of the axolotl regeneration model in the post-genomic era.

40. Sarah Whelan
Mentor: Jeramiah Smith

Germline Marker Characterization in a Species that Undergoes Programmed Genome Rearrangement

The sea lamprey (Petromyzon marinus) undergoes massive programmed genomic rearrangements (PGR) during the midblastula transition. During these rearrangements approximately 20% of the genome is deleted in somatic cells, but is maintained in the germline. Preliminary studies indicate that the genes deleted during PGR have human homologs related to pluripotency; thus PGR, by reducing pluripotency in somatic cells prevents misexpression. In order to better track genomically differentiated cells in early embryogenesis, we sequenced and characterized the lamprey homolog of the classical germline marker vasa. Analyses of the germline locus have revealed that the introns have a reiterated repetitive structure with self-complementarity at the 5’ and 3’ intron boundaries. This unique intronic structure was not shared in the human homolog of the vasa gene, but is similar to sequence motifs (CA and GT dinucleotide repeats) that are enriched in the flanking regions of sequences that are targeted for elimination during PGR. We speculate that this repetitive structure may be functionally related to the retention and expression of germline specific DNAs. However, repeated in situ hybridizations with RNA probes for vasa suggested that it may not be the most appropriate marker for germline genes. Therefore, RNA-seq analysis was done on the sperm transcriptome and somatic transcriptomes. The genes specific to the germline and highly expressed in embryos throughout development will be used for future in situ hybridizations. These in situ hybridizations, along with what is now known about the vasa intronic structure, will then allow for future studies on the mechanisms of PGR

41. Jordan Wolfe
Other Authors: Robin Bagley, Jeremy Frederick
Mentor: Catherine Linnen

Measuring Host-shift Speciation in Neodiprion Sawflies: Can Ecological Divergence Drive Insect Speciation?

Phytophagous insects make up over one-quarter of the described species on Earth and this incredible diversity seems directly linked to their plant-feeding habits. Comparative studies of sister groups have shown shifts to herbivory are consistently associated with increased species diversity in insects, but the reasons for this diversification remain unclear. One hypothesis suggests shifts and subsequent adaptation to new host plants directly promotes herbivorous insect speciation. Host-shift speciation is a form of ecological speciation, where reproductive isolation evolves between populations as a consequence of adaptation to different ecological conditions. If host-shift speciation is prevalent, there will likely be evidence of host-driven divergence within insect species occurring on a wide range of host plants. Here we investigate three sympatric populations of the red-headed pine sawfly, Neodiprion lecontei, for evidence of incipient host-shift speciation. In brief, we use no-choice mating and survival assays to examine these three populations for evidence of pre- and post-mating reproductive isolation. We also examine ecological divergence in female host preference and larval performance between populations.
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Through these experiments, we hope to determine if host shifts predictably drive divergence between populations and if this divergence could lead to speciation.

42. Kalen Wright  
Mentor: Jeramiah Smith

*Evolution of Vertebrate Myelin-Associated Proteins: Insights from a Basal Vertebrate (Sea Lamprey - Petromyzon marinus)*

Sea lampreys (Petromyzon marinus) are basal vertebrates that diverged from our own lineage approximately 500 million years ago. Sequencing of the lamprey genome revealed homologs of a large number of genes that are known to function in the formation and maintenance of compact myelin. In humans, disorders that cause instability or variations in expression levels of these genes cause deterioration of myelin resulting in an array of afflictions, including Charcot-Marie-Tooth and Dejerine-Sottas diseases. Although the lamprey genome possesses most genes necessary for myelination, lamprey lack both of the cell types that produce myelin [oligodendrocytes in the central nervous system (CNS) and Schwann cells in the peripheral nervous system (PNS)], raising fundamental questions as to the function of “myelination” genes in the lamprey and ancestral vertebrate lineages. To shed additional light on the function of these proteins within lamprey, we performed rtPCR on RNAs that were derived multiple somatic tissues and in situ hybridization on tissues and developing embryos. Typically, expression of these proteins is localized to the CNS and PNS in jawed vertebrates. However, lamprey homologs do not exhibit the same patterns of localized expression. Some of these genes are expressed in both CNS and PNS, or across several tissues (including non-neuronal tissues: blood). Notably, expression of the CNP gene in lamprey appears to be localized to the PNS, contrasting the pattern of CNS-specific expression typically observed among jawed vertebrates. These analyses suggest that most CNS/PNS-associated expression patterns evolved uniquely within the jawed vertebrate lineage.

**Biomedical Engineering**

43. Zachery Branham  
Other Authors: Michael Akenhead  
Mentor: Hainsworth Shin

*Modeling the Relationship between Neutrophil Adhesion and Pressure Change in Microvascular Blood Flow*

Recent evidence suggests that activated neutrophils in the microvasculature contribute to microvascular dysfunction due to impaired tissue perfusion, eventually resulting in downstream organ injury and cardiovascular disease. We are interested in examining how the presence and activity of neutrophils affects hemodynamic resistance in the microcirculation, one of the key parameters that influences tissue perfusion. To achieve this, we designed microfluidics-based flow models to mimic the microvasculature in order to quantify how aspects of neutrophil activation, such as adhesion to microvessel walls, influence pressure distributions and, as a result, tissue blood flow resistance. We used COMSOL Multiphysics computational software to identify key geometrical parameters that would define the dimensions of our microfluidics flow channels. Specifically, computational models were formulated to ascertain the microvessel dimensions and number of adherent cells required to have a physiologically relevant effect on pressures, and thus flow resistances, in our chambers. Each model was 300 μm in length, with rectangular
cross-sectional geometries that varied from a maximum of 50 x 50 μm to a minimum of 30 x 30 μm. Cells were modeled using both spherical and ellipsoidal shapes intended to represent cell adhesion and spreading. Cell positioning in each chamber was standardized for two different configurations and randomized for a third. Predictably, pressures in the flow channels increased as cross-sectional dimensions decreased and cell numbers increased. Compared to cell number, flow channels with capillary-like dimensions (30 μm x 30 μm) were found to have the greatest effect on pressure change. Ultimately, the data from our computational analyses verified that it is possible to use microfluidics-based microvascular mimics to elucidate the relationship between neutrophil adhesion and microvessel flow resistance. Moreover, they provided us with the geometrical parameters required to study the precise relationship between neutrophil adhesion and flow resistance utilizing our microfluidics-based approach.

44. Ashley Cutshaw  
Other Authors: Michael Akenhead  
Mentor: Hainsworth Shin, Kimberly Anderson  

*Investigating the Link Between Cancer Cell Metastatic Potential and Cathepsin B Expression Under Fluid Flow*

A key step in cancer metastasis is the entry of tumor cells into the bloodstream in order to spread to downstream tissues. While flowing in the bloodstream, these cells are exposed to fluid flow-derived shear stresses. The present study investigates the effect of shear stress exposure on metastatic breast cancer cells as it relates to cathepsin B (catB), a protease that has been linked with the metastatic potential of breast cancer cells. Our interest in this particular protease is based on the possibility that metastatic cancer cells express catB in an effort to evade white blood cell detection and destruction due to its ability to cleave CD18 integrins. CD18 integrins are used by leukocytes, particularly neutrophils, to phagocytose pathogens, such as cancer cells, as part of the immune defense in the bloodstream. We believe that the bonds white blood cells form between themselves and the cancer cells are cleaved by the protease catB. We propose this to be a mechanism underlying the ability of highly metastatic cancer cells to avoid leukocyte binding. As part of our investigation of this possible mechanism, we hypothesize that shear stress enhances catB release and that this enhancement influences binding between tumor cells and neutrophils. For this purpose, we exposed breast cancer cells that exhibit high (MDA-MB-231) and low (MCF-7) intracellular catB levels to shear stress in a cone-plate viscometer and used flow cytometry to quantify their catB release. We also plan to use flow cytometry to examine tumor cell-human neutrophil binding under flow and determine whether such interactions depend on catB expression. Data from pilot studies suggest that catB release may not be affected by shear stress under the conditions tested, thus far. Further work, however, is still underway to identify any relationship between catB expression levels, neutrophil-tumor cell binding and shear.

45. William Reichert  
Other Authors: Kimberly Anderson, Michael Akenhead  
Mentor: Hainsworth Shin  

*Exploring the Potential Influence of Cathepsin B on Adhesive Interactions between Neutrophils and Breast Cancer Cells*

In this ongoing study, we are investigating a possible explanation for the link between cellular expression levels of Cathepsin B (catB, a lysosomal protease) and cancer cell metastatic potential. In the past several years, previous studies have linked catB to cancer cell invasiveness, but the exact role this protease plays...
remains unclear. We are conducting a set of pilot studies to test one possible mechanism to explain catB involvement in cancer cell metastasis. These studies are based on previous work in our laboratory demonstrating the involvement of catB in cleaving CD18 integrins off the surfaces of immune cells, particularly neutrophils that make up the first line of defense against pathogens in the blood. Interestingly, in addition to helping neutrophils adhere to blood vessels during inflammation, CD18 integrins are also critical for their ability to phagocytose foreign materials, including cancer cells. Based on this, we propose that catB enables cancer cells to avoid immune destruction by influencing adhesive interaction needed by neutrophils to phagocytose cancer cells in the bloodstream. To test this theory, we are conducting a series of experiments to quantify adhesive interactions between neutrophils and breast cancer cells of low (MCF-7) and high (MDA-MB-231) metastatic potential under no-flow and flow conditions that mimic the in vivo bloodstream. Our low and high metastatic potential cells reportedly exhibit low and high levels of catB, respectively. The planned experiments also include assessing the adhesive interactions between either of these two cell lines and neutrophils in the presence of CA074Me, an inhibitor of catB. Currently, the studies are ongoing. We have successfully conducted a set of experiments to quantify neutrophil migration rates on breast cancer layers under fluid flow. We anticipate completing an initial series of studies to quantify catB-dependence of neutrophil migration on cancer cells expressing low versus high catB.

**Chemical Engineering**

46. Elysha Calhoun  
Other Authors: Andrew Lakes  
Mentors: Thomas Dziubla, J. Zach Hilt  

*Antioxidant Capacity of Disulfide-Crosslinked Poly(β-amino ester) Hydrogels*

Cellular oxidation and reduction reactions, which involve the rapid exchange of electrons between molecules, are a continually ongoing, natural process that is a part of aerobic life. These processes often result in stray electrons, existing in the form of radicals called reactive oxygen specials (ROS), which are highly reactive and can nonspecifically react with cellular components. When the production of these radicals exceeds the cell’s defense mechanisms, the internal organelles of the individual cell may be damaged, and cells nearby can be damaged as well. This process is known as oxidative stress, and, if unchecked and untreated, it can be extremely harmful to those effected. This research seeks to find a bioactive material capable of preventing excess ROS early on via the antioxidant capabilities of free thiol groups created in the form of disulfide-crosslinked poly(β-amino ester) hydrogels. There are three main attributes about this material needed to form conclusions about its effectiveness – its ability to act as an antioxidant in the presence of oxidizing agents, cytotoxicity in vitro, and its ability to preserve cell viability under oxidative stress conditions. This study in particular sought to define the specifics of the degradation of the gel in conjunction with its antioxidant capacity, such as degradation rate and effect of storage conditions as well as the attributes previously listed. All conclusions drawn from this experimentation will be presented as well as possible future directions for the material.
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47. Emily Daley  
Other Authors: Anastasia K. Hauser  
Mentors: Kimberly Anderson, J. Zach Hilt

*Enhancing Efficacy of Cancer Radiation Through ROS Generation Catalyzed by Nuclear Localizing Iron Oxide Nanoparticles*

Non-small cell lung cancer (NSCLC) is one of the leading causes of cancer deaths in the United States. To treat this disease, radiation therapy is often employed. However, radiation can cause serious side effects. To increase the effectiveness of radiation, iron oxide nanoparticles (IONPs) can be utilized for their ability to produce reactive oxygen species (ROS). The Haber-Weiss reaction generates the highly reactive hydroxyl radical through Fenton chemistry. The Fenton reaction converts hydrogen peroxide to the hydroxyl radical via a reaction with iron ions. Therefore, uptake of the IONPs increases the production of hydroxyl radicals, which can result in oxidative stress within the cancer cell. When combined with radiation, this oxidative stress can increase the effectiveness of the radiation treatment. However, a significant limitation to this process is that nanoparticles are encapsulated within lysosomes once internalized by a cell. If hydroxyl radicals were generated outside of the lysosomes, there is a greater chance of tumor cell stress and damage. Therefore, the aim of this project was to synthesize nuclear localizing IONPs that are able to escape the lysosomes once internalized by cancer cells. Specifically, A549 cells, which are a human lung carcinoma cell line, were exposed to nuclear localizing IONPs, and confocal microscopy was used to determine if nuclear localizing IONPs can escape lysosomes. Furthermore, ROS generation and viability studies were completed for A549 cells exposed to nuclear localizing IONPs with and without radiation treatments. The results of the studies showed that the nuclear localizing particles appear to escape the lysosomes after uptake. When combined with radiation, they have the ability to increase ROS generation to higher levels than observed with radiation alone. When using the IONPs in conjunction with radiation, a synergistic cancer treatment results, meaning that the decrease in cell viability is greater than the two individual treatments.

48. Ava Vargason  
Other Authors: J. Zach Hilt, Carolyn T. Schumer  
Mentors: Thomas D. Dziubla, Kimberly W. Anderson

*Quantification of the Internalization of Poly(trolox ester) Nanoparticles*

Oxidative stress is characterized by an imbalance of reactive oxygen species and antioxidants in cells, impairing normal cell function. Oxidative stress contributes to a vast number of injuries, including neurodegenerative disease, vascular disease, and secondary tumor formation. Recent studies focus on biocompatible antioxidants to restore the natural balance in cells. One particular antioxidant, trolox, is a water-soluble analogue of Vitamin E that can be used to synthesize poly(trolox ester) (PTx), a polymer with native antioxidant capability. Using a single emulsion technique, PTx was formulated into nanoparticles that successfully scavenge for reactive oxygen species and suppress oxidative stress. Past research has focused on the efficacy of PTx nanoparticles in the suppression of oxidative stress, although little research has been conducted to examine the internalization of PTx nanoparticles. In this work, the amount of associated PTx nanoparticles will be determined on endothelial cells using confocal imaging analysis. Quantification of associated PTx nanoparticles and differentiation between internalized and adsorbed particles will give insight to the intracellular and extracellular antioxidant capabilities of these nanoparticles. It is hypothesized that both adsorption and internalization of nanoparticles, which implicates the control of both extracellular and intracellular oxidative stress.
Poster Abstracts

49. Jared Wittrock
Other Authors: Saikat Das, Suraj Nagpure
Mentor: Stephen Rankin

Silica Oriented Films and their Applications to Nanodisc/Protein Transportation

When proteins are transported or isolated outside of a hydrophilic environment, the proteins lose their characteristic properties. Unfortunately, if one wants to utilize the proteins outside of their usual environments, a technique needs to be produced for the protein or other biological substance to maintain its properties. The approach taken was to deep-coat a mixture with a copolymer, P123, onto unmodified and modified (neutral) glass slides. X-ray diffraction, fluorescence microscopy, and fluorescence spectroscopy were used to characterize the orientation of the films. The desired orientation is a film with pores in the hexagonal closed pack (HCP) structure. The goal was to create a porous silica film, using calcination, with pores about 5-10nm in diameter, so that the nanodiscs would align on top of or into the pores of the film, which would be useful for transporting the biological materials. In correlation with the nanodiscs aligning within the pores, the other caveat to this project is that the solution of biological material should be uniformly distributed across the surface of the film. This is the case, because it is easier to reproduce results and to understand where the effects of the surface-nanodisc interactions are if the film is uniformly coated with the nanodisc solution. The results so far are promising and further tests are being performed to characterize the orientation of the films and to create thinner films (by using different dilutions of ethanol and P123), to make the reproducibility of the project more efficient and to test the interactions and absorption of the nanodiscs and silica films to move onto other biological substances such as proteins.

Chemistry

50. Thomas Bailie
Other Authors: Alexander Bertrams, Gunnar Garten, Mayte Hernandez-Murillo
Mentor: David Atwood

Quick and Effective Removal of Metals from Water

Arsenic, mercury and other heavy metals can be completely removed from water using the synthetic dithiol, N,N’-bis(2-mercaptoethyl)isophthalamide), BDTH2 (commonly known as “B9”). For example, aqueous concentrations of As(III) or Hg(II) in the ppm to ppb range can be reduced to low ppb levels by precipitation as BDT-As(OH) or BDT-Hg (For a review of B9 with Hg see: Water Res. 42 (2008) 2025). B9 is unique among thiol compounds in that it has no odor and does not form disulfide (-S-S-) bonds which would make it inactive towards contaminant capture. In order to address water filtration applications, a derivative of B9, called “AB9”, was synthesized and attached to silica (see figure below). The new solid-supported reagent will be explored for the removal of arsenite (As(III)) from water. To synthesize AB9, first a mixture of isophthalic acid chloride and tetrahydrofuran (THF) was slowly added to a mixture of L-cysteine and triethylamine in deionized water. This procedure was completed under an atmosphere of nitrogen. This solution was mixed for six hours and then added to a separatory funnel to be separated. Upon separation it was then dried with anhydrous sodium sulfate and was then filtered. After filtering, the solvent was evaporated off leaving AB9. For safety purposes, the Material Safety Data Sheets (MSDS) were acquired and reviewed for all chemicals encountered during the experiment. These chemicals included isophthaloyl chloride, isophthalic acid, cysteine, cystine, THF, triethylamine and triethylamine hydrochloride. These sheets were used to determine the melting point, solubility and molecular weight of all reactants, products and byproducts of our reaction.
Poster Abstracts

51. Suhas Bharadwaj  
Mentor: Allan Butterfield  

PIN1 and GFP in Alzheimer’s Disease

Peptidyl-Prolyl cis-trans isomerase NIMA-interacting 1 (PIN1) is an enzyme whose down regulation occurs in Alzheimer’s Disease (AD). PIN1 when functioning normally phosphorylates cytoskeletal proteins such as tau and responds to DNA damage. Oxidative modification in AD causes inactivation of PIN1, which is hypothesized to cause an accumulation of tau protein causing neurofibrillary tangle formation. PIN1 oxidative modifications cause down regulation of key proteins. Unlocking the identity of these key proteins could help researchers create possible protective agents for PIN1 so that the progression from mild cognitive impairment to AD can be prevented. Using redox proteomics brain proteins are isolated, filtered through statistical methods and excised so that they may be identified using MS-MS. Protein Carbonyl, 3-NT, and HNE assays which identify lipid peroxidation, oxidative modification, and nitration byproducts were conducted and the subsequent results were put through rigorous statistical testing so that only the significant protein spots are marked for excision. T-test and Mann Whitney U from the GFP study showed 52 unique spots but after using 1 way ANOVA analysis the unique spots were reduced to 11. A similar trend is seen with the PIN1 study where 46 unique spots were shown to be statistically significant from T-test and Mann-Whitney U but after ANOVA only 8 unique spots remained statistically significant. Using a two-way ANOVA to compare PIN1 and GFP only 4 unique spots were statistically significant. Based on the identity of the proteins marked for excision, certain inferences can be made about the PIN1’s role in the pathogenesis of AD.

52. Steven Chapman  
Mentor: Susan Odom  

Silicon Anode Fabrication with Polymer Binders for Optimizing Lithium-Ion Battery Performance

Silicon is a promising new anode material due to its high gravimetric capacity and its potential for improved battery performance. However, silicon microparticles in the anode swell to upward of 400% their original size upon battery charging. Repeated lithiation and delithiation cycles result in drastic volume fluctuations in the silicon microparticles as lithium ions enter and leave the anode. This expansion and contraction causes the microparticles to crack and fracture upon repeated charging cycles, drastically reducing the performance and capacity of the anode over time. An appropriate polymer binder for the anode of lithium-ion batteries may allow the silicon microparticles to expand and contract while maintaining connectivity and conductivity for constant battery cycling. The binder may act as a cross-linking material to connect silicon microparticles together while keeping the components flexible to reorganize upon volume fluctuations. Improving the stability of the silicon active material in battery anodes is key in extending their lifetimes to create long lasting and more powerful lithium-ion batteries. In this project, a variety of polymers were screened as binders for the fabrication of a silicon microparticle anode; these polymers included polyvinylidene fluoride, polyethylene glycol, poly(D,L-lactide-co-glycolide), and polyacrylic acid. Potential polymers were selected based on their chemical and physical properties, including electron withdrawing capabilities and solubility in organic solvents. Electrode fabrication methods were also optimized to produce uniform functional electrode materials. Ultimately, the addition of an effective polymer binder may allow for silicon to replace graphitic carbon as the anode active material in lithium-ion batteries. Developing silicon-based anodes would drastically increase the battery capacity and lifetime.
Poster Abstracts

53. Erika Darnell
Other Authors: Edith Glazer
Mentor: Stephen Testa

Using Permanganate as a Colorimetric Probe to Understand Ruthenium DNA Interactions

Chemical reactions involving nucleic acids are frequently manipulated and exploited for the development of new biotechnologies. In particular, there is interest in chemical reactions involving transition metal interactions with the different nucleobase components in DNA (deoxyribose nucleic acid). For example, transition metal ruthenium Ru(II) complexes are potential light-activated chemotherapies. It is known that ruthenium catalysts interact with nucleobases, but their mechanisms of reactivity are largely unknown. Therefore, this study was focused on the reaction mechanisms of a ruthenium complex, Ru(bpy)2(dmbpy)), with the individual components of DNA. Each of the four DNA nucleotides, deoxyribose sugar, the four DNA nucleobases, and single and double stranded polymers were tested. These experiments utilized permanganate (MnO4), a colorimetric chemical probe, to detect the reactivity of Ru(bpy)2(dmbpy) with DNA within aqueous solution. Permanganate is a color indicator and will change colors depending on whether Ru(bpy)2(dmbpy) interacts with DNA or not. The color of a reaction can be visualized and quantified by a simple photographic camera. This general method being developed within the lab is called CIENA: Colorimetric Identification of Exposed Nucleic Acids and is being used in these experiments. The results of the experiments suggest in solution with a double stranded piece of DNA, Ru(bpy)2(dmbpy) somehow interacts with the DNA, likely separating the strands, allowing MnO4 to react where it once could not. The results also show that Ru(bpy)2(dmbpy) has an affinity for 5’dGMP, 5’dCMP, and 5’TMP in DNA, and is especially reactive with the guanine nucleobase. Thus, Ru(bpy)2(dmbpy) is disrupting the integrity of the DNA helix particularly at guanine bases; which could explain its anti-cancer activity by prohibiting the use of the DNA for normal biological functions.

54. Corrine Elliott
Other Authors: Aman Kaur, Selin Ergun, Matthew Casselman
Mentors: Susan Odom, Chad Risko

Organic Materials for Optimization of Energy Storage Systems

Lithium-ion batteries (LIBs) are a preferred power source for portable electronics, while redox flow batteries (RFBs) present an opportunity for large-scale stationary energy storage. Materials optimization has brought about substantial improvements in LIBs as well as the development of the aqueous all-vanadium RFB system, but there remain limitations to the efficiency and safety of these devices. LIBs suffer from overcharge - a harmful condition which limits battery lifetimes and can lead to increased internal pressure and thermal runaway, thence to smoking and/or fire. The aforementioned vanadium RFB system is the most advanced yet under consideration, but the voltage window is limited and components are often extremely corrosive. Organic aromatic compounds may constitute a solution to both of the above limitations – as redox shuttles to protect against overcharge in LIBs and as electrolyte materials in non-aqueous RFBs. This research utilizes computational and experimental prescreening/design techniques to identify promising compounds for use in LIBs and RFBs, thereby reducing the amount of time (and money) lost in synthesizing and cycling incompatible compounds. It furthermore encompasses the synthesis and incorporation of said compounds into battery systems to determine the validity of the aforementioned prescreening techniques, as well as the performance of each compound in real-life systems.
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55. Emily Furnish
Other Authors: Tao Jin, William E. Martin
Mentor: Chris Richards

Fabrication and Application of Nanoarrays Coupled with Microfluidics for Single Molecule Imaging of Membrane Receptors

The study of single molecules in biology and chemistry provides important information about the properties of individual molecules, such as the behavior of specific receptors or ion channels within a cell. Single-molecule fluorescence spectroscopy is a method that is useful for imaging and analyzing such single-molecule properties. Nanofabricated devices such as zero-mode waveguides can be used for these applications; however, they are expensive and take a lot of time to manufacture. We will devise a cheap and relatively quick method to fabricate arrays of nanoscale holes in metallic films. Our procedure will utilize photolithography combined with microsphere lithography. The mask that will be used for photolithography has a uniform pattern of round holes that are 1 micron apart and 1 micron in diameter. Once the pattern is transferred to the substrate, we will add etched, 200 nm carboxylate microspheres (beads) to the surface, remove the resist, cover the surface with a metal, and lift-off the beads. This fabrication method will create wells on the substrate that are about 200 nm in diameter but with the uniform spacing and size typically achieved with nanofabrication techniques. These wells will be coupled with microfluidics to isolate single membrane receptors in cells. The microchannels in microfluidic devices, connected to the outside by piercings of inputs and outputs, allow for isolation of single cells and the controlled delivery of reagents to these isolated areas. Once the devices are created they will be used in biological studies. For example, the devices can be used to image and then analyze binding correlation of EGF (Epidermal growth factor) to EGFR-GFP (Epidermal growth factor receptor-green fluorescent protein) in N2a cells (mouse neuroblastoma cell line) with laser spectroscopy. Because EGFR cannot be purified outside of the cell membrane, it is necessary to transfect cells with the protein in order to image the functions of EGFR. So far, we have already seen that binding correlation occurs in 1 micron wells and some 200 nm wells.

56. Karl Hempel
Other Authors: John Hoben
Mentor: Anne-Frances Miller

Characterization of the Reactivity of Flavin Bound in the 'NADOX' Protein Scaffold

The objective of this research is to elucidate mechanisms by which proteins control and modify the reactivity of bound flavins. The specific objective of this project is to characterize the reactivity of a flavin bound in the 'NADOX' protein scaffold, comparing the results obtained from 4 variants of this protein produced by single-site mutagenesis. Specifically, mutagenesis has allowed the production of not only the naturally-occurring protein (the wild-type or 'WT') but also a variant in which a conserved rigid proline is replaced by a flexible glycine (P156G), a variant in which a bulky leucine is replaced by a glycine (L158G) and a variant in which a positively charged arginine is replaced by a conditionally positive histidine (R21H). Graduate student John Hoben is measuring the reduction potentials of the flavin bound in each of these proteins. To understand the reasons for any altered reduction potentials, Karl Hempel measured the sensitivity to oxygen of each oxidized flavin by a number of kinetic assays focusing on the enzymatic properties of the 'NADOX' protein. These measurements utilized oxygen as the final electron acceptor and revealed the extent to which the amino acid substitutions affect the energetics of oxidized flavin - protein interactions. This work complements previous work done on the determination of the changes in energy upon flavin reduction to reveal how much energy is associated with redox tuning.
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vs. how much is associated with redox-independent properties of the flavin. By comparing the values obtained for each of the protein variants, the extent to which each amino acid contributes can be determined.

57. Ebony Nava
Other Authors: Cassandra Almasri, Keith Allen, Ben Arrants, Alec Bradley, Aaron Trejo
Mentor: Stephen Testa

*Using Redox Reactions to Identify DNA Nucleotides: Improving a General Chemistry Laboratory Experiment*

A general chemistry lab experiment (CHE 111) is called “Using Redox Chemistry and Color to Identify DNA”. For this research project, each of the six STEMcats students started with the CHE 111 experiment and were free to pursue any strategy that they envisioned could improve the lab. At first, the students pursued their own experiments independent of each other. After four weeks, they started to come together to pool their information. What started out as six independent researchers pursuing different avenues ended as one group working for a common goal via different approaches. In the CHE 111 experiment, DNA nucleotides react with the oxidizing agent sodium permanganate, which result in color changes that can be detected by eye. The permanganate reacts with thymidine (T) to become yellow, cytidine (C) to become light purple, and is unreactive with adenosine (A) and guanosine (G), leaving these two nucleotides a dark purple. In this experiment, the redox reaction can be used to identify T and C via color change, but not A or G. Two of the most desired improvements to this experiment were to get the A and G nucleotides to react, and to make the reactions faster. To this end, some of the experimental conditions that were investigated included increasing the reaction temperature, reducing reactant concentrations, including catalysts, changing the salts and salt concentrations, changing buffers, changing the pH, and reducing reaction volumes. Based on the group’s investigations, the original experiment could possibly be improved in the following ways: reduce the concentration of the nucleotides by 50% to save resources, use potassium permanganate instead of sodium permanganate for more distinguishable colors, use lower pH for G reactivity, run the reactions at higher temperature to speed up the reactions, and run the reactions in as little as 11 mL to conserve resources.

58. Rebekah Smith
Other Authors: Jose Abisambra
Mentor: Chris Richards

*Application of Photoconvertable Fluorescent Protein to Study the Movement of Proteins within a Live Cell*

Proteins can be tagged using photoactivatable fluorescent proteins, for example Photoactivatable Green Fluorescent Protein (PA-GFP) and Photoactivatable Monomeric Cherry (PA-mCherry), to observe protein movements within the cell using a Total Internal Reflection Fluorescence (TIRF) microscope. Dendra2, a photo-convertible tag, has been used to allow a protein to switch excitation wavelengths from 488 nm to 535 nm when exposed to 405 nm, which allows the observation of emission to change from 535 nm to 595 nm, eliminating the need for both PA-GFP and PA-mCherry. These fluorescent proteins allow us to visualize the departure of nicotinic acetylcholine receptors (nAChRs) from the plasma membrane. Applying the same labeling technique, we can also examine the degradation of proteins in the endoplasmic reticulum. In Alzheimer’s disease, tau has shown a correlation between elevated phosphorylation and reduction in overall rate of tau transport in neurons. The use of Tet cells allows for
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the regulation of tau expression, which can be turned on with the addition of tetracycline. Point conversion allows ribosomes in one area to be photo-converted, using Dendra2, in order to interpret ribosomal transport dynamics, for both tau producing and non-tau producing cells, in relationship to time.

College of Law

59. Natalie Watkins
Other Authors:
Mentor: Beau Steenken

Examining Judicial Activism in a Historical Context

The purpose of this project is to examine the ways in which judicial activism has evolved during and had an impact on the course of American legislative history. This has to be done by assessing how the structures of the US legal system frame the research of a given problem, selecting secondary sources and using them to begin active legal research of the given legal problem, conducting primary legal research (case law) to find and expand upon potentially relevant authorities, and assessing the importance of updating the law while using citators to evaluate the continued validity of all authorities. Upon examination of these events, it was evident that Supreme Court cases involving Article I, Section 8, Clause 3 (the Commerce Clause) as well as cases during the Postbellum period appeared to frequently produce judicially activist rulings. Through the examination of these cases as well as a variety of secondary legal sources, this research highlights the historical impact of judicial activism.

Communications

60. Kyle Hancock
Other Authors:
Mentor: Deanna Sellnow

Helping Others Help Themselves: An Earthquake Early Warning Message Testing Experiment

According to the U.S. Geological Survey, approximately 10,000 earthquakes occur in the southern California area each year and the chance of the next great earthquake occurring in the next 30 years is almost inevitable. A recently released report from USGS reports a 99% chance of quake of magnitude 6.7 or higher within the next 30 years (USGS.gov). Instructional crisis communication research may determine best practices for effective earthquake early warning messages. This study employs a pretest/posttest message-testing project to determine the degree to which a smartphone application designed using the IDEA model is effective in empowering low income and low literacy populations in California to take appropriate actions for self-protection in the event of a high impact earthquake. If successful, the results of this study will inform the development of an application that will ultimately save lives. Keywords: IDEA Model, instructional communication, crisis communication, disaster warnings
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61. Loretta Stafford
Other Authors: Brenton Smith
Mentor: Alan DeSantis

*Started from the Bottom: A Decade of Rap Rhetoric*

Loretta Stafford worked to continue the research started by past Chellgren Fellow Brenton Smith. Under the supervision of Dr. Alan DeSantis of the University of Kentucky's Department of Communication she analyzed the lyrical content of rap music throughout the past decade. To accomplish this, she compiled a list of the most popular songs using Billboard's music chart archives. Over 70 songs from the past ten years were analyzed using the Grounded Theory approach -- seeking out all themes of each song, rather than looking for specific themes. The themes were then ranked to determine which ones occurred most frequently. The evolution of lyrical content was also examined as Loretta completed analysis of songs from the later portion of the decade. In conclusion, the findings of Loretta Stafford's research dig deep into the realm of rap and hip-hop culture to clarify of what the top names in the game are really capitalizing off.

Computer Science

62. Matthew Resch
Mentor: Jerzy Jaromczyk

*Experimenting with SageMath*

SageMath (http://wiki.sagemath.org/) is a mathematics software system that provides a uniform interface for more than a hundred open-source packages. Sage is a free open source alternative to Mathematica, Maple, Magma and Matlab designed to assist with studying and solving problems in pure and applied mathematics. In this research we focus on using SageMath notebooks for creating examples and experiments relevant to computer science. Notebooks allow the user to create embedded graphics, access the Internet, and share the work across the network. We analyze a number of examples using Cryptology, Graphs and Web application capabilities of the system. These examples can be easily developed with Sage and used in the classroom to demonstrate difficult concepts, algorithms and data structures.

63. Angelo Stekardis
Mentor: Nathan Jacobs

*An Examination of the Introductory Methods Used in Computer Vision*

Technology that utilizes cameras in order to perform complex analysis on individuals, groups, and environments has grown to be an area of major interest over the past few years. It has become evident that computer vision and its applications have potential to make significant impacts in consumer, security and military technology. One of the most interesting applications of these technologies relates to how imaging data from human faces is processed. Depending on the programming language, there exists many different software platforms that allow users to analyze image data at a higher level. For Python, Menpo is one of the platforms that specializes in facial point localization. In this work, I studied the ways in which tools such as Menpo may be used in order to solve simple problems related to facial feature recognition. To do this, I ran Menpo on the data from the following website:
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http://everyday.noahkalina.com/index.php in order to determine how often the website’s creator got a haircut. While this may seem like a simple task, using image processing software in order to detect patterns in human faces has numerous practical uses. These uses range from detecting lies based off of facial cues to noticing drug use based off of gradual changes in complexion. The simple foundations for these methods that I studied elucidate the true potential for computer vision’s impact on modern society.

64. Devin Wright
Other Authors: Joedocei Hill, Christopher Schardl
Mentor: Jerzy Jaromczyk, Neil Moore

*Deploying, Customizing and Maintaining Multiple Genome Browser Instances*

Using GBrowse and an additional suite of software, we maintain genome browsers for several strains of fungi from the Clavicipitaceae and related families. The suite that we have developed automates a number of cumbersome steps required in making customized genome browsers and loading each browser's database with genome sequences, annotations and additional information. Included in the project are, in particular, scripts for importing gene models into our database; extracting various forms of gene sequences; and computing, refining, and aligning groups of orthologous genes. The ortholog groups and alignments generated by our software are currently being used to analyze the phylogenomics and evolutionary history of the Clavicipitaceae, an important family of plant-pathogenic fungi.

Dietetics and Human Nutrition

65. Mary Boulanger
Mentor: Alison Gustafson

*The Relationship Between Sleep and Moderate Intensity Aerobic Exercise in College Students: A Study on the Barriers to Sleep, Motivations for Physical Activity, and the Impact of Sleep Deprivation on Physical Activity*

College students have to balance school, work, staying healthy, and living on their own for the first time. This balancing act often leads to sleep deprivation and decreased physical activity. Sleep and physical activity are important lifestyle factors that influence health and quality of life. Lack of sleep impacts learning, memory, grades, perception of effort, mood, and overall health. Lack of physical activity is associated with an increased risk for obesity, cardiovascular disease, and other chronic diseases.

Behaviors that are established during the college years pervade through adulthood, making the decline in sleep and physical activity in college students a poor predictor for their future health. Considering that nearly 70% of the American adult population is overweight or obese, which increases the risk for several leading causes of death, sleep and physical activity should be forefront issues in the health field.

However, there is a clear gap in the research about sleep and physical activity. There are no apparent research studies about how sleep duration and moderate intensity aerobic exercise are related in college students. The aim of this study is to determine the relationship between sleep duration (defined as less than 8 hours, 8 hours, greater than 8 hours) and physical activity (defined as above, below, or about 150 minutes of moderate intensity aerobic exercise per week) among college undergraduate students. An understanding of the relationship between sleep and moderate intensity aerobic exercise in college students will aid in the development of sleep and physical activity intervention strategies.
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Earth and Environmental Sciences

66. Meredith O’Dell
Mentor: Michael McGlue

Paleoceanographic Analysis of Petroleum Source Rocks

This project involves the use of x-ray fluorescence spectrometry (XRF) to perform chemical analysis on shale samples from the Abraxas core in the Midland Basin in West Texas and determine the type of marine environments in which they were deposited. With this paleoceanographic data, it is possible to draw conclusions about the core’s value as an oil drilling site. For this particular project, once the chemical compositions were obtained for ninety samples of the Abraxas core using the XRF, cross plots were created to analyze the elemental composition of the rocks at various depths of the core. For the XRF scans of trace elements, the most significant element was molybdenum. When molybdenum is cross-plotted with total organic carbon in the sample, it is possible to determine whether or not there are black shales at a given point in the stratigraphy of the core. The presence of black shales is indicative of an anoxic event or euxinia at the time of deposition. These phenomena are some of the key indicators that the shale being examined would be a good potential petroleum source rock. For the scans of major elements in the samples, the most important relationships were those of silica, calcium, aluminum, magnesium, and titanium in relation to their depths. High concentrations of silica indicate that the rocks are brittle, while high amounts of aluminum suggest the presence of ductile clays that can be easily fracked - a promising attribute for petroleum source rocks. Calcium in large quantities hints that the depositional environment was likely a reef zone dominated by carbonates. Titanium is an element only found within continental crust, so its presence in an ocean basin suggests continental runoff, potentially due to large monsoons, at the time of deposition.

67. Carlos Sanchez
Other Authors: Noah Dixon, Ashley Bandy
Mentor: Alan Fryar

Water Quality in the Wolf Run Basin, Lexington, Kentucky

Part of the University of Kentucky’s campus is located in the Wolf Run basin, which drains much of downtown Lexington. Several types of pollutants impact the basin’s water quality, including pathogenic bacteria and other microorganisms, sediment, nutrients, and various other chemicals such as hydrocarbons, metals, and salts. Both point source leakage (e.g. underground pipes) and storm-induced runoff from lawns and pavements contribute these pollutants to the basin. Beginning January 29, 2015, we collected weekly to biweekly samples from the inlet to the rain garden behind the Gluck Equine Center and the Blue Hole at McConnell Springs. We measured air temperature, water temperature, pH, specific conductance (SC, a measure of salinity), and dissolved oxygen (DO). We collected samples for total coliform bacteria, Escherichia coli (E. coli), anions, and metals. Results are consistent with the different locations of the sampling sites within the basin. McConnell Springs drains most of the basin, which has an area of 30 km², while the rain garden only receives flow from part of UK’s campus. The values for water temperature, pH, SC, and DO were more stable over time for the Blue Hole than for the rain garden, which could be explained by the fact that flow in the rain garden was made up of a larger percentage of recent precipitation, which fluctuated with time. Values of SC at each site approximately doubled from February 12 to February 26, which reflects runoff of road salt in melting snow and ice. Values of DO generally increased as water temperature decreased. Counts of total coliform and E. coli bacteria were much higher in the Blue Hole than in the rain garden, which could be explained by
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McConnell Springs receiving more nutrients, leakage from sanitary sewers, or fecal matter from animals in the basin.

Economics

68. Rick Guha
Other Authors: 
Mentor: Chris Bollinger

Brand Recognition on Equity Performance

This paper analyzes the effect of brand value on equity performance through the use of different regression models. The movement of stock prices can be caused by a countless list of factors. Many of which are based on rational reasoning stemming from fundamental factors. Others can be derived from irrational reasoning, often rooted in flawed investor psychology. The question this paper seeks to answer is what effect, if any, brand recognition has on the performance of the associated stock. Brand recognition is particularly important to consider due to the large emphasis many corporations put on building and maintaining their brands. The obvious goal of this is to create perceived value which results in greater sales and benefit the bottom line. However if the perceived value of a particular brand is overvaluing the intrinsic value of the related equity, this will have negative effects for the owners in the long run. The findings do indicate a negative impact, however, the results are not statistically significant. The research used a sample of 84 publicly traded American companies over a six year period. The models used were multi-factor models based on the Fama-French three factor model, with the addition of other fundamental factors. All models consistently showed a negative impact on stock performance, although magnitude and significance varied.

69. Ross Hildabrand
Mentor: William Hoyt

Fayette County Property Values

This research will explore the relationship between property values in Fayette County, Kentucky as a function of characteristics of the individual house, characteristics of the neighborhood a house is located in, the high school zoning of the property, the middle school zoning of the property, and crime in the area. The data will be compiled from the Property Valuation Administrator of Fayette County to provide characteristics of the homes and neighborhoods, and zoning and crime will be mapped to correspond to different properties and locations. This relationship is timely and relevant because of the school rezoning that will be taking place in the spring of 2015 in Fayette County.
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**Gender and Women's Studies**

**70. Ryan Winstead**  
Mentor: Philip Harling

*Queer Spaces in Kentucky: Understanding LGBTQ Migration*

Situated as a geographical fusion of the Bible Belt and the rural south, Kentucky - specifically Appalachia, KY - has been popularly known as a breeding ground of intolerance and bigotry toward the LGBTQ community. Consequently, there exists the notion that a large portion of the LGBTQ community members migrate out of the region in favor of more secular, urban residences to escape social alienation and become immersed in a more expansive queer community. Our research sought to explore the validity of this notion and gain a more complete understanding of the ways in which rural and urban spaces are conceptualized by the LGBTQ Kentucky community through migration. We hypothesized that while there are both positive and negative elements to living in either urban or rural spaces, the general migratory trend is from rural to urban. We tested this hypothesis by conducting ten semi-structured interviews with LGBTQ Kentuckians at both colleges and universities across the state. Individuals were asked questions regarding the motives behind their migration, the discrimination they faced at their former and current residences and the satisfaction and the impact moving has had on their lives. Two majors themes appeared among a majority of the participants: first, discrimination, particularly stemming from religious ideologies, played a large role in pushing the LGBTQ individuals away from rural areas; secondly, while new social technology has permitted rural LGBTQ Kentuckians greater access to local queer communities, the migratory trend is still one of rural individuals moving to more urban areas. The results of this study make clear the progress and resilience rural LGBTQ communities maintain in the face of widespread discrimination, and illuminate the diverse ways in which oppression can be subverted over time. Simultaneously, however, it is a call to action to provide more support to rural locales for LGBTQ folks

**Geography**

**71. Shiza Arshad**  
Mentor: Michael Samers

*Pakistani Immigration to the United States*

The number of Pakistanis moving to the United States has increased exponentially since the 1980s. This community is widely spread throughout the United States, however, the Pakistani immigrant population is focused in metropolitan areas. These areas are akin to enclaves of Pakistan that are transported across the Atlantic Ocean to the United States. Thus, it is vital to examine this immigrant population as it is continues to play an important role in American society. The purpose of this research is to examine a number of questions regarding Pakistani immigration patterns including how this immigrant population settles in the United States, what the demographics of this population are and why they choose to stay in certain areas. This research will also breakdown and focus on certain groups, particularly women and non-Muslims, within the Pakistani community. The goal is also to examine various ideas present within the post-9/11 world about Pakistani immigrants. This research will offer a new lens for understanding immigration through a comparative analysis of Pakistani immigration patterns with that of Chinese and Mexican immigrants. This will present a question about whether Pakistani immigration patterns are normative in comparison to other immigrant populations. Through analysis of data from a number of
sources, such as the Migration Policy Institute, this paper will conclude that Pakistani community has certain characteristics, particularly religious affiliation, that heavily influence its migration patterns and that this community will continue to play an important role in American society.

Health Management and Policy

72. Kaylee Hicks
Mentor: F. Douglas Scrutchfield

Evaluating Community Health Needs Assessments to Gauge the Impact of Hospital-Health Department Collaboration

Nonprofit hospitals are required under the Affordable Care Act to complete a community health needs assessment (CHNA) every three years in order to maintain their tax-exempt status. Local health departments (LHDs) are required to complete a community health assessment (CHA) and improvement plan prior to accreditation by the Public Health Accreditation Board. Evidence suggests that when LHDs and hospitals collaborate on LHD CHA development, the quality and scope of the CHA improves. No research has been done to examine the impact of collaboration on the hospital’s CHNA. This study explores whether prior collaboration with a LHD on their CHA improves the overall quality of the hospital’s subsequent CHNAs, examining the various components of those CHNAs and factors that influence that variation. Our sample was comprised of two sets of counties. The first were those in Kentucky that had hospital CHNAs in a county that also had a LHD CHA completed (N=22). The second were CHNAs in peer counties without a LHD CHA (N=19). Experts reviewed all CHNAs using a validated survey analyzing content, format, and impact. We used descriptive statistics as a mechanism to compare our hospital CHNAs in counties with a LHD against their peer counties. We compare the quality of the CHNA in communities where the LHD had or had not also completed a CHA, and where collaboration between the two entities occurred. We have also examined the quality of various components of the hospital CHNA in order to ascertain the specific areas where collaboration improved the hospital’s CHNA. The variation in the character of the CHNA in our experimental and control counties raises further questions regarding the specific nature of the collaboration and the character of other collaborative efforts, for example emergency preparedness or disease outbreak investigation and control.

73. Kaitlin Lemaster
Mentor: Wayne Sanderson

Lung Cancer in Coal Mining Areas

Kentucky has some of the highest rates of cancer in the United States. A significant portion of these cases are in the eastern portion of the state within the Appalachian region. The cancer with the highest incidence in this area is lung cancer. Appalachia contains 420 total counties, and is comprised of parts of 13 states. The residents of this area have an increased risk for several major chronic disease, including diabetes, heart disease, and both cancer incidence and mortality. In eastern Kentucky specifically, the mortality rate for overall cancer is 36% higher than the rest of Appalachia, and 50% higher than the rest of the United States. The purpose of this analysis is to determine the association between coal mining in the areas of Appalachia and lung cancer incidence and mortality disparity in cancer mortality compared to other regions of Kentucky and the U.S. Data from several peer-reviewed studies, the Kentucky Cancer
Registry, and from the Behavioral Risk Factor Surveillance System were assessed. Upon analyzing data concerning lung cancer, several confounding factors were discovered. These maladies included smoking, poor diet, lack of exercise, lack of access to adequate healthcare, and other behavioral characteristics associated with the area. Currently, because of these confounding factors, it is difficult to determine whether coal mining may be directly related to increased lung cancer. However, it can be argued that the mining creates a “coal mining-dependent economy”, resulting in the cycle of maladaptive practices that are known causes of cancer (i.e smoking, lack of exercise, etc.). It is important to note, however, that in the Western part of Kentucky, coal mining is not associated with increased lung cancer risk. The results of this analysis should add to the assessment of whether increased cancer risk in Eastern Kentucky is associated with the coal industry.

Hispanic Studies

74. Michael Parsons
Mentor: Susan Larson

_The Independence Debate: Effects of Language, Culture, and Globalization on Spanish Nationalism_

This research compares Basque and Catalán nationalist movements in Spain. The goal is to determine which cultural and linguistic factors influenced attempts for secession, and examine recent downward trends in public opinion regarding secession. Upon examination of various pieces such as Benedict Anderson’s theoretical text “Imagined Communities,” Julio Medem’s controversial documentary La pelota vasca, and Inman Fox’s “La invención de España,” both regions showed movements with less coherence than anticipated. This research finds that attempts for secession, while part of greater nationalist movements, have recently been diminished by rapid globalization, presenting a challenging scenario for the future of nationalism.

History

75. Austin Sprinkles
Mentor: Buck Ryan

_The Fight for Freedom: How Russia's Tsar Alexander II and Kentucky's Cassius Clay became unlikely companions in the abolition movement_

As William Faulkner, the Nobel Prize-winning American novelist said in Requiem for a Nun (1950): "The past is never dead. It's not even past." A century earlier, Russia and the United States were struggling with the scourge of involuntary servitude, when two abolitionists emerged: one from Kentucky and the other from the royal ruling family of Russia. Kentuckian Cassius Clay, who would go on to be named minister of Russia in the Lincoln administration (Clay 260-264), and tsar Alexander II, known as Alexander the Liberator for his 1861 emancipation of serfs, called “the greatest single law in history.” (World Biography). After Lincoln's assassination in 1865, America followed suit, abolishing slavery with the 13th Amendment. For both nations, the effects of slavery and serfdom would haunt their national conscience for generations. In 1965, Congress passed the Voting Rights Act to ensure and protect African-American voting privileges. In Russia many felt that the abolition reforms did not do enough, leading to “the disintegration of faith in enlightened despotism and the turn by many to the belief that the
desired reforms could come only through popular participation in government” (Emmons 441-45) which ultimately led to peasant support of the 1917 revolution (Zenzinov). In both Russia and the U.S., the past is not even past, an insight seen in the writings of both Clay and Alexander II, according to a content analysis of published works by and about these two abolitionists who were separated by language, culture and continents yet united through a shared philosophical background. This shared background developed into a reformist fervor which led to their roles as leaders in the abolitionist movements. Findings from this rhetorical study will be valuable to U.S. and Russian historians, scholars studying slavery in America and serfdom in Russia, and the aftermath of their abolition.

**Horticulture**

**76. Kelly Kramer**  
Other Authors: Anjana Mandal, Ross Basham, George Brown III, Grant Boggess  
Mentors: Norm Strobel, Mark Williams

*Effect of Mushroom Homogenate on Peroxidase Activity in Cucumber Plants*

A primary goal of the research collaboration between Drs. Mark Williams and Norm Strobel is the identification of natural materials that can serve as safe and effective alternatives to synthetic chemical pesticides for the suppression of plant diseases and insect pests. The need for such alternatives is particularly acute for Kentucky organic farmers who raise cucumbers because their crops are frequently devastated by a bacterial wilt disease caused by a bacterium, Erwinia tracheiphila, which is transmitted by cucumber beetle vectors. Although conventional growers can manage the disease with insecticides, that approach is unsuitable for organic growers. Inducible resistance to the pathogen and/or its insect vectors is a promising organic-compatible approach for management of cucumber bacterial wilt. Various components of fungi have found to trigger plant defenses, and increased activity of the enzyme peroxidase (POD) is a common correlate of the induced-resistant state. The hypothesis that fungal biomass might serve as an inducer of disease resistance in cucumber was tested by exposing cucumber tissues to crude homogenates of commercial mushrooms (Agaricus bisporus) and determining the effect of such exposure on POD activity. Incubation of germinating cucumber seeds with mushroom homogenate in a soil-free system promoted increases of 25-33% in POD activity relative to water controls. Application of mushroom homogenate by drenching the potting soil in which young cucumber seedlings were growing resulted in systemic increases of 40-150% in the POD activity of cotyledon tissues relative to water controls. Wounding cotyledons of water-drenched control plants to simulate insect feeding increased cotyledon POD activity, but wounding resulted in substantial declines in POD activity of cotyledons of plants grown in homogenate-drenched soil. Implications of these findings for plant disease management and opportunities for future student researchers will be discussed.
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Interior Design

77. Boone Proffitt
Mentor: Patrick Lucas

Renewing a Campus Front Door: The Infrastructure and Interactions of the Limestone-Avenue of Champions Corridor

The University of Kentucky recently celebrated its 150th birthday, and throughout this time, the University has drastically expanded. But interestingly enough, it has expanded almost exclusively to the north. In fact, the northernmost 38 acres of campus has largely not changed in fifty years. Accordingly, this study addresses the need for an effective renovation of North Campus, particularly six nodes focused about the Limestone-Avenue of Champions intersection that support academic, athletic, and residential land uses. Through a literary review of campus master plans for “20th century universities,” with special regards to the planning history of the University of Kentucky, a chronology of precedents and initial benchmarks solidified the need for a corridor analysis. The corridor analysis was then expanded to include structural dynamics, investigating how potential changes will interact with the progressive University of Kentucky Transportation Master Plan. Furthermore, interviews with university administrators have set the stage for both infrastructure and public engagement in this “front porch” of campus, linking academy and community indelibly. When juxtaposed, infrastructure and public engagement are two pillars where positive interactions and civic development between the University of Kentucky campus and Lexington communities can occur. These ideas are cemented in an examination of survey design, particularly in how to optimize public participation in urban affairs. As such, in order for students, staff, faculty, and remaining invested parties to achieve their goals at this institution, the University of Kentucky must first establish a variety of public spaces that nurture community exchange.

Journalism

78. Elise McConnell
Other Authors: Terry Brockman
Mentors: Buck Ryan, Megan Dickson

Creativity Meets Politics: Pushing Originality, Emotion and Intrigue to Attract Young Voters

According to the Pew Research Center, young voters swung the 2012 presidential election. Can young voters swing the U.S. Senate race in Kentucky, considered to be among the nation's most important races (Taylor, 2014)? As changes sweep through the political world, creativity is essential for survival. This test of creativity in the form of short public service announcements revealed that the key to getting young voters' attention was a combination of originality, emotion, and intrigue. This research was based on in-depth exploration of creativity across the fields of photography, advertising, music, theater, and poetry. In April 2014, 49 subjects, whose ages range from 18 to 29, viewed six public service videos with different combinations of originality, emotion, and intrigue, and both quantitative and qualitative data was collected. The hypothesis that emotion would be a stronger factor than either originality or intrigue was upheld. Using bivariate tests and running a logistic regression on the significant variables suggested that the determining factor of a successful PSA (ie. one that respondents would hypothetically choose to fund) was a combination of originality and emotion. However, due to the low sample size, caution must be taken in drawing conclusions. The study of creativity in the political arena is a promising area of study,
and larger-scale research must be done. These and future findings can benefit campaign managers looking to attract young voters and scholars studying the impact of creativity on the millennial generation.

79. Jenna Perkins
Other Authors: Danielle Hawthorne
Mentor: Buck Ryan

*Anatomy of a Neo-Nazi Rant: How a First Amendment Lesson Can Influence whether it did More Harm than Good*

Free speech on college campuses in an era of political correctness (Berman, 1992) has emerged as an important issue with controversies in national news coverage concerning the invitations to graduation speakers at prominent universities, and their subsequent recession. Ever since Vietnam War protesters at the University of California at Berkeley pushed the boundaries of objectionable speech on campus 50 years ago (Cohen, 2014), questions have arisen about what rhetoric is acceptable. At a Constitution Day event, students at a southern university got an unexpected test of the First Amendment when a Neo-Nazi candidate for the U.S. Senate delivered a white separatist rant from the podium. Interviews with 20 Honors students who organized Constitution Day, 5 of whom were witness to the Neo-Nazi rant, revealed that all of them not only found, on balance, more good than harm in the event, but also could relate a memorable lesson about the meaning of the First Amendment either in school (primary, middle, high school, or college) or by parents or grandparents. A separate survey of 75 students, either other Honors students (22) or JOU 101 students (53), revealed that a fraction of the students (9.1% Honors, 13.2% Journalism) thought that the rant did more good than harm, but in each case their views correlated with the ability to articulate a memorable lesson in the First Amendment, either through school or through family. The conclusion was as follows: More civic education is required, and U.S. Senator Robert C. Bird was wise to establish the celebration known as Constitution Day, as he felt that such civic education was lacking yet essential to America’s grand experiment in democracy. This study’s findings will be valuable to scholars studying the First Amendment and to college and high school journalism teachers testing the limits of free speech.

80. Clay Thornton
Other Authors: Scotty Reams, Abby Shelton
Mentor: Buck Ryan

*On Jobs, Values, and Misguided Polls: An Analysis of Young Voters ‘Bowling Alone’ in Kentucky’s 2014 Midterm Elections*

Young voters’ importance has increased with population size and political impact. Millennials showed their power to swing elections when re-electing Obama; so, would young voters flex their political muscles in the midterms or remain "bowling alone" (Putnam, 2000)? Although 10 million young people voted in the 2014 midterms, they remained "bowling alone" with a turnout of 21.5 percent compared to 20.9 percent in 2010 (CIRCLE, 2014). An in-depth case study of first-time voters in the 2014 Kentucky midterms compared their "coming to public judgment" (Yankelovich, 1991) on which candidate to support in a local mayoral election. The key determinants focused on issues and values for both. A third determinant was party affiliation in the Senate race and character in the mayoral election. News coverage was not a key determinant. The most important issue to young voters in both was jobs, but a content analysis of front-page newspapers revealed little on jobs. Instead, coverage focused on conflict and horse
race factors. Among the losers were the pollsters, as none predicted McConnell’s 15-point victory. For young voters, who kept journals of coming to public judgment in the 10 weeks before the election, seven possible factors emerged in their decision-making: issues, values, personal contact, character, competence, opinions of others, and party affiliation. In the mayoral race, the young voters had personal contact with the candidates, unlike the U.S. Senate race. Nonetheless, personal contact did not emerge as a key determinant. Public safety was a key issue for the young voters in the mayoral election, whereas in the U.S. Senate race, student loans and the Affordable Care Act were key. The case study, using quantitative and qualitative research methods, involved 19 Honors students. An analysis of their journals revealed 74 percent, 14 of 19, fell in line with Yankelovich's 7 Stages of Coming to Public Judgment. Finding will be valuable to campaign managers and politicians, scholars researching young voters, and journalists covering future elections.

**Kentucky Tobacco Research and Development Center**

**81. Shreeya Shrestha**  
Other Authors: Hannah Sombeck, Megan Arcangel  
Mentors: Ling Yuan, Keith Allen

*Cloning, Bacterial Expression, and DNA Binding Property of a Transcription Factor Involved in Plant Growth and Development*

Plant growth and development are complex biological processes controlled by a number of factors including environmental signals and hormones. These factors modulate the expression of a large number of genes encoding transcription factors (TF; a. k. a. transcriptional regulators) in order to fine-tune the developmental process. The basic helix-loop-helix (bHLH) TFs constitute one of the largest TF families in plants and are known to play a significant role in plant growth and development. The bHLH TFs regulate gene expression by binding to a specific DNA sequence (CANNTG, where N stands for A/T/C/G; also known as the E-Box) in the promoter regions of their target genes. We investigated the DNA binding affinity of a bHLH factor involved in growth and development in the model plant Arabidopsis. We used polymerase chain reaction (PCR) to amplify the full-length complementary DNA (cDNA) encoding the bHLH TF (HBI1, HOMOLOG OF BEE2 INTERACTING WITH IBH 1) from Arabidopsis and cloned it into an E. coli expression vector. The recombinant bHLH protein was produced in E.coli and purified by GST-tag affinity chromatography. The purified protein was used in electrophoretic mobility shift assay (EMSA). A 32 basepair long DNA sequence of the target gene (GASA6, GA-STIMULATED ARABIDOPSIS 6), containing putative binding site (E-box) for the bHLH, was biotinylated and used as a probe for EMSA. The purified protein was incubated with the DNA probe, and the DNA-protein complex and probe-only control were resolved by polyacrylamide gel electrophoresis. Binding of the bHLH protein to the target DNA sequence resulted in a shift in the mobility during electrophoresis. In conclusion, the HBI1 binds to the E-box sequence in the GASA6 promoter, and the binding is highly specific.
Developmentally-Appropriate Sex Education Knowledge: A Guide for Parents and Their Children

The United States has higher adolescent pregnancy and sexually transmitted disease rates than in most other developed countries. The current adolescent pregnancy rate in the United States is 2-4 times the rate in France, Sweden, Canada, and Great Britain (Darroch, Singh, & Frost, 2001). Sexual education in the United States is mostly based on abstinence-only methods. 81% of male and 87% of female teenagers reported receiving formal sex education on, “how to say no to sex” (Martinez, Abma, & Copen, 2010). Therefore, a lot of sex education efforts are falling on the parents of children. However many of the parents do not know where to start or are not comfortable navigating this alone. The current research study examined evidence-based sexual health education for children as delivered by parents. The sex education research was, divided into developmentally-appropriate stages based on the Sexuality Education and information Council of the United States (SEICUS): level 0 included ages 0-4, level 1 included ages 5-8, level 2 included ages 9-12, level 3 included ages 12- 15, and level 4 included ages 15-18. Each stage was also categorized based on whether the topic was related to divided human development, relationships, personal skills, sexual behavior, sexual health, and society and culture. Each of these categories also had sub-categories, which will be displayed in the presentation. Research clearly indicated what was developmentally appropriate for the children to know within each stage as well as what the parents should be teaching and discussing with the child for each topic of the stage that their child is in.

Geomorphic Changes in Inner Bluegrass Streams, Lexington, KY

Stream effects resulting from urbanization can be difficult to assess, especially without quantifiable measures. Agencies have spent billions of dollars rehabilitating streams to decrease these effects through Best Management Practice usage. This study’s goal was to establish monitored sites of urban effected streams, measuring their morphology and hydrology long term within Kentucky’s Inner-Bluegrass Region. Four initial stream reaches representing different riparian variables and flow regime in the same watershed were chosen and established over the summer of 2014. Reach selection was based on riparian vegetation and stream flow. Establishment of reaches included longitudinal profiles, pool and riffle cross-sections, and pebble counts. Rosgen classification was used to establish baseline conditions. As a part of the historical monitoring, documentation of urbanization, how urbanization influences streams’ geomorphic characteristics, and how those characteristics have changed. Once establishment was complete, a process of analyzing data, researching past stream movement through the landscape and classification, and comparing past and present geomorphic characteristics began. We assessed lateral stream movement using historical aerial photographs, along with measured erosion and changes to the
stream channels. Stream reaches were more entrenched, straighter, and wider than historically, encouraging higher flow velocities and increasing the rate stream channels carve the landscape through erosional processes. As our research continues, we expect results to illustrate streams in the urban Inner-Bluegrass region function much differently than in the past. This knowledge will aid us in creating systems that work for the new hydrologic regime being delivered to urban stream sites.

**Mechanical Engineering**

**84. Justin Cooper**  
Mentor: Alexandre Martin, Haoyue Weng

*Numerical Implementation of 3D Adaptive Moving Mesh with Flux Coupling*

Re-entry vehicles and rocket nozzles both currently use carbon phenolic matrices as an integral part of their thermal protection systems. Due to extreme temperatures, oxidation at the surface of the material leads to a recession front which must be accurately modeled to effectively optimize usage. Modeling the surface recession of ablative material has proven to be a challenge, especially when surface balance equations are solved. The present proposal aims at the implementation of a robust 3D mesh movement scheme which is consistent with the Geometric Conservation Law. The scheme will also be adapted so that it preserves the flux matching balance equation at the interface between the gas and the porous material.

**85. Troy Soileau Jr.**  
Other Authors:  
Mentor: Alexandre Martin

*A Study of Ablative Phenomena at Varying Initial Conditions*

Ablative Thermal Protection Systems utilize a carbon fiber precursor, FiberForm, in applications with high re-entry velocities. In order to understand the phenomenon of ablation better, three hundred twenty-two numerical simulations were conducted on the material response of this carbon fiber test piece in a tube under varying initial conditions of flow pressure and temperature, as well as material permeability and density. Utilizing a highly sophisticated material response code, MOPAR, the effects of these initial conditions were observed to determine which condition was the most impactful on pressure downstream of the test piece, overall mass loss, and surface temperature increase, respectively. The data presented here corroborates previous knowledge and can be used both in application of designs and as justification for further investigation into this area of research.
Poster Abstracts

Microbiology, Immunology and Molecular Genetics

86. Bill Aboagye
Other Authors: Michael Nonnemacher, Brian Wigdahl
Mentor: Gilson Capilouto

The Effects of Morphine on the Blood Brain Barrier: An In Vitro Study

Morphine abuse by human immunodeficiency virus type 1 (HIV-1)-infected individuals leads to an increase in viral replication and peripheral viral load, rapid disease progression and increased incidence and severity of neurocognitive abnormalities compared to non-drug abusers. The blood-brain barrier (BBB) is an obstacle that must be overcome during neuroinvasion with eventual development of HIV-associated neurocognitive disorders (HAND). Previous studies of mu-opioids and alteration of BBB permeability have suggested that exposure increases cellular transmigration through an uncharacterized mechanism. In this study, a human brain microvascular endothelial cell (hBMEC) line, hCMEC/D3, was used to establish an in vitro transwell model of the BBB to investigate the effects of chronic (24, 48, 72-hour) morphine treatment on barrier structure and function. The FITC-dextran permeability assay was used to determine the confluence of the cells, the transmigration assay to test the migratory response of the endothelial cells and western blot to test for alteration in tight junction protein expression in the membrane fraction of the cells. We observed that prolonged morphine exposure does not alter the rate of FITC-dextran passage and also peripheral blood mononuclear cell (PBMC) transmigration is increased across the hCMEC/D3 monolayer following 72-hour morphine exposure. Functionally, an increase in PBMC transmigration and firm adhesion was observed following prolonged morphine exposure, in the absence of an increase in overall barrier leakiness. The results suggested that morphine activates hCMEC/D3 cells leading to a cell environment permissive to transmigration. These studies may uncover a mechanism by which morphine disrupts periphery-CNS homeostasis leading to accelerated HAND.

87. Olivia Grothaus
Other Authors: Tanya Myers-Morales
Mentor: Sarah D'Orazio

Listeria monocytogenes Dissemination to the Brain

L. monocytogenes (Lm) is known to cause meningitis, a diffuse infection of the brain, resulting from high-titer in the blood and invading the blood-brain barrier in immune-compromised patients, and rhombencephalitis, an infection localized in the brainstem, appearing in young, healthy individuals, commonly in ruminants. It appears strains that cause the brainstem infection are governed more by virulence properties of the bacteria. It has been proposed that Lm can invade neurons and travel via axonal migration to the brain. It is also known that the Inlam mutation, expressed by a mouse-adapted engineered Lm strain increases the binding affinity to both E-cadherin and N-cadherin, expressed on neurons, in mice and humans. Therefore, we hypothesize that neurovirulent strains of Lm are present in the circulating population and are able to spread via neurons, specific bacterial factors being required to do so. Thus, we first investigated whether this Inlam mutation naturally occurs in the environment by looking at over 450 isolates from a variety of sources. We found three strains to contain an S192F mutation, the same locus as one of the Inlam mutations. Looking at the predicted structure, we determined that the mutation would not increase binding affinity for N-cadherin or E-cadherin as the S192N mutation in Inlam. We also tested Inlam in our mouse model to determine the localization of the bacteria in the brain. In addition, we investigated another Lm isolate known to have caused Rhombencephalitis in a
ruminant by testing in the mouse model. The Rhombencephalitis isolate did not show any marked
difference between the cortex and the brainstem in mice 5, 6 and 7 days post infection. This could be due
to infection method, where mice do not spend the same time as ruminants with food in their oral cavity or
harvesting too late.

**Molecular and Cellular Biochemistry**

88. Kyle Auger  
Other Authors: Madushi Raththagala, Casper Wilkens, Birte Svensson  
Mentor: Matthew Gentry

*Defining Starch Binding by Glucan Phosphatases*

Starch is a vital energy molecule in plants that has a wide variety of uses in industry, such as feedstock for
biomaterial processing and biofuel production. Plants employ a three enzyme cyclic process utilizing
kinases, amylases, and phosphatases to degrade starch in a diurnal manner. Starch is comprised of the
branched glucan amylopectin and the more linear glucan amylose. Our lab has determined the first
structures of these glucan phosphatases and we have defined their enzymatic action. Despite this progress,
we lacked a means to quickly and efficiently quantify starch binding to glucan phosphatases. The main
objective of this study was to quantify the binding affinity of different enzymes that are involved in this
cyclic process. We established a protocol to quickly, reproducibly, and quantitatively measure the binding
of the enzymes to glucans utilizing Affinity Gel Electrophoresis (AGE) and Surface Plasmon Resonance
(SPR). The results show that the glucan phosphatases possess differing abilities to bind to different glucan
substrates. One glucan phosphatase possesses a 50 fold higher affinity for amylopectin than the other,
while it only possessed a 3 fold higher affinity for amylose. Both glucan phosphatases showed similar
affinities for the short oligosaccharide β-cyclodextrin. We performed structure-guided mutagenesis to
define the mechanism of these differences. We found that the carbohydrate binding module (CBM)
domain provided a stronger binding affinity compared to surface binding sites (SBSs).

89. Bushra Manzar  
Other Authors: Farah El-Najjar  
Mentor: Rebecca Dutch

*Effect of Human Metapneumovirus Matrix Protein Mutagenesis on Cellular Localization*

The Human Metapneumovirus (HMPV) is a recently identified virus which causes lower and upper
respiratory tract infections in people of all age groups across the world. The HMPV matrix protein (M) is
a structural protein that plays a large role in viral assembly. Studies from several viral systems indicate
that ubiquitination of lysine residues in matrix proteins can influence protein localization or function.
However, no studies on the role of ubiquitination in the HMPV-M protein have been performed. In order to
test whether ubiquitination of HMPV M lysine residues occurs and affects protein localization and
function, mutagenesis of key HMPV M protein lysine residues to alanine was performed using
QuikChange mutagenesis, and the mutated genes were cloned in to the pCAGGS expression vector,
which allows high level expression in mammalian cells. Experiments to evaluate the effect of these
mutations on protein molecular weight will be performed to assess ubiquitination, and protein localization
studies will be carried out using immunofluorescence. Overall, these experiments will provide valuable
new information about a key viral protein.
Poster Abstracts

Music Theory

90. Abraham Dutch
Mentor: Rob Schultz

*A Geometric Analysis of The Beatles*

This project seeks to analyze the relationship between melody and harmony within songs by The Beatles through the use of Dmitri Tymoczko’s geometric approach to music analysis. This approach represents the relationship between independent musical voices by graphing pairings of voices as single points in n-dimensional space, where n is the number of voices being analyzed. Specifically, the project represents the melody notes and roots of the underlying chords as points in 2-dimensional voice-leading space and plots the voice leadings as lines in that space. The x-axis of the voice-leading space represents parallel motion of the voices (movement in the same direction by the same amount), while the y-axis represents contrary motion (movement in the opposite direction by the same amount). Because there are only 12 pitches used in Western music, these pitches are represented as integers from 0 to 12, with the pitch C being arbitrarily chosen as 0. All octaves of a single pitch are represented by the same number in this space, which can be expressed mathematically by saying that all numbers are calculated modulus 12 (every number is equivalent to its remainder when divided by 12). The results obtained from graphing voice-leadings in The Beatles using this method will be discussed in more detail in the actual project. By analyzing The Beatles, which have widely influenced modern popular music as a whole, the project hopes to find a mathematical connection between notes used in the melody of modern popular music and the harmony which accompanies them.

Nursing

91. Cynthia Morris
Other Authors: Adebola Adegboyega, Karen R. Damron
Mentor: Frances Hardin-Fanning

*Providers' Perceptions of Meaningful Use Mandate*

The purpose of this cross-sectional study was to explore Kentucky providers’ perceptions of the impact of meaningful use standards on healthcare practice and smoking cessation rates. In order to receive incentive bonuses for meeting meaningful use standards, health care providers are likely to be spending more time on tobacco cessation counseling. It is imperative to know how effective cessation counseling is in reducing tobacco use and how health care providers are optimizing use of their counseling time.

Questionnaires were mailed to all Kentucky Family Medicine primary care providers along with a postage paid return envelope. The questionnaire contained items that assessed demographics, smoking cessation counseling habits and perception of meaningful use effectiveness. Four researchers reviewed and compared findings to determine common themes. Voluntary feedback was provided by 63 of the 251 participants. All but one physician (0.4%) offered smoking cessation counseling. Most providers (99.6%) already offered tobacco cessation counseling of some form, while only 44% use the cessation template and 61.4% think it should be required that they ask about tobacco history. Providers expressed that the templates are “user unfriendly” and patient outcomes were dependent on patient motivation and not just physician counseling.
Poster Abstracts

**92. Lindsey Ratermann**
Other Authors: Allison R Jones  
Mentor: Melanie Hardin-Pierce, Susan Frazier

*Alcohol and Drug Impairment as a Predictor in Trauma Patient Outcomes*

Trauma is a major cause of death in the United States; alcohol and drug use are associated with traumatic injury. However, the association of an impaired state with injury severity and trauma outcomes is unclear. Thus, the aim of this study was to evaluate the relationship between alcohol and drug use with injury type, severity, and outcomes of patients after trauma. We performed a secondary analysis of the 2009 National Trauma Databank data set. We randomly selected patients from each of four geographical regions (Northeast, Midwest, South, and West). We compared trauma characteristics and outcomes between those impaired with alcohol and/or drugs (illegal or prescription). Patients (n = 4000) were primarily male (72%), Caucasians (64%) aged 20 - 40 years with 26% exhibiting alcohol above the legal limit (26%), 20% illegal drugs, and 4% prescription drugs. Most traumatic injuries were classified as blunt trauma (81%) due to motor vehicle collision (41%). Those impaired due to alcohol and/or drugs were 5 years younger on average; males and African Americans had a greater proportion of impairment than predicted. There were also more assaults associated with impairment than predicted, and the largest proportion of trauma associated with impairment occurred in the southern region. Injury severity, hospital length of stay, and mortality were not different between those impaired and those not. Impairment secondary to alcohol and drug use was associated with trauma characteristics, but not outcomes.

**93. Juanita Routt**
Other Authors:  
Mentor: Susan Frazier, Melanie Hardin-Pierce

*Regional Differences in Trauma Features, Clinical Management, and Outcomes*

Trauma is the fourth leading cause of death in the United States (US). There is a limited understanding of the US distribution of trauma, the match between available and needed trauma resources, and patient outcomes. Thus, the purpose of this study was to compare demographic and trauma variables, trauma resources, and patient outcomes across US regions (Northeast, Midwest, South, West). A secondary analysis of randomly selected (1000 from each region), de-identified data from the 2009 National Trauma Data Bank was used to characterize and compare demographic, trauma characteristics, trauma resources, and patient outcomes among regions. Participants (n = 4000) were primarily Caucasian (64%) males (72%) aged 40 + 20 years with a severe (76%), unintentional (78%) injury. Nearly half of injuries occurred on a street or road, and a majority were blunt trauma injuries (80%). Twenty seven percent of participants were admitted to the intensive care unit for 6 + 9 days; while 17% of participants required mechanical ventilation for 5 + 8 days. Fifty seven percent of participants developed at least one complication, and 4% of participants died during hospitalization. When compared by region, there were significant differences in demographic and trauma characteristics, as well as differences in the required and available trauma resources and trauma patient outcomes. Understanding regional differences in trauma, resources, and outcomes is required for appropriate resource distribution to support optimal patient outcome.
**Poster Abstracts**

**Oral Health Practice**

**94. Aneesha Laungani**  
Other Authors:  
Mentor: Craig Miller, Robert Danaher

*Herpes simplex virus (HSV)-1 Reactivation Phenotypes from QIF-PC12 Cells in vitro*

Objective: The objective of this research was to test the hypothesis that in vivo HSV-1 reactivation phenotypes can be recapitulated in an in vitro model of HSV-1 latency. Methods: Rat pheochromocytoma (PC12) cells were neuronally differentiated and infected with two HSV-1 strains at multiplicity of infection (MOI) of 1 to 5 in 12-well plates. HSV-1 isolates (CM1 and CM2) obtained from two individuals who experienced recurrent cold sore were evaluated. Cell cultures were maintained with transient exposure to acyclovir to allow a quiescent (QIF) viral state to be established. One week after removal of the antiviral agent, heat stress was used to stimulate reactivation from QIF on 17-day post-infection. Reactivation of virus was determined using a direct plaque assay. Results: CM1 spontaneously reactivated from 33.3% and 41.7% of cultures established at MOI’s of 1 and 5, respectively. CM2 spontaneously reactivated from 12.5% and 20.8% of cultures established at MOI’s of 1 and 5, respectively. Parallel cultures established with CM1 and CM2 at an MOI of 1 reactivated from 75% and 25% of QIF cultures following heat stress, respectively. Spontaneous reactivation of HSV-1 in QIF did not correlate with clinical HSV-1 reactivation frequencies in humans. Conclusions: CM1 had a higher spontaneous reactivation rate and higher heat stress induced reactivation than CM2. Between the two strains examined, correlation between the clinical and in vivo phenotypes was not observed.

**Pharmacology and Nutritional Sciences**

**95. Emrakh Askarov**  
Other Authors: Manolo Cottom, Tiler Cross, Dustin Daley, Hassan Hadi, Brent House, Johnna Little, Alec Prew, Moriah Raleigh, Gabriela Talavera-Santiago, Brian Yuen  
Mentor: Eric Blalock

*Down Syndrome and Alzheimer Disease in the Neurovascular Unit: Staining Micro-bleeds, Laser Microdissecting Brain Capillaries, and Electroporating PC12 Cells*

Cerebrovascular aging affects many individuals and results in decreased brain function associated with Alzheimer disease. Aging Down syndrome patients show the same neurological deficits as Alzheimer patients, suggesting a common cause. Is the problem due to the cerebral vasculature; and furthermore, is there a treatment? In Dr. Head’s lab, brain tissue from normal and Down syndrome cases with and without Alzheimer disease were mounted on slides and stained with Prussian Blue, which binds to iron deposits from microbleeds. Microscopic brain bleeds in Alzheimer and Down+Alzheimer cases were increased. Further, these brain microbleeds are surrounded by beta amyloid, a protein in Alzheimer brain plaques that may be the cause of Alzheimer’s disease. In Dr. Blalock’s lab, laser capture microdissection was used to collect neurovascular units from these brain specimens. The goal here was to gather highly specific neurovascular unit tissue for future tests on molecular relationships between microbleeds and cognition in Down syndrome and Alzheimer's disease. In Dr. Thibault’s lab, electroporation was used to deliver DNA to PC12 cells in order to model insulin-based glucose delivery for nerve function in the neurovascular unit. In this study, microbleeds were found to be related to cognitive deficits, and highly specific neurovascular units were collected for further analysis. Finally, electroporation methods for
insulin DNA delivery to PC12 cells were streamlined. Thus, micro-hemorrhages in the brain may cause cognitive changes, and stopping them may be a good target for new therapies.

**Physics and Astronomy**

96. Marc Higginson-Rollins  
Mentor: Christopher Crawford

*Design of Precision Magnetic Fields for Fundamental Neutron Symmetries*

The traditional magnetic design process involves guessing a reasonable conductor geometry, using finite element analysis (FEA) software to calculate the resulting fields, and modifying the configuration iteratively to reach an acceptable solution. Taking the opposite approach, we developed a method of calculating the conductor geometry as a function of desired magnetic field. This method is based on the magnetic scalar potential, which satisfies the Laplace equation. The desired field is imposed as a boundary condition. The conductor windings follow equipotential contours of the solution on the boundary. We use COMSOL to initially simulate these potentials, then MATLAB LiveLink functionality to extract these contours and simulate the resulting magnetic fields for verification. This design and validation procedure is demonstrated on a precision electromagnetic coil being developed for an experiment to measure the electric dipole moment of the neutron to a precision of 1e-28 cm.

97. Connor Johnstone  
Mentor: Christopher Crawford

*Fluxgate Magnetometer Construction and Use in Passive/Active Magnetic Flux Cancellation*

Many physics experiments require a very precisely controlled magnetic field that accounts for varying noise fields such as nearby electronics and the ever-changing magnetic field of the earth. A fluxgate magnetometer is a device that can sense a directional magnetic field by driving one current loop to induce a second field either orthogonal or parallel to the field to be measured. A second current loop picks up both of these fields and, based on the material properties of the core material, the induced current can be used to determine the magnetic field. A third coil can also be driven to automatically cancel the field, and it is believed that this technology can be used in conjunction with current magnetic shielding technology (using many layers of expensive mu-metal to create a passive shielding effect) to draw the flux through the cores and ultimately to create cheaper and more effective shields for experiments.

98. Daniel Jones  
Mentor: Christopher Crawford

*Double-cos-theta Coil with Printed Circuit Endcaps*

The objective of this project is to design, optimize, and construct a double cosine theta coil. The design will be cylindrical, with printed endcaps. The purpose of this coil is to contain a perfectly homogeneous magnetic field inside the cylinder, whilst creating no field outside of the cylinder. The design of the endcaps will be a boundary value problem such that an inner circle will have a constant field, and an outer circle will contain a field which falls to zero at the outer boundary. The current carrying wires will all be
supplied the same current, which will determine the field inside the cylinder, as the wires correspond to equipotentials for the magnetic scalar potential. The design for the bottom endcap will cause a small amount of inhomogeneity, as it will need to accommodate the probe, but the design intends to minimize this. Ultimately, the project intends to construct a coil that contains a homogeneous field throughout the cylinder.

99. David Mathews
Mentor: Christopher Crawford

**Optimization of a Trapezoidal Filter Algorithm on an Nvidia GPU with CUDA**

Introduction: When large sets of data come from a reaction, the traditional method is to use a filter algorithm to do some initial analysis with the CPU. For real-time analysis and output of results of the data from a reaction, the linear methods of a CPU are not very efficient. The parallel architecture of a GPU is perfect for manipulation of multiple data arrays like those present when using a filter algorithm. Methods: Each analysis method used was written twice. One time for the CPU, one for the GPU and then each method was compared using the duration of evaluation time. Two primary methods were used: a so-called “brute force” method and the more elegant, Fast Fourier Transform (or FFT) method. The brute force method was the straightforward calculation of the convolution integral of the trapezoidal filter and the data set. This method was significantly slower than the more efficient FFT method but gave good insight into how much more effective the GPU was at massive numbers of simple calculations. The FFT method, while requiring more steps overall, had fewer total calculations making it significantly faster per data set. Results: As expected, the GPU was more efficient. Using the “brute force” method, the GPU was a little over 7 times faster when dealing with the mass number of computations. Using the FFT method, the results were more varied but remained around 7 times as fast on average. Conclusion: The GPU is a far more effective method than the CPU and will allow for easier real-time analysis of large sets of data from reactions.

**Physiology**

100. Lauren Bates
Other Authors: Evan Blanford, Deja Bowen, Calli Brooks, Margaret Hoffman, Annie Rice, Vanessa Riggs, Amber Robinson, Hannah Widner
Mentor: Brian Delisle

**Circadian Rhythms: Assessing Individual Chronotypes Through Subjective and Objective Testing**

Almost every living organism, from the blue-green algae to people, has its own internal biological clock or rhythm. The timing for many of our biological rhythms is circadian, meaning it peaks and troughs about once a day. Circadian rhythms help us to be ready for everyday situations, such as studying, exercising, sleeping, and metabolizing our food. The peak timing or phase of circadian rhythms varies from person to person based on their personal chronotype. This discovery introduces a new dimension to our overall fitness level: Time. Knowing a person’s individual chronotype can help identify the optimal times of day to perform certain activities that follow a circadian rhythm. There are several different ways to assess an individual’s personal chronotype: subjective questionnaires and objective biological testing. We investigated how well the chronotypes assessed by the morningness–eveningness and social jet lag...
questionnaires correlate with recorded sleeping behavior and changes in skin temperature in a cohort of Undergraduate students. The results of this work highlight the advantages and disadvantages of using subjective and biometric testing in the identification of an Undergraduate student’s chronotype.

101. Ikenna Chukwudolue  
Mentor: Karin High, Robert Kline  

Chronic Orofacial Neuropathic Pain Generates Endoplasmic Reticulum Stress

Pain is a significant public health problem that costs society at least $560-$635 billion annually, an amount equal to about $2,000.00 for everyone living in the U.S. This includes the total incremental cost of health care due to pain from ranging between $261 to $300 billion and $297-$336 billion due to lost productivity (based on days work missed, hours of work lost, and lower wages). CDC statistics for a survey collected by NIH reports headaches, chronic facial/neck pain are chief complaints of 34% of respondents. Persisting neuroplastic processes necessary for nerve and tissue repair mechanisms can become dysregulated and dysfunctional over time with chronic overactivation. In our chronic orofacial neuropathic pain model, the Data show chronic pain itself is a sufficient generator of neuronal damage and a potential precursor to Alzheimer’s Disease (AD)-like pathology. In the present study, a trigeminal inflammatory compression (TIC) injury mouse orofacial neuropathic pain model was employed to investigate the mechanistic relationship between chronic orofacial neuropathic pain and endoplasmic reticulum (ER) stress. Our data indicating that trigeminal nerve injury induces time sequenced brain cortical neuronal and hippocampal stem cell loss. The chronic orofacial neuropathic pain model induces activation of stress proteins within the lumen of the cellular endoplasmic reticulum (ER). Specific proteins upregulated in the chronic pain model within 1-3 weeks include: 1) phosphorylated promoter protein kinase R (PKR)-like ER kinase (pPERK), the endoplasmic reticulum (ER) stress sensor; 2) phosphorylated eIF2α (p-eIF2α), promotes cell death after sustained activation; 3) hyperphosphorylated tau (pTau), drives neurotoxicity and cognitive decline. These studies Imply that chronic neuropathic pain may share the same development pathway with Alzheimer’s Disease (AD) at its earliest stages.

102. Cody Manning  
Other Authors: Elizabeth A. Schroder, Don E. Burgess, Abhijit Patwardhan, Claude S. Elayi, Karyn Esser  
Mentor: Brian Delisle  

Study of QTc Variance in Transgenic Mouse Model of Long QT Syndrome Type 3: Implications for Concealed LQTS

The overall flow of electricity through the heart can be measured using an electrocardiogram (ECG). Individuals with the pro-arrhythmic Long-QT syndrome (LQTS) have an abnormally long heart-rate corrected QT interval on the ECG (QTc,>460ms). This is indicative of abnormal ventricular repolarization. About 1:2500 individuals have congenital LQTS, which is most often the result of a mutation in one of the genes encoding a cardiac ion channel. Patient data suggests that ~30% of genotype positive LQTS patients have normal QTc values but are still at risk for sudden death (concealed LQTS). The aim of this project is to identify a method to accurately unmask patients with concealed LQTS. Type 3 LQTS (LQT3) is characterized by a mutation in the cardiac Na+ channel gene SCN5A. Clinical data of 46 patients with the LQT3 deletion mutant 1507-1509KPQ demonstrated a concealed phenotype in 11 patients. To understand the concealed LQT3 phenotype, we utilized a transgenic mouse model that
knocked in delta1507-1509KPQ mutation in SCN5A. In vivo telemetry was used to record ECGs over several days in control and LQT3 mice housed in 12-hour light:dark conditions. After the ECG data was collected the QTc for both groups was calculated using a version of Bazett’s formula adjusted for mice. The control mice showed consistent QTc value in both the light and dark phases. The LQT3 mouse showed normal QTc values during the dark phase, but long QTc values during the light phase. These data demonstrate that LQT3 mice show a time of day prolongation in their QTc intervals. We conclude that measuring the QTc interval at different points of the day may help identify LQT3 patients with concealed LQTS.

103. Shelby Meier  
Other Authors: Michelle Bell, Alexandria Ingram, Danielle Lyons  
Mentor: Joe Abisambra

**Inhibition of PERK Decreases Brain Atrophy in rTg4510 Mice: Novel Therapeutic Target for Alzheimer’s Disease**

Alzheimer’s disease (AD) is the most common type of dementia seen in the adult population. In 2014 alone, the costs of caretaking for this disease were estimated to be more than $200 billion dollars. The economic and societal consequences of this disease are unsustainable and are expected to worsen with an increasing adult population. This makes finding a therapeutic treatment for AD of the utmost importance. We recently discovered that the protein kinase PERK is upregulated in a tau transgenic mouse model of AD. PERK mediates one of three pathways of the unfolded protein response (UPR), a mechanism that protects cells from endoplasmic reticulum stress. Active PERK inhibits the eukaryotic translation initiation factor 2-alpha (eIF2α), which reduces overall protein synthesis. While short term UPR activity is protective, prolonged activation of the UPR-PERK pathway leads to cell death. We hypothesized that PERK inhibition would improve the pathological and functional features inherent to tau transgenic mice. We tested our hypothesis by treating tau transgenic mice with a PERK inhibitor (GSK2606414). We found that after only one month of treatment, brain atrophy and neuronal function were almost completely rescued. This dramatic recovery suggests that PERK inhibition is an attractive therapeutic strategy for AD and related disorders. Future efforts are to test the impact of PERK inhibition in other models of AD.

104. Lory Nigoghossian  
Other Authors: Leovarda Nunez, Garrett O’Brien, Zain Hassan, Jenika Soni, Rachel Brakeville  
Mentor: Jonathan Satin

**Determining the Maximum Frequency that a Cardiomyocyte Can Support**

In the United States, tachycardia causes 325,000 deaths per year. When the heart is subject to such rapid beating, the cells are in distress. Intracellular calcium levels couple electrical excitation to contractions. Therefore, high frequencies can be detrimental to a cardiomyocyte because the calcium within the cell can no longer keep up. In order to test this hypothesis, we collected heart cells from a rat and placed them in a calcium bath. As a model of whole heart function, we monitored contractions and calcium levels inside the cytosol after isolated cells were stimulated by various frequencies. Higher frequencies caused alternating peaks and high diastolic calcium levels. The data suggests that at higher frequencies, calcium was not able to keep up; therefore the heart didn’t contract correctly. We observed that the cell didn’t have enough time for the calcium uptake, which prevented the cell from relaxing. We propose that a calcium blocker will allow the heart to function at higher frequencies.
105. Mark Vinas
Other Authors: Ishita Parikh
Mentor: Steven Estus

The Effects of TRPM8 Gene Variants on Migraine

TRPM8 is a member of the transient receptor potential cation channel family. TRPM8 is a ligand-gated ion channel that is activated by cold or menthol. When activated, the TRPM8 protein lets Na+ and Ca2+ ions enter the cell, which depolarize the cell and generate action potentials. The somatosensory cortex in the brain perceives the incoming signal as the sensation of cold. Markus Schurks’ research found that heredity is an important aspect in susceptibility to migraines. About 50% of affected individuals have a first-degree relative who suffers from migraine, which supports the idea that migraine risk is modulated by polymorphisms in the human genome. Single nucleotide polymorphism (SNP), rs10166942, was recently found to be associated with migraine risk in three large genome-wide association studies. People with the minor SNP allele have reduced risk of migraines. More recently, the minor SNP allele was also associated with lower sensitivity to cold. Two SNPs, rs13004520 and rs17868387, were found that are co-inherited with one another 100% in people and were in robust linkage disequilibrium with the migraine SNP. Both of these SNPs change TRPM8 amino acids (missense mutations). These mutations are predicted by poly-Phen to alter TRPM8 function. The minor and major alleles of the TRPM8 gene are being inserted to pcDNA5/FRT/TOPO, a tetracycline inducible vector, to avoid the toxicity found with long-term high TRPM8 gene expression in G418 selected AD293 cells. Using cold or menthol stimulus, the response of the two forms of the TRPM8 cells will be tested. When stimulated by cold or menthol, it is hypothesized that cells with the minor allele form will require stronger stimulus to import the same Na+ and Ca2+ into the cells. Elucidating the function of these two SNPs will thus show how TRPM8 function may be altered to reduce the risk of migraine.

Plant Pathology

106. Connor VanMeter
Other Authors: Ching-Kai Chuang
Mentor: Peter Nagy

Effective Inhibition of TBSV Replication by Cellular TPR-domain Proteins

Viruses are a continuing threat to our society. Tomato bushy stunt tombusvirus (TBSV) is a (+)RNA virus that causes tomato to produce stunted fruit. This virus is used as a model to study virus replication and virus-host interactions based on yeast as a model host. TBSV utilizes two proteins to form a viral replicase complex: a RNA chaperone (p33) and a RNA-dependent RNA polymerase (p92pol). This complex is common to all (+)RNA viruses. This research has allowed for the screening of numerous cellular proteins for TBSV-host interaction. The above screens led to the identification of a new group of virus inhibitory factors, called cell-intrinsic restriction factors (CIRFs). Among the most potents CIRFs are the tetratricopeptide repeat (TPR, a 34 amino acid sequence) containing host proteins that greatly inhibit TBSV replication and assembly. The TPR motif interacts with TBSV when p92 binds to the co-opted cellular heat shock protein 70 (Hsp70). This work has led to the identification of a series of TPR-containing proteins that inhibit tombusvirus replication and assembly. These proteins can be split into two groups: Hsp70/90 binding and non-Hsp70/90 binding. These TPR sequences have been tested in vitro and using a yeast two-hybrid system to measure protein-protein interaction between TPR and TBSV p92. The TPR sequences have also been tested for association and dissociation with viral factors using surface
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plasmon resonance. These findings give insight into the inhibitory role of TPR in TBSV replication. Future research may show how the TPR motif influences replication in other (+)RNA viruses.

Political Science

107. Chloe Atwater
Mentor: Tiffany Barnes

Victim Blaming: A Partisan Issue?

In recent years, comments made by legislators about rape victims have made it necessary to ask the question: Is there a correlation between political affiliation and the tendency to blame victims for their own rape? In this paper, it is argued that the tendency to victim blame is correlated with political affiliation. More specifically, it was hypothesized that: H1. Democrats and Republicans will be about as likely to blame victims for their own sexual assaults when the victim is walking home from school; H2. Republicans will be more likely to blame victims walking home from a bar than from school; and H3. Democrats will be less likely than Republicans to blame victims who are returning from a bar. A survey was conducted with a very subtle one word treatment to determine which of these hypotheses would hold. The data showed both H2 and H3 to be supported, but H1 to be refuted; Republicans were more likely to blame the victim in both scenarios and were more likely to blame a victim returning from the bar than from school, while interestingly Democrats were more likely to blame a victim returning from school than from the bar.

108. Mariam Malik
Mentor: Justin Wedeking

Assessment of Attorney-Judge Interactions During State Supreme Court Oral Arguments

My research was based on previous research conducted by Dr. Justin Wedeking, in the Department of Political Science at the University of Kentucky. In this research, the behavior of the federal Supreme Court justices were analyzed during oral arguments, with a focus on whether the quality and number of questions those justices ask has an effect on the ruling. This research uncovered that the justices usually asked more questions to the respondent, approximately 70% of the questions the justices asked were to the respondent. After the rulings of these cases were announced, they were compared with the number of questions asked during oral arguments. Dr. Wedeking's research found that the side that received more questions generally lost the case. This means the petitioner has about a 70% chance of winning a case at the national level. Based on this research, Dr. Wedeking has applied the same procedure to state supreme courts to see if they would get the same results. One reason for comparing federal and state supreme courts is the difference in how the judges are selected. The national Supreme Court is appointed by the President of the United States and confirmed by the Senate. In many state supreme courts, the judges are selected through some type of election system. Studying state supreme courts allows us to see if judges behave differently when they are appointed versus being elected. Based on the results from the national level, the hypothesis in this research is that in state supreme courts, the side that receives more questions from the judges will lose.
109. Ryan McElhose  
Mentor: Emily Beaulieu

*Social and Political Impacts of Felon Disenfranchisement*

The United States is home to 5 percent of the world's population yet is home to 25 percent of prison inmates in the world. In efforts to understand the impacts of mass incarceration, Ryan has researched through his literature review the social and political impacts former offenders face with a felony conviction. In this literature review, it is important to first evaluate the historical contexts that shape felon disenfranchisement laws, how former offenders are marginalized from the political process, the impact of being excluded from social programs, current policies about enfranchisement, and an evaluation of other countries policies that support enfranchisement.

110. Austin Barnett  
Mentor: Jonathon Golding

*Drug Crime Perceptions*

One hundred fourteen million Americans age 12 or older (46% of the population) reported illicit drug use at least once in their lifetime (bjs.gov, 2008). This statistic highlights the availability of drugs, and the frequency in which illicit drugs are coming into contact with society. With such a clear problem on our hands it is interesting to note how little research has been conducted to gauge public opinion of drugs and drug users. The purpose of the present study was to investigate the opinions and perceptions of individuals toward drug trafficking. Hypothesis 1 stated that participants would be more tolerant toward individuals depending on the drug type. For example, tolerance would be higher for marijuana compared to pain pills and crack cocaine. Hypothesis 2 predicted that participants would rate larger amounts of a drug in one’s possession as more criminal compared to smaller amounts. Hypothesis 3 indicated that males would view drug offenses overall as less severe as compared to females. We used a 3 (Race: Caucasian, African American, Hispanic) x 3 (Drug Type: Marijuana, Crack Cocaine, Pain Pills) x 2 (Drug Amount: low versus high) within-participants design. A total of 83 community member participants read 18 different scenarios comprising the design of the study. After reading each scenario participants then responded to five questions about the scenario (e.g., severity of the crime). The results supported Hypothesis 1. For example, participants rated trafficking marijuana as the least severe crime, followed by pain pills, and then crack cocaine as most severe. Also, Hypothesis 2 was also supported; trafficking small amounts of drugs was perceived as less severe than trafficking large amounts. Finally, Hypothesis 3 was supported; males rated drug trafficking crimes as less severe compared to females.
111. Jacob Anthony Batuhan
Other Authors: P.A., Crooks, J.P., Culver, L. P., Dwoskin
Mentors: Arlington George Wilson, Michael Bardo

*Oral Administration of Vesicular Monoamine Transporter-2 (VMAT2) Inhibitors JPC-077 and JPC-141 Reduce Methamphetamine-Induced Reinstatement in Rats.*

While abuse rates for methamphetamine have been steadily declining, studies indicate a third of all abusers will relapse into addiction at some point during treatment. Thus there is significant need for a drug which directly addresses the issue of relapse. Several newly synthesized 1,4-diphenylethyl analogs of lobelane (a defunctionalized derivative of lobeline) have been found to be potent and selective vesicular monoamine transporter-2 (VMAT-2) inhibitors, indicating potential to aid in reducing methamphetamine (METH) abuse and preventing relapse. In this study we test the therapeutic potential of two of these analogs (JPC-077 and JPC-141) on METH-induced reinstatement of self-administration behavior in male adult Sprague Dawley rats following extinction. After surgical implantation of a jugular catheter, rats learned that methamphetamine infusions (0.05mg/kg) could be earned via completion of a simple task (lever pressing), followed by 10 days of extinction (no methamphetamine). METH seeking behavior was then induced by a pretreatment with METH (0.5mg/kg, i.p) on 3 sessions, where two doses of either compound (constant across subjects) were randomly administered 15 minutes prior to the session. Results showed that JPC-077 (100 and 170 mg/kg) and JPC-141 (130 and 170mg/kg) significantly blocked METH-reinstatement behavior. Further, these results were achieved at doses lower than those required to produce a decrease in locomotor activity (previous work in our laboratory) indicating that results were not due to nonspecific suppressant effects. These results indicate that JPC-077 and JPC-141 are potentially viable drugs for the treatment of METH abuse and relapse; however further pharmacokinetic and toxicological research must be conducted before translating these findings to human counterparts. (Supported by NIH grants U01 DA13519 and T32 DA01617.)

112. Stacey Brothers
Other Authors: Brittany D. Walls
Mentor: David Berry

*Utility of the CAARS Validity Scales in Identifying Feigned ADHD, Random Responding and Genuine ADHD in a College Sample*

As concern about college students feigning symptoms of Attention Deficit/Hyperactivity Disorder (ADHD) has increased, the ability to detect feigning has become even more important. The Conners’ Adult Attention Deficit/Hyperactivity Rating Scale (CAARS) includes only one validity scale, the Inconsistency Index, which detects random responding, not exaggeration or feigning of ADHD symptoms. The Conner’s Infrequency Index (CII) can be used to detect feigned ADHD and has demonstrated exceptional specificity (93%) and modest sensitivity (30%) (Suhr, Buelow, and Riddle, 2011). While the CII seems to be less effective in detecting inconsistent responding, the Inconsistency Index on the CAARS is able to detect this pattern. Although the CII has demonstrated successful detection of feigned ADHD, it must be further validated before clinical application. The present study will use a simulation design that analyzes differences on the CAARS between persons who have a clinical diagnosis of ADHD and nonclinical patients randomly assigned to one of four groups: those that answer honestly, others that respond completely randomly (RANDfull), some that respond partially randomly (RANDhalf), and those that feign ADHD symptoms (ADHD simulators). After the testing is complete, each group’s responses on the CAARS validity scales will be analyzed to determine their ability to detect and differentiate between honest responding, random responding, and faking bad.
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**113. Brittany Coulter**  
Mentor: Jonathan Golding

*What Are People's Views on Plea Bargains in Sexual Assault Cases?*

Although most people think that all court cases are heard by juries, data show this is not true. In fact, more than 90% of criminal cases are never tried before a jury (Keating, 2012). A plea bargain is any agreement in a criminal case where the defendant agrees to plead guilty in return for some concession from the prosecutor. Research has shown that the public is generally not supportive of plea bargains when severe types of crime are involved (e.g., murder and rape; Herzog, 2003). The present study was designed to examine more closely whether participants would support plea bargains in child sexual assault and in adult sexual assault cases. It was hypothesized that (1) participants would be less likely to support plea bargains for child sexual assault versus adult sexual assault; (2) participants would be more likely to support a plea bargain when it was issued to prevent the trauma of having the victim testify than if it was issued to save the court time to prosecute other cases; and (3) participants would be more likely to support a plea bargain of a reduced jail sentence versus probation. The present study was a 2 (Age: six year old vs 26 year old) x 2 (Reason: prevention of trauma versus saving court time) x 2 (Deal: reduced sentence versus probation) within-subjects design. Forty-three participants (20 females) read case descriptions for the eight cases comprising the design. Hypothesis 1 was supported; participants were more upset when a six year old (M = 5.95) was assaulted versus a 26 year old (M = 5.39). Hypothesis 2 was supported; participants were more likely to support a plea bargain when it was issued to prevent trauma (M = 2.64) versus to save court time (M = 2.51). Hypothesis 3 was supported; participants were more likely to support a plea bargain of a reduced jail sentence (M = 3.02) versus probation (M = 2.12).

**114. Cheyenne Davis**  
Other Authors: Destiny Singleton, Davis Whaley, Michael Chen  
Mentor: Robert Lorch

*Recognition of Dissonance in Simple Science Texts during Reading*

One important component of reading comprehension is sensitivity to possible inconsistencies in a text because inconsistencies often signal to the reader that they have misunderstood something. The current study was designed to investigate the effect of inconsistencies in scientific texts on reading. Three experiments were conducted using the same basic procedure. College students read 20 texts a sentence at a time while their reading times were recorded for each sentence. Each text contained a single “target sentence” that was preceded by a “context sentence” whose relation to the target was manipulated. In Experiments 1 and 2 there were two conditions: The context sentence was either neutral or inconsistent with respect to the following target sentence. In Experiment 1, the context and target sentences in each text were adjacent in the text; in Experiment 2, a neutral filler sentence was inserted between the context and target sentences. It was hypothesized that inconsistencies would increase reading time of the target sentence in both experiments. Results supported this. Experiment 3 replicated Experiment 1, but with the addition of another variable: A connective word was added to the target sentence to signal the inconsistent relation between the context and target sentence. It was hypothesized that the addition of a connective word would decrease the effect found in the first two experiments. The results supported this. Together, the results of the three experiments demonstrate that inconsistencies in scientific texts (a) cause increased reading time regardless of distance between the target sentence and inconsistency and (b) the presence of transition words reduces this effect even when inconsistencies are present. The current study helps in understanding the process of reading comprehension in scientific texts.
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115. Eileen Doan
Mentor: Jonathon Golding

The Impact of the Presence of a Child on Perceptions of Battered Women who kill their Abusers

Domestic violence is prevalent throughout the world. Statistics state that 33% of women and 25% of men have or will experience violence from their partner in their lifetime (Black, Basile, Breiding, Smith, Walters, Merrick, Chen, & Stevens, 2011). Moreover, annually there is an estimated 5 million victims of physical abuse by an intimate partner (Black et. al, 2011). Finally, a study by Bourget and Gagne (2012) found that of 738 family-related homicides, 21% were committed by women. In many of the partner killings committed by women, there are children in the family. The purpose of the present study is to investigate how the presence of children in a family impacts a case involving a domestic partner killing. Hypothesis 1 predicted that having a child (regardless of where the child was at the time of the killing) should result in more not-guilty verdicts compared to not having a child. Second, females should vote not guilty more than males. The experiment was a 2 (Participant Gender) x 4 (Child Condition: no child, child not in the house, child in the house, child witnesses killing) between-participants design. Two hundred thirty-nine community members (Females = 126, Males = 113) were asked to read a trial about a woman who killed her husband after experiencing abuse and then make case judgments. The results supported Hypothesis 1; having a child led to 60% not guilty verdicts when there was a child and 52% when there was no child. The results also supported Hypothesis 2; women voted not guilty (63%) more often than males (54%).

116. Taylor Elder
Other Authors: Paul Geiger, Hannah Combs, Ian Boggero
Mentor: Suzanne Segerstrom

Self Perception on Subjective and Objective Health

There are many signs that show aging whether it is due to appearance, the start of physical pain, or decreased cognition. However, the most difficult to diagnose is declining cognition, especially since there is no approximate age at which signals decline. An important factor to determining one’s own level of health is through self-perception. This study focuses on older adults’ self-perception of their level of cognition and aims to look at it through subjective and objective health. The participants in this research were 150 older adults who volunteered their time for the sake of this study. The level of cognition is reported by through a variety of tasks including Trails A&B and Digit Span, while emotional functioning is measured through the use of the geriatric depression scale and emotion regulation questionnaire. Older adults are hypothesized to have more accurate perception of cognitive functioning with higher levels of emotional functioning.
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117. Janet Hall
Mentor: Peggy Keller

Parental Problem Drinking and Emotion Regulation in Emerging Adulthood

Introduction: Parental problem drinking (PPD) is a common family stressor, as 40% of American children will be exposed to PPD by the time they reach the age of 18 (Grant, 2000). Understanding the mechanisms involved in how and why PPD is associated with adverse outcomes across development is therefore important. The proposed study examines emotion regulation as one such mechanism. Emotion regulation refers to the ability to alter the experience or expression of emotion in service of goals (Gross, 2007). The study focuses on cognitive emotion regulation, including reappraisals of situations eliciting emotional reactions, and on anger and depressive rumination (the repeated and prolonged attentional focusing on emotions). Method: Data from approximately 200 college students, half of whom are children of alcoholics, were collected. Participants completed questionnaire measures of PPD (Children of Alcoholics Screening Test), emotion regulation (Cognitive Emotion Regulation Questionnaire, Anger Rumination Scale, and Depressive Rumination Scale), and mental health (Depression, Aggression, Anxiety, and Alcohol Problems). All measures have well-established psychometric properties. Results: Data preparation is ongoing and therefore results are not yet available. Data analyses will include correlations. Specifically, correlations between PPD and emotion regulation will be tested, along with between emotion regulation and mental health. T tests to compare children of alcoholics to children of non-alcoholics will also be conducted. Discussion: Findings will contribute to understanding of the effects of PPD on the transition to adulthood, and potentially identify useful targets for treatment of children of alcoholics.

118. Kayla Hicks
Mentor: Jonathan Golding

The Impact that Amount of Money and Type of Crime Have on Juror Perceptions of Elder Financial Exploitation

Elder financial abuse (EFA) is a major problem in the United States. In fact, one study found that 41 out of 1000 elders reported being a victim of EFA, which is much higher than self-report rates for any other type of abuse (National Center on Elder Abuse, 2011). The present study was designed to examine how type of criminal charge and amount of money involved affect a participant’s perception of guilt in an elder financial abuse case. There were three hypotheses. Hypothesis 1 stated that females would be more pro-victim than males. For example, females would be more likely to find the defendant guilty than males. Hypothesis 2 stated that participants would be more likely to find a defendant guilty if a lower amount of money was taken ($10,000) versus a higher amount of money ($1,000,000). Hypothesis 3 stated that participants would be more likely to find the defendant guilty when charged with KRS 209 (Financial Exploitation of an Adult) versus KRS 514 (Theft by Deception). The present study used a 2 (Participant Gender) x 2 (Amount Stolen: $10,000 versus 1 million) x 2 (Type of Crime: Financial Exploitation of an Adult versus Theft by Deception) design. One-hundred-twenty-six community members read a trial in which a man allegedly stole money from his mother. Despite the hypotheses, the results yielded a three-way interaction. Females showed a main effect of Type of Crime; KRS 209 resulted in more guilty charges than KRS 514. Men, however, showed an interaction between crime and amount of money. For KRS 209, a low amount of money resulted in more guilty verdicts (60%) than a high amount of money (36%). For KRS 514, a high amount of money (50%) resulted in a slightly greater number of guilty verdicts than a low amount of money (43%).
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119. Natalie Holt
Other Authors: Angela Hayden, Janice Almasi
Mentors: Elizabeth Lorch, Richard Milich

The Effect of a Narrative Comprehension Intervention on Story Recalls of Children at Risk for ADHD

Children with ADHD exhibit deficits in narrative comprehension relative to comparison peers. The current study examined the effect of a narrative comprehension intervention on story recalls by third graders at risk for ADHD. The intervention specifically targeted known narrative comprehension deficits that include recognizing goal structure, making causal relations among story events, identifying important information, and generating accurate inferences. Sixteen children received the intervention across fifteen after-school sessions. Two teachers taught the intervention to groups of four children through engaging texts and an ongoing narrative that required active involvement from the children. Participants completed free recall tasks and answered comprehension questions about a televised cartoon, Rugrats, and a short audiotaped fable during pre-test and post-test sessions. Preliminary results from Rugrats recalls indicate the experimental group at one school showed a larger improvement in recall of events of high importance than the control group. The experimental group also increased the percent of factual questions answered correctly from pre-test to post-test beyond the control group. The experimental and control groups performed similarly during the post-test at recalling events on the causal chain. These early results suffer from lack of power but still indicate promising effects of the intervention.

120. Hannah Kembel
Mentor: Jonathan Golding

Perceptions of Non-Consensual Sexual Intercourse in Marital Relationships

Even though research has shown about nine percent of all rapes are committed by a spouse (Rathus, Nevid, & Fichner-Rathys, 1997), spousal rape cases are rarely prosecuted. Rape can be defined as “any unwanted intercourse or penetration (vaginal, anal, or oral) obtained by force, threat of force, or when the partner is unable to consent” (Bergen, 1999, p. 1). This definition emphasizes consent; without explicit consent sexual intercourse would be considered rape. The purpose of the present study was to determine how people perceive non-consensual sexual intercourse in married couples when it is not specified as rape—no physical force. It was hypothesized that (1): prior abuse in a marriage should lead participants to view non-consensual sexual intercourse as a crime when there was no abuse history, (2): female participants should be more pro-victim (e.x. less victim blame) than male participants, and (3): threats that involve emotional harm (e.g. taking kids) should have higher pro-victim ratings than threats not involving emotional harm. We used a 2 (participant gender) x 2 (prior history of abuse) x 4 (threat type: taking kids, posting nude photos online, withholding money, divorce) within participants design. Participants read 8 vignettes in which a wife stated she did not want sex, but she eventually complied after a threat. Participants rated each vignette on several measures (e.g. level of consent, husband committed a crime). Each vignette was followed by several questions (e.g. did the husband commit a crime). The primary results supported Hypothesis 1: prior abuse in the relationship led to the non-consensual sex being viewed as a crime more than when there was no prior abuse. Hypothesis 2 was also supported: female participants tended to be slightly more pro-victim than male participants. Finally, Hypothesis 3 was supported: threats that involve emotional harm led to higher pro-victim ratings than threats that did not involve emotional harm.
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121. Ameena Khan  
Mentor: Jonathan Golding

The Impact of a Defendant not Testifying in a Child Sexual Assault Case

Under the Fifth Amendment, a defendant is not required to testify and can waive his/her right to testify in a trial. Although a defendant does not have to testify, conventional wisdom states that a jury expects an innocent defendant to take the stand and that it is impossible to gain acquittal without testifying. (Zipperer, 1991). However, there is no published research investigating the impact of a defendant not testifying in a court of law. The present study was designed to investigate the perception of a defendant who chooses not testify. It was hypothesized that (1) a defendant who does not testify will lead to more guilty verdicts and higher pro-victim judgments (e.g., victim sympathy) than when a defendant testifies, (2) strong evidence (regardless of whether a defendant testifies or not) will lead to more guilty verdicts and higher pro-victim ratings than weak evidence, and (3) female mock jurors will have more guilty verdicts and higher pro-victim judgments (e.g., victim credibility) than male mock jurors. The present study included 416 participants (244 females and 172 males) who read a trial summary in which a man was being tried for the rape of a six-year-old girl. We used a 2 (defendant testify: yes or no) x (strength of evidence: strong vs. weak) x 2 (participant gender) between-participants design. The results supported Hypothesis 1. There were more guilty verdicts when the defendant did not testify (M= .80) than when he did testify (M= .68). In addition, Hypothesis 2 was also supported; strong evidence led to more guilty verdicts (M=0.82) than weak evidence (M=0.65). Finally, in support of Hypothesis 3, females (M= .81) rendered more guilty verdicts than males (M= .63). This research will assist the legal community in determining how best to prosecute child sexual assault cases.

122. Kaitlin Moore  
Mentor: Jonathan Golding

Spousal Rape

Marital rape is a prevalent form of violence against women. Research on this topic estimates that between 10-14% of women have been raped by their husbands (Russell, 1990). Although marital rape is now criminalized in some form in all fifty states, research shows that marital rape is often viewed as a lesser crime (Bergen, 2006); some question whether a man can actually rape his wife (Whatley, 2005). The present study was designed to examine mock juror decision making in cases of marital rape as a function of expert testimony. The study involved three hypotheses. First, women should have higher pro-victim judgments (e.g., guilty verdicts) than men. Second, testimony from a Sexual Assault Nurse Examiner (SANE) should produce higher pro-victim judgments, followed by a Registered Nurse (RN) and then a condition with no expert. Third, pro-victim judgments for women should increase as the level of training for the examining nurse increased. However, for men pro-victim judgments should show a large increase only when a SANE nurse testified. This study used a 2 (Participant Gender) x 3 (Expert Testimony: SANE, RN, none) between person design. Hypothesis 1 was supported; women voted guilty (M = .84) more than men (M = .57). Hypothesis 2 received partial support. Guilty verdicts were lower (M = .62) for the no expert condition compared to the RN (M = .77) and SANE (M = .77) conditions. Finally, hypothesis 3 received partial support. For women, guilty verdicts were highest in the RN condition (M = .93) closely followed by the SANE (M = .82) and none condition (M = .78). However, for men, there was a steady increase in guilty verdicts as the level of training for the examining nurse increased: none condition (M = .42), RN condition (M = .56), and SANE condition (M = .70).
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123. Jaye Odom
Mentor: Elizabeth Lorch, Richard Milich

How Anxiety Moderates the Social Outcomes of Children with ADHD

The purpose of this study was to examine how anxiety could impact the social outcomes of children with attention-deficit/hyperactivity disorder. Over 100 children with and without ADHD participated in play groups at sites in Ohio and South Carolina. Parents and teachers filled out measures regarding social skills; participants completed a scale that examines anxiety symptoms. Trained lab assistants coded for specific social behaviors and overall acceptance and overall rejection of each child during the play groups. Results indicated that anxiety had a moderating effect on parent reported social skills when hyperactivity symptoms were present. Teachers reported social skills when inattention symptoms were present and overall rejection when inattention symptoms were present. Parents reported better social skills when fewer hyperactivity symptoms were comorbid with more anxiety symptoms. Teachers reported that children with more inattention symptoms had better social skills when they also had more anxiety symptoms. Global ratings indicated that children with high inattention and low anxiety symptoms were the most rejected. Limitations and future directions are discussed.

124. Francesca Reynaert
Mentor: Christia Spears Brown

Predictors of Girls' Achievement Motivation

The purpose of this study is to examine how adult encouragement (from parents and teachers/coaches) is related to girls’ self-efficacy and valuing in math, language arts, and sports. The participants of the study were 345 girls between 13 and 18 years of age, recruited from schools, school-related programs, and summer camps (253 Latina girls and 92 European American girls). The participants completed several survey measures in their classroom or similar settings. First, the authors hypothesized that girls’ perceptions of others’ encouragement would predict their self-efficacy beliefs (i.e., how good they perceive themselves to be in math, language arts, and sports), and that their self-efficacy beliefs would predict their valuing of those domains (i.e., perceived importance and liking of math, language arts, and sports). In other words, the authors predicted that girls who felt encouraged in a domain would perceive themselves to be more competent in that domain, and in turn, enjoy that domain more and feel that it was important. Second, the authors predicted that encouragement would have a more profound effect on math and sports (because they are stereotype-inconsistent domains, and thus girls might not naturally perceive high self-efficacy) than on language arts (which is a stereotype-consistent domain, and thus less dependent on one-to-one encouragement). The series of multiple regression analyses suggested a moderated mediation by domain, with encouragement as the predictor variable, self-efficacy as the mediator variable, and value as the outcome variable. As predicted, encouragement was the most important in predicting self-efficacy for sports, followed by math. These results have implications for the importance of parents and teachers/coaches in encouraging girls across academic and athletic activities.
125. Jessica Richardson  
Mentor: Jonathan Golding  

_Stalking Tactics: Perceptions in the Courtroom_

Rates of stalking have steadily risen in recent years, with 1 in 6 women and 1 in 19 men having been stalked at some point (National Center for Victims of Crime, 2012). With one in four female victims being stalked by an acquaintance and 61% being stalked by a current or former romantic partner, examining how juries might perceive and decide on criminal charges of stalking is a critical step in helping those victims. The purpose of the present experiment was to examine how different “tactics” (e.g., breaking a car window) of stalking might influence jurors’ judgments. Such tactics have to do with acts of control over the victim or acts intended to instill fear. We had two specific hypotheses. First, it was predicted that more severe tactics (e.g. breaking into the victim’s apartment) used by a defendant should lead to more pro-victim judgments (i.e. guilty verdicts) than less severe tactics (e.g. no physical damage to victim’s property). Second, female participants should render more pro-victim judgments (i.e. guilty verdicts) than male participants. To investigate these hypotheses, we used a 3 (Stalking Tactics: no physical damage to victim’s property, breaking the victim’s car windshield, breaking into victim’s apartment and going through her underwear drawer) x 2 (Participant Gender) between-participants design. Community member participants (N = 209) read a trial summary of a stalking case and then answered questions about the trial. Hypothesis 1 was supported. Guilty verdicts were higher when the tactics were more severe (M = .81) compared to tactics that were less severe (M = .71). Hypothesis 2 was also supported; guilty verdicts were more common for females (M = .88) than males (M = .64).

126. Taylor Rippe  
Mentor: Jonathan Golding  

_The Impact of Parent Gender and Type of Child Physical Abuse in Criminal Court Cases_

A general definition of child abuse is difficult to find, and even more so a definition of physical abuse (Bostrom, 2003). Previous studies have examined the psychological effects of children who experienced physical abuse (Prino & Peyrot, 1994), but little is known about how child physical abuse is perceived in court. In 2012, an estimated 6.3 million children were involved in child abuse referrals to Child Protective Services across the United States (U.S. Department of Health & Human Services, 2012). The current study investigated whether different types of physical punishment are perceived as child abuse. There were three hypotheses. Hypothesis 1 stated pro-victim judgments (e.g., number of guilty verdicts) should be higher when physical contact involved an object (e.g., a belt) compared to physical contact not involving an object (i.e., slapped in face or spanked on bottom). Hypothesis 2 stated that fathers using physical means to punish their child should lead to higher pro-victim judgments compared to mothers. Hypothesis 3 stated that participants physically punished in the past would lead to fewer pro-victim outcomes than those not physically punished in the past. A total of 320 community members read a trial summary in which a parent used physical means to punish an 8-year-old boy. The results supported Hypothesis 1. Participants rendered more guilty verdicts when the child was punished using a belt (M = .56) than when the child was slapped (M = .51) or spanked on the bottom (M = .34). Also, Hypothesis 2 was supported; participants voted guilty more often when the father (M = .56) punished the child versus the mother (M = .39). Finally, Hypothesis 3 received support; participants who were physically punished in the past (M = .40) voted guilty less often than those not physically punished in the past (M = .63).
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127. Kennedy Slusher  
Mentor: Jonathan Golding

Perceptions of Stalking Victims in Civil Court

Stalking is defined as “a pattern of repeated and unwanted attention, harassment, contact, or any other course of conduct directed at a specific person that would cause a reasonable person to feel fear” (Justice.gov, 2012). It is estimated that 46% of stalking victims experience at least one unwanted contact from their stalkers per week and more than 50% of stalking victims have lost five or more days of work due to the fear of their stalker (Bureau of Justice Statistics, 2013). While 50 states have criminal laws against stalking, only 13 states currently have civil statues against stalking (victimsofcrimes.org). Because very little is known about stalking victims in civil court, the purpose of the current study is to investigate how mock jurors perceive women who bring stalking cases to civil court. The present study was a 2 (participant gender) x 2 civil suit amount: high vs. low with a control group (a criminal case). Hypothesis 1 stated that women should be more likely to have more pro-victim judgments (e.g., guilty verdicts) than men across all conditions. Hypothesis 2 stated that there should be more pro-victim judgments in the low amount condition compared to the high amount condition. Hypothesis 3 stated that pro-victim ratings should be higher in the civil suit conditions as opposed to the criminal case condition. Two hundred eleven (females = 118) community members read a trial about a woman stalked by an ex-boyfriend and then made case judgments. Hypothesis 1 received support. For example, women (M = .86) had more guilty verdict/ plaintiff decisions than men (M = .64). Hypothesis 2 was not supported. Finally, Hypothesis 3 received some support. For example, participants in the civil court conditions (M = 7.33) had lower sympathy for the alleged victim compared to the criminal court condition (M = 7.95).

128. Faith VanMeter  
Mentor: Peggy Keller

Changes in Child Maltreatment Rates Over Time: Correspondence with Substance Use Rates and Changes in Socioeconomic Status

Child maltreatment (abuse and neglect) is a social problem across the US. More information about the potential causes of child abuse is therefore needed. This study takes a new approach to the problem through secondary analysis of state-level data. Based on prior research showing the increased risk of child maltreatment in the context of parent substance use or poverty (Cancian, Slack, & Yang, 2010; Bushman & Cooper, 1990), we predicted changes in socioeconomic status (SES) and drug and alcohol use rates would influence child maltreatment. Data were for 50 states and Washington, DC (N = 51), and were public data provided by the Administration for Children and Families, the Substance Abuse and Mental Health Services Administration, and the US Census. Overall victimization rates, fatality rates, and victimization rates broken down into age groups were examined. Substance use rates for alcohol, marijuana, and other illicit drugs were examined. Poverty rate, percent high school completion, and unemployment rate were combined to provide a single measure of SES. We focused on changes from 1999/2000 to 2001/2002, and from 2009/2010 to 2011/2012. From 1999 to 2002, most measures of child victimization increased over time. Relations between substance use and child maltreatment depended on SES. For example, increases in marijuana use predicted increases in child fatality rates, but only for states that also saw decreases in SES. From 2009 to 2012, rates of victimization only for 0-3 year olds increased, and fewer relations between substance use, SES, and child maltreatment were observed.
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### 129. Hailey Walters

Other Authors: P.A. Crooks, J.P. Culver, L.P. Dwoskin, J.R. Nickell, G. Zheng  
Mentors: Michael Bardo, Arlington Wilson

*Oral JPC-077 and JPC-141, vesicular monoamine transporter-2 inhibitors, reduce methamphetamine self-administration in rats*

Recently, a series of 1,4-diphenethyl analogs that could potentially aid in reducing methamphetamine (METH) abuse and relapse have been synthesized from lobelane. These compounds are vesicular monoamine transporter-2 (VMAT-2) inhibitors. The effects of oral administration of these two compounds (JPC-077 and JPC-141) on METH self-administration in rats are reported. After undergoing surgical implantation of a jugular catheter, rats learned that METH infusions (0.05 mg/kg) could be earned with lever presses in an operant chamber. To assess the effects of JPC-077 and JPC-141 on METH self-administration, rats earned infusions of METH 15 minutes after being gavaged. Results for JPC-077 showed a reduction in METH self-administration. Likewise, JPC-141 reduced METH self-administration. While both JPC-077 and JPC-141 reduced METH self-administration, the results suggest that JPC-077 may have a higher therapeutic index compared to its counterpart, JPC-141. Further, doses of JPC-077 that caused a greater than 50% reduction in METH self-administration were approximately three-times lower than those required to significantly reduce locomotor activity (based on previous work conducted in the laboratory), which indicates that the current results are not due to nonspecific suppressant effects. Thus, JPC-077 and JPC-141 represent novel, orally bioavailable prospects for treating meth abuse.

### 130. Taylor West

Mentors: Sung Hee Kim, Richard Smith

*Effect of Awe on Future Self*

Research shows that awe, compared to other positive emotions, leads to greater patience, higher helping behavior, and greater life satisfaction (Rudd et al., 2012). Research on temporal discounting shows that the greater self-continuity between our current and future selves we feel, the more likely we delay gratifications. The present research aimed at synthesizing these two lines of research by examining whether awe would enhance self-continuity between the two selves. We hypothesized that awe, relative to another positive emotion, would increase similarity between two selves, a measure for self-continuity. 116 participants were randomly assigned to either majestic nature or baby animal images condition. Research shows that nature images elicit awe, while animal ones elicit affection (Shiota et al., 2007). Afterwards, they completed mood items and an assessment of their current and future selves. We analyzed the data using an independent t-test. In both conditions, participants reported a similar, high level of happiness, indicating the emotions generated by images were positive. However, participants in the awe condition reported stronger feelings of being inspired, calm, grateful, humble and insignificant than did those in the affection condition. As expected, participants in the awe condition reported significantly greater similarity between their current and future selves ($M = 4.54, SD = 1.32$) than those in the affection condition ($M = 4.05, SD = 1.42$), $t(109) = 1.85, p < .03, r = .17$. In sum, adding to benefits shown by previous research, the present study suggests another potential benefit of awe: enhancing positivity toward future self.
131. Rachel Wilson  
Mentor: Jonathan Golding  

**Impact of Demeanor in Jury Decision Making**

Demeanor is an individual’s “outward behavior”, including facial expressions, voice intonation, and displays of emotion (e.g., crying; Guralnik, 1987). In the courtroom it is generally accepted that jurors should be allowed to use the demeanor of a witness when judging the credibility of a witness. However, the law is less clear about whether jurors should consider the demeanor of the defendant, when he or she does not testify. Typically, jurors are not allowed to use the defendant’s demeanor when judging guilt or innocence when the defendant does not testify. However, anecdotal evidence from trials indicate that jurors do base their judgments, at least partially, on defendant demeanor. For example, in the Casey Anthony trial of 2011, the defendant (Casey) was found not guilty of killing her daughter. Casey did not testify, but during the trial she often had a very distressed demeanor (including a sad face and crying) when her deceased daughter was mentioned. The present experiment was designed to investigate whether the demeanor of a defendant who does not testify impacts juror decision making. The main hypothesis was that a crying defendant would lead to more pro-defendant judgments (e.g., more not-guilty verdicts, more sympathy toward the defendant) compared to a defendant who did not cry. To investigate this hypothesis, we used a 2 (Participant Gender) x 2 (Demeanor: crying vs. not crying) design. Undergraduate students were asked to read an online trial summary of a case that involved a wife killing her husband and then answered questions about the trial. Each trial included photographs of the defendant either crying or not crying as she sat at the defense table; the defendant did not testify. The results will be analyzed using analysis of variance to investigate the hypothesis.

132. Tyler Wood  
Mentor: Jonathan Golding  

**Political Retractions: The Negative Effect of Instructions to Disregard**

In politics, situations arise when a politician must retract a statement because he or she changed a position. Research, however, has shown that interference from competing pieces of information (i.e., original information and new information) makes it difficult to remember and/or process information. Psychologists have found that interference can be reduced by an instruction to disregard irrelevant information. The purpose of the present study was to investigate the impact of an instruction to disregard a politician’s position on an issue. Hypothesis 1 was that participants exposed to only one position would have more positive opinions of a politician than participants exposed to two opposing positions. Hypothesis 2 stated that participants asked to “disregard” the first of two opposing positions should favor the candidate less than if they were not asked to disregard the initial position. This study used a 2 (Political Issue: immigration versus taxes) x 3 (Instruction: only one position, two positions, but disregard position one, two positions but no disregard instruction) between-participants design. Participants (N = 130) read about a candidate’s position on a bill and then answered questions about the candidate. The dependent variables were the politician’s likeability, honesty, believability, consistency, and likelihood of receiving participants’ votes. The first hypothesis was supported. For example, the likelihood of voting for the politician showed the mean for the single position (M = 4.98) was significantly higher than the mean for the changed position (M = 3.87) and the retraction “forget” condition (M = 3.05). Hypothesis 2 was also supported; there was a marginally significant difference between the changed position (M = 3.87) and the retraction “forget” condition (M = 3.05) for likelihood of voting for the politician.
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Rehabilitation Sciences

133. Amanda Hayek
Other Authors: Amy L. Confides, Sarah M. Abshire, Timothy A. Butterfield.
Mentor: Ester E. Dupont-Versteegden

Massage is associated with an increase in satellite cell number in young and old rats.

Background: Massage is a manual therapy modality extensively used as clinically as an alternative or complementary treatment for a variety of ailments. Benefits of massage include pain relief, faster recovery after exercise, increase in joint flexibility, alleviating of anxiety and depression, enhancing immunity and improving circulation. Currently, the underlying mechanisms of massage are not well understood and these are the focus of our investigations. We have recently shown that massage in the form of cyclic compressive loading (CCL) has an immunomodulatory effect on uninjured muscle of young rats, but whether muscle stem cells (satellite cells) were involved was not investigated. Also, the difference in response to CCL in muscles from aged rats is unknown. Satellite cells play a role in skeletal muscle regeneration and since we showed an immunomodulatory response to CCL we suggest that there may be a change in satellite cell number with massage. Hypothesis: We hypothesized that CCL would induce an increase in satellite cell number in muscles from young rats, which would be blunted in aged.

Methods: Male Fisher Brown Norway rats (n=8) at ages 10 (young) and 30 (old) months were divided into a CCL group which received one bout of CCL and a control group which did not. CCL consisted of 30 minutes of compressive loading at 4.5N load on the gastrocnemius muscle using our innovative CCL device. Rats were euthanized 24 hours after one bout of CCL and gastrocnemius muscles were dissected, sectioned on a cryostat at 8 mm, and immunoreacted for Pax7 to identify satellite cells. Pax7 positive cells were counted using Axiovision acquisition and analysis software and number of pax7 positive cells was expressed per muscle fiber. Results: Overall, gastrocnemius muscle from aged animals had more Pax7 positive cells compared to young. However, following CCL pax7 positive cells were increased 20% in gastrocnemius muscles from young as well as old rats. Conclusion: Results indicate that massage in the form of CCL is capable of increasing satellite cell number and this response is not blunted in the aged.

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SAHA Cardiovascular Research

134. Julia Vandra
Mentor: Susan Smyth, Jason Anthony Brandon

Phenotypic Characterization of the Expression of LPP3 in the Vasculature: an Immunohistochemistry study

Coronary artery disease (CAD) is the leading cause of death in both men and women worldwide, and it greatly increases an individual’s risk of a myocardial infarction. CAD begins with the deposition of cholesterol within the intimal layer of the vasculature, ultimately driving the development of atherosclerotic plaques due to dysfunction and interactions of immune and vascular tissues. Previous investigations of human atheroma indicate an abundance of the bioactive lipid lysophosphatidic acid (LPA) compared to levels in healthy control tissue. LPA is a universal lysophospholipid that has been shown to play a central functional role in many of the processes implicated in the development of CAD including smooth muscle cell (SMC) proliferation and migration, endothelial cell permeability, platelet activation, and the uptake of lipids via macrophages. Autotaxin, a lysophospholipase, generates LPA from
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lysophosphatidylcholine and conversely, LPA can be degraded by a membrane protein, lipid phosphate phosphatase 3 (LPP3). LPP3 is encoded by the gene PPA2B, which was recently implicated in the development of CAD. To investigate LPP3’s role in the development of atherosclerotic plaques, tissue specific knockout mice have been generated. Here we investigate the location of the expression of LPP3 in the vasculature, by using fluorescent immunohistochemistry staining on murine aorta tissue sections. This fluorescent method allows us to visualize LPP3 with endothelial cells, smooth muscle cells and monocytes all on one tissue section. Upon analysis, we have found that there is smooth muscle proliferation and migration from the tunica media into the intima concentrating around the atheroma. Furthermore, we see LPP3 expression within the plaque itself along with monocytes. Identifying the location of LPP3 can help us to further understand the role of LPP3 in the vasculature and its implication in the development of CAD, plus lead to potential drug therapy targets aimed at the LPA axis.

Sociology

135. Jalyn Hewitt
Mentor: Ana Liberato

Gender, Beauty and Representations of Femininity within Disney Princess Films

This paper examines representations of femininity in Disney princess films. The paper particularly pays attention to gender representations in reference to ideas and images of good versus evil, beauty and in relation to social class, race/ethnicity and forms of embodiment. The analysis is based on four Disney princess films: The Little Mermaid (1989), Cinderella (1950), Snow White (1937), and Sleeping Beauty (1959). The paper uses observations based on the films Aladdin (1992) and The Princess and the Frog (2009) as a means to develop thematic comparisons between the older and more recent Disney films. The analysis reveals how beauty is portrayed within the princesses’ physical characteristics and how ugliness is portrayed within the villainesses’ physical traits. It shows that Disney puts focus on certain body types, and these body types are connected with the character’s morale, whether they are considered good or evil, and whether they are deserving or undeserving of love, compassion and empathy. Disney films have a great impact on how many young children are primary socialized to think about gender, beauty, and relationships through a hero/heroine and a villain/villainess; in many ways children apply these images and perceptions of beauty and relationships to reality. Key words: Disney Films, Femininity, Beauty, Heroine, Villainess, Race/Ethnicity, Social Class

136. Brichelle Love
Other Authors: Jessica Horohov, Jared Friesen
Mentor: Shaunna Scott

Diversifying an Economy: Tourism and Recreation on the Russell Fork

The Eastern Kentucky community of Elkhorn City (pop. 1000) seeks to develop and diversify its local economy to make greater use of its outdoor recreation and tourism assets, including the world class white water of the Russell Fork River, the Breaks Interstate Park, and extensive bicycle, hiking, ATV and horse trails. In partnership with the Elkhorn City Heritage Council, students and faculty from the University of Kentucky and Eastern Kentucky University have conducted participatory action research to obtain a "Trail Town certification" from the state of Kentucky and to assist the community in developing and implementing a shared vision for a more diverse and sustainable economic future for Elkhorn City. This
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poster presents an overview of the Elkhorn City and its plans for the future as well as findings from survey research conducted by University of Kentucky undergraduate students, which indicate that more work needs to be done to include local residents in the economic development planning process.

Spinal Cord and Brain Injury Research Center

137. Madison Klump
Other Authors: Christopher M. Calulot
Mentor: Diane Snow

*Role of the Chondroitin Sulfate Proteoglycan, Neurocan, in Inhibition of Sensory Neurite Regeneration*

In the adult mammalian brain and spinal cord, neuronal injury results in failed regeneration, in part, due to the up-regulation of chondroitin sulfate proteoglycans (CSPGs). The majority of CSPGs produced after injury originate from reactive astrocytes surrounding the injury site. Regeneration could be improved by attenuation of highly inhibitory CSPGs produced after injury. The goal of this project is to focus specifically on the response and growth of sensory neurons in the presence of astrocytes that express the inhibitory CSPG, neurocan. In brief, astrocytes were harvested from late embryonic chicken brain or spinal cord and cultured to 20% confluency. The astrocytes were exposed to TGF-beta to simulate injury, which induced the up-regulation of neurocan, as well as other inhibitory CSPGs. Various tests were conducted to monitor cell expression patterns and cell interactions in culture. The next steps are to 1) co-culture chicken sensory dorsal root ganglia neurons with either control (untreated) or test (shRNA treated astrocytes, i.e. neurocan deficient), and 2) evaluate axonal outgrowth of these neurons using immunostaining and image analysis techniques. Thus far, we have optimized the conditions for co-culture of both sensory neurons and astrocytes, confirmed the upregulation of CSPGs in the presence of TGF-beta, and optimized immunocytochemistry techniques for cell identification and the monitoring of axon outgrowth. Ultimately, data from "knocking down" neurocan expression will allow determination of the role of neurocan in axonal inhibition and whether attenuation of neurocan alone can improve regeneration, or if attenuation of multiple CSPGs is required. Such techniques will be useful in designing therapies for recovery of function following injury. (Support: NIH (NINDS, NS054370 to DMS, and the Run2Walk Foundation).

138. Sibi Rajendran
Other Authors: Charles Mashburn
Mentor: James Geddes

*Expression of Calpain 5 Isoforms*

Calpains are a family of calcium-dependent proteases, with fifteen members identified to date. “Classical” calpains (CAPN1-3, 8, 9, 11-14) were previously thought to be the predominant form of calpains in mammals. However, “non-classical” or “atypical” calpains (CAPN5-7, 10, 15, 16) are also abundant in mammals. Recent data from our lab indicates that Calpain 5 is the second most abundant calpain in the brain and spinal cord. Relatively little is known regarding Calpain 5, including its role in the nervous system and beyond. While a single isoform has been identified for most calpains, recent data from the human genome project suggests that there may be three or more isoforms of Calpain 5. This project investigates the presence and expression levels of these isoforms. cDNA has been synthesized from
mRNA obtained from Human Embryonic Kidney (HEK) cells. Real-time PCR Primers to identify Calpain 5 isoforms A, B, and C were designed based on sequence data from NCBI. The isoforms A and B contain additional inserts at the N-terminus or internally. As the N-terminus of CAPN5-C contains a nuclear localization signal, the insert at the N-terminus may alter the intracellular localization of this Calpain 5 isoform. Preliminary data indicates the presence of isoforms B and C, with optimization of protocols in progress. Isoform A was not detected. It is unclear if this reflects levels or the specificity of the primers. Future directions include utilizing quantitative real-time PCR to visualize amplification of cDNA and to better understand relative gene expression of the isoforms. These experiments will be repeated using other cell lines (including the SH-SY5Y human neuroblastoma line) and human tissues, as it is anticipated that isoform expression levels will vary among cell types. The Calpain 5 orthologue, Tra-3, is essential for necrotic neurodegeneration in C. elegans. The long term goal of these studies is to understand the physiological and pathological functions of Calpain 5 in the mammalian CNS.

**Theatre**

139. Abby Schroering  
Mentor: Tony Hardin

*Morphology of Shakespearean Punctuation*

This project examines the ways that editors have altered punctuation in the plays of Shakespeare since the First Folio in 1623. The conclusions will show that surveys of punctuation methodology from the 16th century to the present illustrate the absence of a consensus about the correct usage of punctuation or the relationship between its rhetorical and syntactical values. The results will show a series of derived rhetorical and syntactical values for specific instances of punctuation from passages of Shakespearean plays. These values are calculated through a system in which each occurrence of each punctuation mark throughout each observed edition of the play is assigned a numeric rhetorical value and an alphabetic syntactic value based on the time period in which the edition was published and the contextual relation to the other punctuation marks in the passage. The purpose of these results is to potentially serve to inform directing and performance decisions in production or illuminate the intention of the text for readers.

**Toxicology and Cancer Biology**

140. Hannah Latta  
Other Authors: James Sledziona, Michael Henry  
Mentor: Vivek Rangnekar

*Profiling Metabolic Differences between Par-4 Expression Status in Fibroblasts and EMT Status in Prostate Tumor Cells*

One of the significant phenotypic changes displayed by tumor cells is their preference for aerobic glycolysis. Instead of directing pyruvate molecules to the Krebs cycle, the tumor cells send these molecules to the lactic acid pathway, even in the presence of oxygen. Termed the Warburg effect, this phenomenon can be quantified by comparing the ratio of oxygen consumption rate (OCR) to extracellular acidification rate (ECAR) between cancerous cells and non-cancerous cells. This profile can be affected by tumor suppressor genes. Our experiments focused primarily upon comparisons between the metabolic profiles of Par-4 WT and Par-4 null murine embryonic fibroblasts (MEF’s). Par-4 is a tumor suppressor
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which promotes apoptosis, preventing stressed or damaged cells from proliferating and transitioning into
tumors. Consistent with the Warburg effect, reduced OCR:ECAR ratios were observed in the Par-4 null
cells when compared to the Par-4 WT cells. We followed up this finding by performing experiments to
observe the effect of natural compounds and FDA-approved drugs on glycolysis rates in Par-4 WT and
Par-4 null fibroblasts. It was expected that the substances would cause a significant increase in the
OCR:ECAR ratio in these cells. Although an occasional increase was observed, when compared with the
Par-4 null control, the increase was found to be statistically insignificant. Additionally, two prostate
cancer cell lines were also profiled: PC-3 and TEM-18. TEM-18 cells are EMT positive and potentially
more malignant than PC-3. We found that TEM-18 cells demonstrate higher glycolytic flux and a lower
OCR:ECAR ratio than PC-3. The ultimate goal of this project is to determine effective glycolytic
inhibitors for Par-4 null cells. Additionally, future experiments will be conducted to ascertain the link
between increased glycolysis rates and other related phenomena (i.e., observed obesity in Par-4 null
mice).

Veterinary Sciences

141. Zerina Mehic
Other Authors: Fernanda Cesar, Day Barker
Mentor: Amanda Adams

Effects of Yeast Supplementation on Immune Function in Foals during Weaning

It is well known that foals face post-weaning health challenges of gastrointestinal and respiratory
infections, all of which are likely a result of compromised immune function. The use of probiotics
(Saccharomyces cerevisiae) in other livestock has shown to enhance immunity during weaning, but the
effect on foals had not yet been studied. Thus, we hypothesize that yeast-supplementation will improve
weaning-induced immune suppression. Nineteen foals randomly entered one of two treatment groups in
order of birth. Group 1 (n=9) received 10 grams of orally administered live yeast 21 days prior to weaning
and for 21 days post-weaning. Group 2 (n=10) received no supplement. Both groups were weaned
abruptly on day 0. Blood samples were collected into TempusTM blood RNA tubes on day -21 (prior to
treatment and weaning), day 0 (weaning), days 3, 6, 13, and 21 post weaning. RNA was extracted from all
samples using the TempusTM blood RNA extraction kit followed by reverse transcription to obtain
cDNA, followed by Real-Time PCR with gene-specific primer-probes set for IL-4, IL-6, IL-17c, IFN-γ,
and TNF-α. Relative quantity (RQ) values were calculated as 2-DDCT and used to express results as
changes in gene expression, with mean DCT for week 0 set as the calibrator. Data were analyzed by two-
way RM ANOVAs with significance at P≤0.05. Results showed an overall significant time effect
regardless of treatment for IFN-γ (Day 0 vs 6), TNF-α (Day 0 vs 3) and IL-6 (Day 13 vs 20) gene
expression. There was no significant change in IL-17c or IL-4 over time for all foals. Results indicated a
treatment by time effect only for IFN-γ gene expression (Day 0 vs 6). In summary, weaning had a
significant impact on immune function in foals regardless of treatment. Yeast supplementation during the
weaning period had few effects on immune function in foals.
142. Marie Noel  
Mentor: Martin Nielsen

**Comparison of Two Parasite Egg Counting Techniques**

While there are many egg-counting techniques used in parasitology, McMaster tends to be widely used as it is the established standard test. A method recently developed is the mini-FLOTAC technique. Since Mini-FLOTAC has been newly introduced, there is little evidence to show if it has benefits over the McMaster. A study comparing the two methods in both precision and accuracy is needed. This study accomplishes that goal through a two-part procedure. Part One: a set of fecal counts was executed using both methods. A herd of horses used by the Veterinary Science department at the University of Kentucky was used; 24 horses of mixed breeds, 23 mares and 1 stallion ranging in age from 3-14 years. The count was performed in triplicates, and each sample was counted using first Mini-FLOTAC, and immediately after, McMaster. Part Two, a set of fecal counts was performed using spiked fecal samples. These samples had no eggs initially, and were spiked with a known number of eggs. Half the samples were left with no eggs, one portion of the samples were spiked with 5 EPG (Eggs Per Gram), one portion with 50 EPG, one portion with 500 EPG, and one portion with 1000 EPG. A blind count was completed using both methods on each sample, which were presented at random to the individual counting. To quantify the data from Part One of this experiment, the coefficient of variation was calculated for each method and compared to find which technique had greater precision. For Part Two of the study, the percent error was found for each sample, averaged, and then used to find an average percent accuracy for each method. The percent values for each method were then compared to find which technique had greater accuracy. This provides researchers with a better analysis of each method comparatively.
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