February 21st, 2019
Frankfort, Kentucky

Transforming Education for a Brighter Tomorrow
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Welcome from the *Posters-at-the-Capitol* Organizing Committee

Jonathan Gore  
eku.edu

George Antonious  
kysu.edu

Michael Henson  
moreheadstate.edu

AJ Boston  
murraystate.edu

Shauna Reilly  
nku.edu

Evie Russell  
uky.edu

Charles Leonard  
louisville.edu

Cheryl Davis  
wku.edu
To All To Whom These Presents Shall Come:

WHEREAS, Kentucky’s universities emphasize the importance of research in higher education for students and the pursuit of in-depth knowledge; and

WHEREAS, Kentucky’s Council on Postsecondary Education strongly encourages Kentucky universities to place emphasis on research initiatives, thereby increasing the opportunity for undergraduates to engage in research and scholarly work; and

WHEREAS, Undergraduates who participate in research and scholarly activity are more likely to pursue advanced degrees; and

WHEREAS, The Commonwealth of Kentucky honors those students who contributed to the 17th annual Posters-at-the-Capitol event;

NOW, THEREFORE, I, MATTHEW G. BEVIN, Governor of the Commonwealth of Kentucky, do hereby declare February 21, 2019, as

UNDERGRADUATE RESEARCH DAY

in Kentucky.

DONE AT THE CAPITOL, in the City of Frankfort the 7th day of January, in the year of Our Lord Two Thousand Nineteen and in the 227th year of the Commonwealth.

MATTHEW G. BEVIN
GOVERNOR

ALISON LUNGERGAN GRIMES
SECRETARY OF STATE
Schedule of Activities*

9:00 .................................................. Registration Opens on Mezzanine (House-side)

9:00-9:45 .......... Poster Setup, Participant Browsing, and Legislative Visit Time

9:45-10:20 ........................................ Photos (by institution) on Senate Staircase

9:45 .......... Eastern Kentucky University
9:50 ............... Kentucky State University
9:55 ............... Morehead State University
10:00 .............. Northern Kentucky University
10:05 ............... University of Kentucky
10:10 ............... University of Louisville
10:15 ............. Western Kentucky University
10:20 ............... Murray State University

10:25-10:30 .......... Group Photo (all students and mentors) on Senate Staircase

10:30-11:00 ........................................ Welcome Ceremony in Rotunda

11:00-11:30 ........................................ Participant Browsing Time

11:30-1:00 ....................... Catered Lunch Buffet on Mezzanine (Senate Side)

12:30-1:30 ....................... Desserts Reception on Mezzanine (Senate Side)

1:00-2:30 ........................................ General Poster Display Time

2:30 ......................... Conclusion (Return easels and boards to registration table)

*All times listed are in Eastern Standard Time.

The Posters-at-the-Capitol Organizing Committee & Operations Team thanks all of the coordinators and faculty mentors. We recognize and thank the following as well:

Amanda Fuller (Kentucky Academy of Science); Andrea Hales (WKU); Brenda DeHart (Morehead); Caroline Atkins (CPE); Cassie Malick (EKU); Cathleen Webb (EPSCoR); Christopher Crumrine (UK); Gin Sisemore (Murray); Jordan N. Smith (Murray); Jenna Williams (UL); Jill Hunt (Murray); John Drees (UL); Kaitlyn Clary (Murray); Laura Buchanan (Murray); Linda Stevens (Capitol); Rachel Cornwell (Murray); Sharon Reynolds (Morehead); Tammy Knochelmann (NKU); Two Peas in a Pod; Tymon Graham (KYSU).
President Michael Benson, Eastern Kentucky University

The Posters-at-the-Capitol program has proudly showcased the best of our Commonwealth’s public institutions of higher education for 18 years, and Eastern Kentucky University is proud to continue this long-standing tradition.

As a “School of Opportunity” since our founding in 1874, Eastern Kentucky University prides itself on giving undergraduates meaningful research opportunities that supplement their classroom experiences to enrich their intellectual curiosity. The projects displayed from EKU and our sister institutions at this event reflect the collaborative process that distinguishes quality higher education and embodies our passion for helping students reach their full potential.

Every April, as part of EKU’s annual Scholars Week, our entire campus celebrates the scholarly and creative talents of our best and brightest students. Their efforts, in collaboration with our outstanding faculty, inspire us all to always give the very best of ourselves to get the best from our students.

Hearty congratulations to all the students and faculty mentors who have joined forces to make the 2019 Posters-at-the-Capitol a huge success.

I wish you continued success as you strive for excellence in every endeavor.
President M. Christopher Brown, Kentucky State University

Kentucky State University is delighted to participate in the annual Posters-at-the-Capitol.

As the Capital City’s “University on the Hill” serving students across the Commonwealth, we are committed to the scholarly activities to aid an already remarkable student-learning experience.

In its 18th year, we are elated that our student researchers and world-class faculty mentors came together to produce admirable work to positively influence society. Within the academy, our students and faculty think critically, engage in an innovative- and inclusive-learning community, and offer solutions to problems facing our community, both in Frankfort and at-large. We are excited to provide these opportunities and create collaborations to support an exceptional learning community and allow our students to showcase their knowledge and talents on a larger scale. At Kentucky State University, continuous collaborations and investigative learning and first-hand experiences are underscored as cornerstones of the academy.

I extend my most sincere thanks to the faculty mentors and extraordinary students for their time, effort and knowledge to the academy. We at Kentucky State University are pleased to continue participation and commend all participants on their contribution to the Commonwealth and nation.
President Jay Morgan, Morehead State University

Students at Morehead State University look forward each year to communicating their achievements in research to Kentucky legislators and peers from across the Commonwealth at Posters-at-the-Capitol.

At MSU we take great pride in our support for undergraduate research, broadly defined to include the original scholarship and creative endeavor of all academic disciplines.

We are pleased that our students have many opportunities for success in this area, including participating in our Undergraduate Research Fellowship, Undergraduate Honors or Regional Engagement Fellowship programs; working as volunteer research assistants who receive academic credit for independent studies; and presenting at our annual Celebration of Student Scholarship. These invaluable outside-of-the-classroom activities employ the personal mentorship of faculty who are experts in their fields to enhance student learning and critical thinking. It is evident that undergraduate research promotes the academic and intellectual culture of our campus and, as it has been shown nationally, enhances student engagement, retention, and success. In such a creative environment, the potential is maximized for students to learn lessons which will translate into the skillsets sought by prospective employers resulting in social, industrial, and economic development for our state and nation.

We proudly recognize our students and their mentors for their significant achievements and thank them for their contributions to this year’s Posters-at-the-Capitol. We are confident in their continued success.
Interim President Robert (Bob) Jackson, Murray State University

Welcome to the eighteenth annual Posters-at-the-Capitol. Murray State University’s leadership in this worthwhile event is both a testament to our students, who are seeking out scholarly activities in growing numbers, and to our University as we all work to provide a greater number of high quality, research-based teaching and learning opportunities for Murray State students.

Thank you for your support of this program and for your ongoing service to these undergraduate students as they continue to positively impact our state and nation.

Murray State University places a high premium on programs that promote collaborative interactions between our faculty and students. Through our Office of Research and Creative Activity and our system of Residential Colleges, Murray State University continuously supports faculty-student interactions. By providing our students with these kinds of learning opportunities, Murray State is meeting the objectives of the Kentucky General Assembly by ensuring that our graduates are well prepared for the workforce and careers following college. We make it our priority at Murray State to make every effort to ensure that every student is provided with an experiential learning opportunity.

I join the Posters-at-the-Capitol Organizing Committee in inviting all citizens of our Commonwealth to visit and review the work of Kentucky’s most gifted students. Also, Murray State University is honored to play a key role in organizing this event each year. Congratulations to all students and faculty whose hard work has made Posters-at-the-Capitol such a great success.
At Northern Kentucky University, we provide a special educational experience for our students. For many of them, this experience includes a significant research project. It transforms students, teaching them patience, discipline, and analytical skills. As students take ownership of their projects, they develop more confidence as they present their findings.

They hone their writing and analytical skills as they conclude their results. Undergraduate research, scholarship and creative activity prepares students for the next phase of their life, regardless of their future career.

As part of our support of applied learning, NKU is proud to participate in the 18th annual Posters-at-the-Capitol. We know that this event is the culmination of months of hard work by students and their faculty mentors. We commend all of the student presenters for their hard work.

NKU’s emphasis on applied learning empowers students to practice their classroom knowledge and skills on projects that make a difference throughout the region. This hands-on experience deepens their understanding of disciplinary content and allows them to form meaningful relationships with their advisors.

Undergraduate research, scholarship and creative activity also furthers NKU’s emphasis on transdisciplinary learning. Across campus, NKU faculty members collaborate in class and on projects that show students how various disciplines intersect. Through applied learning, students work with faculty and students outside their major. The collaborative process drives innovation and deeper student learning.

We look forward to hearing more from our talented student participants in the future and seeing how the subject of many of these posters and presentations change the way we live and think.
President Eli Capilouto, University of Kentucky

The University of Kentucky, as the state’s flagship and land grant research institution, is truly the University for Kentucky. As such, a fundamental component of our commitment to the state and the people we serve lies in research — the creation of knowledge.

The world-class researchers at UK conduct this important work across an array of disciplines in collaboration with communities. This place has been — and continues to be — home to pioneers and providers, bold dreamers and strategic thinkers, and passionate undergraduate researchers who make our vision and work possible.

Undergraduate research — the interplay between research in the lab and academic preparation in the classroom — provides a rich educational experience for our students. It prepares them to change our Commonwealth, and the world, for the better.

Now in its 18th year, Posters-at-the-Capitol is an opportunity to recognize undergraduate research as an essential part of academia — one that benefits students, faculty, and the Commonwealth. Now, more than ever, it is crucial to understand and invest in the research and discovery that informs the education we provide, uplifts the communities we serve, and fuels a global economy.

Through undergraduate research, students experience the intellectual inquiry that is the foundation of scholarship at the University of Kentucky. They have the precious opportunity to work alongside experts in their fields of study — receiving mentorship and guidance as they enhance what they learn in the classroom with practical applications in the field. For faculty, this represents one of the greatest rewards in higher education — watching an eager young mind passionately pursue new knowledge. Igniting curiosity in the next generation of leaders enriches our faculty's experience and is at the core of what we do and why we do it.

Undergraduate research at the University of Kentucky embodies a vital component of what Kentucky can do.

By engaging in innovative research activities and inspiring a generation of thinkers, pioneers, and inventors, we position ourselves to address our state’s most stubborn challenges. We help create a better future for all those we touch and teach.
President Neeli Bendapudi, University of Louisville

As Kentucky’s premier metropolitan research university, the University of Louisville provides opportunities for our students to work with leading scientists in fields that have implications not only for our community, but also for the Commonwealth and the world.

Our undergraduate students seek solutions to many of the issues facing today’s society in areas ranging from health care to social work. They do so with the support of outstanding faculty, and they often do so in the Commonwealth’s largest living laboratory – the city of Louisville.

We are pleased that so many of our students are able to share their work with our elected leaders and the citizens of Kentucky through the 18th annual Posters-at-the-Capitol. By highlighting their efforts and experiencing similar work by students at Kentucky’s other public colleges and universities, they are exposed to questions, ideas and opportunities that will lead to important advances for our Commonwealth.

Congratulations to the student presenters, your faculty mentors and all who are participating in this exciting event. I look forward to seeing your work firsthand and to meeting many of you who will be the academic leaders of tomorrow.
President Timothy C. Caboni, Western Kentucky University

The cornerstone of the undergraduate experience at Western Kentucky University is the opportunity for our students to pursue meaningful, useful research that involves teamwork, analytical and problem-solving skills, leadership and an understanding of the broader community. Working alongside faculty mentors, WKU students engage with business and industry, health care professionals, community and social organizations and others in hands-on research that seeks to solve real-world problems.

Now in its 18th year, Posters-at-the-Capitol provides an outstanding venue for our students to showcase their impressive work for Kentucky lawmakers. By interacting with these students, asking questions about their research experiences and seeing first-hand the outcomes of their efforts, we are confident that legislators and policy makers will gain a greater appreciation for the value of the undergraduate research experience at all of Kentucky’s Postsecondary institutions.

At WKU, we want our students to acquire the appropriate knowledge and gain the relevant experience to prepare them for success in the workplace so that they can make a good living. By engaging them in high level research that results in an improved regional economy and an increased quality of life for citizens throughout the Commonwealth and beyond, we are ensuring that WKU graduates develop the capacity and desire to make a good life - not just for themselves but also for those around them.

Congratulations to all the students whose work is on display today. We thank you for your leadership and the talent you bring to our campus, and we wish you well in your future endeavors.
## Eastern Kentucky University

<table>
<thead>
<tr>
<th>Poster #</th>
<th>Students</th>
<th>Faculty Mentor</th>
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<tbody>
<tr>
<td>77</td>
<td>Robin Martinez, Sarah Angelucci, Shelby Taylor</td>
<td>Stephanie McSpirit</td>
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<td>Jennifer Meunier, Rebekah Marstiller</td>
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<td>Ryan Penn, Jonathan Malzone</td>
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# Kentucky State University

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<td>Deyshon Ward</td>
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<td>Cort Groathouse</td>
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<td>122</td>
<td>Cora Teets</td>
<td>Kristopher Grimes</td>
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## Morehead State University

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<td>Anna Gdovka</td>
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<td>Jorden Crowe, Emily Lush, Vanessa Jones, Sidney Young, Abigail Mohr</td>
<td>Gregory Corso</td>
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<td>96*</td>
<td>Lori Porter</td>
<td>Thomas Pannuti</td>
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<td>Annuet Soehnlen, Ann Wilkinson</td>
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<td>Miranda Johnson</td>
<td>Michele Paynter Paise</td>
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<td>109</td>
<td>Joshua Webb</td>
<td>Sherif Rashad</td>
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</table>

*From Morehead State University-Space Science Center, a Kentucky Program of Distinction.

The Kentucky Postsecondary Education Improvement Act of 1997 (HB1) designated funding in support of instructional and applied research programs of distinction at each of the comprehensive institutions in Kentucky.
<table>
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<th>Poster #</th>
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<th>Faculty Mentor</th>
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<td>Taylor Davis</td>
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*From Murray State University-Telecommunication Systems Management, a Kentucky Program of Distinction. The Kentucky Postsecondary Education Improvement Act of 1997 (HB1) designated funding in support of instructional and applied research programs of distinction at each of the comprehensive institutions in Kentucky.
## Northern Kentucky University

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# University of Kentucky

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<td>Sarah Anderson</td>
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77. Robin Martinez, Sarah Angelucci, Shelby Taylor, Stephanie McSpirit (Mentor)

The Mountain Horse Oral History Project

Our faculty-student research team at Eastern Kentucky University has been collecting oral histories on Kentucky’s gaited mountain Horses, once referred to as the “Country Saddler” since 2016. We have collected over 50 oral histories with funding and support from the Kentucky Oral History Commission. These histories and stories of the Kentucky mountain horse, both past and present, have been indexed and digitally archived and are now readily available to the public through the William H. Berge Oral History Center. I have been involved in preparing and indexing these oral histories as a publicly accessible and searchable archive and would like to share my experiences in being trained in oral history methods with those legislators and the members of the public that might stop by my poster presentation. Part of my poster will outline and show what is involved in preparing an oral history for public access using OHMS indexing methods. My poster will also share some of my own analysis and review of this oral history collection. One the themes that I have already seen developing is how important the Mountain Horses have been to people in the past and present. They are used for numerous activities and without them some of the people wouldn’t be able to do the things they have done or currently do.

78. Sarah Cornell, Morgan Lakes, Andrea King, Stephanie Adams (Mentor)

Promoting Recovery: The Benefits of Decriminalizing Sex Work

Research shows that there has been an increase in sex work that is in direct correlation with the heightened legislation criminalizing this area of work. Common areas of sex work are prostitution, adult filmmography, and exotic dancing. Situations of trafficking, inability to leave occupation, or consented work may all apply to this study. Current laws and regulations encourage negative mentalities and oppressive attitudes that lead to stigmatization of this population in society. The goal is to ensure an environment that is healthy and secure for these adult entertainers, while decreasing stigma. Our efforts are not to legalize, but decriminalize sex work in methods that can allow the shift from punitive consequences to recovery and rehabilitation in regards to the appropriate case-by-case basis. Our poster is intended to provide information that will lead to legislative actions that are sensitive to the specific needs of the population of the adult entertainment industry.

79. Jennifer N. Meunier, Rebekah Marstiller, Dr. Michael J. Bradley (Mentor)

The Economic Impact of Festivals in Winchester, Kentucky

To date, there are a limited number of studies regarding the economic impact and community engagement of festivals in rural communities of the United States. Acknowledging strained finances of many rural Kentucky communities, researchers sought to determine if festivals provide economically viable benefits to rural Kentucky communities. This study estimates the economic impact and reports the visitor satisfaction of two festivals in Winchester, Kentucky, a rural community in central Kentucky’s Clark County. The survey instrument targeted festival related visitor expenditures in Winchester and Clark County, as well as visitor satisfaction with the festival, vendors, and the host city. The economic impact results were positive, indicating that it is worth the investment of communities to hold these festivals. In addition to the economic impact, the visitor satisfaction results were positive. The total economic impact of festivals is greatly influenced by the number of days the festival is held and whether or not visitors are required to seek overnight lodging in the host community. Results of this study show that while the investment of time and personnel to host a festival is significant, that festivals contribute positively
to the economy of the community. Previous research finds that through economic development, the additional income from festivals allows communities flexibility to pursue other endeavors. As such, the economic impact of festivals directly influences community well-being and engagement. Through hosting festivals, rural communities are positioned to bolster their financial health, and in turn, are positioned to invest directly into the well-being of their community through revitalization efforts and inspiring future investment in community services.

80. Katheryn A. Heinrich, Mentors: Dr. Michelle Gremp & Dr. Julie Rutland
The Importance of Graduate Degrees in Education
There is much speculation today as to the benefits of educators obtaining graduate degrees and whether or not higher education is necessary for being an effective educator. However, the completion of a graduate degree has a distinctive impact on both the quality of students' learning and the educator's quality of life. Graduate degrees provide teachers with significantly improved teaching practices that better equip them to do their jobs. Teachers with graduate degrees have greater qualifications for obtaining leadership positions, an enhanced sense of self-efficacy, professional connections that could potentially be a vital educational resource, an increased salary leading to overall better quality of life, and higher research, writing, and problem-solving skills. The latter three skills are beneficial to both teachers and students as these are the skills that are most fundamental for effective teaching and learning. Graduate degrees have been observed to positively affect the development and retention of high-quality teachers in our school systems and ensure that the people who are assigned to instruct children for the majority of their week are knowledgeable in their content area and equipped to handle any problems that may arise. We plan to analyze data from a qualitative online survey among graduate students participating in a Master of Arts in Interdisciplinary Early Childhood Education (IECE) program from January 2015 through December 2018. The students involved completed a self-assessment based on Kentucky IECE teacher competencies at the beginning of their time in the program, at graduation, and one year post-graduation. The survey is a measure of self-perception of competency in implementing high-quality instruction. This information portrays how confident teachers were in their instructional competency before, during, and after receiving a graduate degree, and demonstrates the importance of professional degrees in obtaining confidence and high-quality instruction from our incoming educators.

81. Stuart Jones, Dr. Sandy Hunter (Mentor)
Fast Drivers, Slow Progress: Implementation of Evidence-Based Protocols in Emergency Medical Services
This presentation focuses on a review of current practices and literature on topics such as prehospital spinal immobilization, an overview of cardiac emergency management, and protocol conception for EMS agencies. This research points to ways in which EMS, as a whole, can improve its ability to implement the current literature into practice. The survival of the profession may rely on its ability to transcend the deeply “traditional” practices employed in many systems in order to reach the scientific standards of care outlined by current literature. There will also be discussion on an in-progress review of protocols from multiple EMS agencies from the state of Kentucky. This project focuses on EMS agencies in Kentucky from all geographic regions of the state as well as a wide range of call volumes.
82. Ryan Penn, Walter S. Borowski (Mentor)

*Nutrient Export at Meadowbrook Farm, Madison County, Kentucky: Local Steps Toward Improving Global Water Quality*

Our first goal is to measure the concentration and export of nutrients (dissolved ammonium, NH4; nitrate, NO3; phosphate, PO4; total phosphorus, SP) leaving the farm. We sampled water within a stream draining farmland that flows over an instrumented weir during eight storm events in the field seasons of 2017 and 2018. These data, used in concert with flow measurements, enable us to calculate nutrient export. We found that kilograms of these nutrients can be exported in a single storm event, leading to enormous export values over the longer term. Our second goal is to limit excess nutrients leaving the Farm by constructing riparian zones and catchments along the stream. Then, we want to measure nutrient export after remediation to compare nutrient export before and after our efforts. If nutrient amounts decrease, similar methods can be employed elsewhere to decrease nutrient contamination of Kentucky and U.S. waterways, perhaps also leading to global improvements in eutrophication.

83. Adam Gehlhausen, Emily McCord, Dr. Lindsay Calderon (Mentor)

*Pt-Mal-LHRH, a Newly Synthesized Compound Attenuating Breast Cancer Tumor Growth and Metastasis by Targeting Overexpression of the LHRH Receptor.*

To address, whether Pt-Mal-LHRH is more selective and therapeutic than carboplatin and cisplatin we tested our compound in-vivo. First, we verified the therapeutic index of Pt-Mal-LHRH and found it to be safer than cisplatin. There was no toxicity induced from 2.5-40 mg/kg injection doses, however, lethality for cisplatin is around 11 mg/kg. Further, we found that Pt-Mal-LHRH does exhibit immune suppression, which is similar to other chemotherapies, however, it does not reduce it below basal. Lastly, we compared Pt-Mal-LHRH to carboplatin and found that it is significantly more effective at reducing tumor size at doses 2.5-20mg/kg. Taken together we have found that Pt-Mal-LHRH is therapeutically more effective at reducing tumor size compared to carboplatin, while, showing a safer toxicity profile than cisplatin.

84. Steven Pesina, Mentors: Dr. Maria Iribarne & Dr. David Hyde

*Analysis of the immune response’s effect on the regeneration of photoreceptors in gosh mutant zebrafish (Danio rerio)*

Recently, a cone-blind photoreceptor zebrafish mutant named gold rush (gosh) was reported (Iribarne, et al 2017), and it has been suggested that Müller cell proliferation can be modified by the activity of microglia in the retina (Wang & Wong, 2014). To understand this mechanism of photoreceptor recovery, we examined the role of the microglia in gosh retinal regeneration. Dexamethasone was used to inhibit microglia activation for either 4 or 7 days-post-treatment (dpt). Macrophage/microglia were visualized with a transgenic line Tg[mpeg:GFP]. Immunohistochemistry was performed to visualize nuclei (DAPI) and the proliferation marker PCNA, or double cone by zpr1. In the methanol treatment group, gosh mutants have a greater number of activated microglia, with more being present and translocated to the outer nuclear layer (ONL) than WT. PCNA positive cells are present in Müller cell, and neuronal progenitors in the inner nuclear layer (INL), and rod precursors in the ONL. gosh mutants showed higher numbers of PCNA positive cells compared to WT. When treated with dexamethasone, WT and gosh showed similar microglia features as not active. WT and gosh showed a decrease in PCNA positive cells in their INL but no change to those in the ONL. The WT retina showed a normal appearance with a long, slim cone body cell. Gosh showed a discontinuous cone layer with abnormal cones; between the two treatment groups of the same type of fish, no difference was seen. The number of rod cells looked similar between all treatment groups. Our results suggest that dexamethasone can inhibit microglia in WT and gosh at 3 wpf and 7 wpf up to 7 days treatment. This inhibition of microglia inhibits Müller cell proliferation but doesn’t affect neuronal and/or rod progenitors’ proliferation. Dexamethasone treatment resulted in photoreceptors development and recovery is based upon neuronal and/or rod progenitors’ proliferation.
85. Alex Dixon, Dr. Dae Wook Kim (Mentor)
*MACHINE LEARNING-BASED PREDICTIVE ANALYTICS OF UNIVERSITY ENROLLMENT*

Machine Learning plays an indispensable role in a number of free or commercial predictive analytics tools used for multiple purposes, including web analysis, recommendation systems, biomarker discovery, and cyber security. Specifically, building a predictive model is highly desired for the purpose of university admissions. However, these tools raise significant robust concerns since the tools are not easy to customize the specific domain data and the university enrollment data is not an exception either. To tackle this research problem for the university enrollment data, we proposed a novel predictive system that effectively analyzes the enrolled applicants’ behaviors by integrating a collection of their behavioral patterns together, predicting if a prospective applicant is likely to enroll in a university or not. The extensive evaluation based on enrollment data collected from a database from Fall 2013 to Fall 2017 of a university within the U.S. has demonstrated that these patterns can accomplish high prediction rates of approximately 90% and low false positive rates of 5% using Random Forest as a statistic classifier and are also not sensitive to the selection of machine learning algorithms. In addition, we explored the relative importance of the proposed patterns, which has achieved the best prediction accuracy. Despite its high prediction accuracy, more enrolled applicants’ patterns could be discovered and incorporated into our system. Nevertheless, our system demonstrates the lower bound of the effectiveness of using enrollment patterns to predict prospective student matriculation for University admissions.

86. Andrew Coyle, Mentors: Dr. Steve Parchment & Dr. Minh Nguyen
*NOT A SIMPLE MATTER: REJECTING MATERIALISM AS A SOLUTION TO THE MIND-BODY PROBLEM*

Department of History, Philosophy, and Religious Studies Many scholars accept materialism as an adequate solution to the mind-body problem. However, acceptance of materialism creates more problems than it purports to solve. This poster provides a background to the mind-body problem. This poster explores materialism as a potential solution to the mind-body problem. After reviewing materialism, it is rejected as an adequate solution to the mind-body problem. The poster concludes by positing property dualism as an alternate solution.

87. Megan Brooke Alexander, Dr. Jonathan Gore (Mentor)
*HOW NEED FOR POWER EXPLAINS WHY NARCISSISTS ARE ANTISOCIAL*

Past research has found that narcissists engage in antisocial behavior. Some past research has even looked at reasons why narcissists engage in antisocial behavior. However, no research has looked at Need for Power as a factor to why narcissists engage in antisocial behavior. The purpose of the current research is to examine Need for Power as a potential mediating factor between narcissism and antisocial behavior. The current research was conducted in two studies. Participants (n= 408) of study one consisted of undergraduate students who completed an online survey focusing on Narcissism, Need for Power, and Aggression. The results of study one found that Need for Power fully mediated the association between narcissism and aggression. Participants (n= 323) of study two consisted of adults who completed an online survey through Mechanical Turk. Study two focused on 7 types of Narcissism, 4 types of Need for Power, Need for Influence, and Lifetime Criminal Behavior. The results of study two found that most forms of narcissism positively associated with criminal behavior, but only the desire to resist subordination mediated the link between narcissism and criminal behavior.
88. Austin C. Owens, Dr. Stephen C. Richter (Mentor)
Social Organization in a Population of Copperheads (Agkistrodon contortrix)
In social species, intraspecific interactions lead to hierarchal organization. More competitive individuals are given dominant positions while the weaker or less fit members of the group are relegated to more submissive roles. This pattern is common in animals whose lives revolve around sociality, and can be readily observed in lion or wolf communities, for example. Population dynamics and behavior show trends in individual function within a group. The obligate social structures present in these animals, as well as many primate, cetacean, and avian species are well-studied, and are viewed as behavioral bridges between natural and human communities. Whether species that exhibit a more facultative sociality organize themselves in this way remains unknown. Many pit-vipers have shown a tendency for short-term sociality during the breeding season, when foraging in prey-dense areas, and when brumating in hibernacula. This limited sociality makes them ideal subjects for studying the stratification of roles in populations that alternate between gregarious and solitary lives. We investigated the demographic structure of a population of copperheads (Agkistrodon contortrix) in the Red River Gorge region of Kentucky. By using mark-recapture and physiological information, we created size classes for each sex and compared the rates of recapture in conjunction with environmental data and body condition. If copperheads have stratified roles when in high densities, then mark recapture should show stronger competitors visiting the foraging site more frequently and consistently.

89. Jessica Brook Dobbs, Dr. Ginni Fair (Mentor)
Poverty's Impact on the Academic Achievement of Students within Eastern Kentucky School Districts
Poverty is a persistent cycle that plagues the United States, but specifically Eastern Kentucky. This is especially evident within the school districts there. The overall purpose of this poster is to help highlight the magnitude of poverty within Eastern Kentucky and its impact on the academic success of the students. When analyzing data from the Kentucky School Report Card from the 2016-2017 school year, twenty-four counties were identified as having at least 75% of the student population within the district qualifying for free & reduced lunch. After the identification of those twenty-four counties, the elementary K-Prep Proficiency and Distinguished scores for both Math and Reading for the district were collected. Then each school district was contacted by phone and asked a set of questions: 1. What are some of the needs of students from low-SES families look like within your school district? 2. Are there any academic supports in place to intervene for challenges that may arise in the classroom from their low-SES? 3. If you had more financial aid or resources, what would you like to have implemented in your school district for these students? 4. Have you tried something, and it was effective or not effective for this group of students overall? 5. Do you believe that there is a direct connection between socioeconomic status and academic achievement in your school district? Why or why not? After receiving answers from an individual within the district, the answers to the questions were analyzed for trends. The data collected was utilized to formulate the most effective interventions and approaches that schools should use to allow their students to be successful academically. This poster also highlights what school districts said they would do if they had the resources and financial aid necessary.

90. Jessica Baker, Dr. Jonathan Gore (Mentor)
Exploring Appalachia’s Self-Esteem and the Coping Methods Used When Presented with Discrimination
The purpose of this study was to validate the rejection-identification model among the Appalachians, and how perceived discrimination predicts their personal and collective self-esteem. In the present study, the proposed model tests the hypotheses that the rejection from a dominant group will result in a direct adverse effect on well-being, as well as positive effects that are mediated by ingroup identification and self-stereotyping. Participants were 197 undergraduate students, who were provided with several questionnaires in an online survey that was accessed through the SONA system. This is a prevalent phenomenon in the Appalachian culture, but no one has tested this combined model on the population previously. The current study displayed that while some pathways of the model were supported, such as the effects that discrimination and identify with one’s Appalachian culture. It seems that there may be other mechanisms at work when it comes to the Appalachian population and coping with discrimination.
Breanna Bowling, Dr. Minh Nguyen (Mentor)
"That doctor done a' did me in": A Linguistic Approach to Medicine in Appalachia
Appalachia stretches across 13 states in America and is home to approximately 25 million people. Despite representing nearly 8% of the entire population of the United States, the natives of Appalachia continue to face a devastating socioeconomic and healthcare crisis that has persisted throughout several generations. Likewise, Appalachians face another threat: cultural stereotyping and assimilation which contributes to poor public health and the slow dismantling of a deep and rich culture that is Appalachia. In order to understand the healthcare crisis in Appalachia, it is vital that the unique culture of this region is appreciated and preserved. To do so, the dialect of Appalachia must first be seen as a language in its own respect. Appalachian dialect follows its own direct rules, patterns, and grammar. Research also suggests that the language is composed of several different branches of dialect based on class, race, and gender, exemplifying complexity. Much of the healthcare crisis is due to the complexity of the language and culture of Appalachia. The gap between language, culture, and healthcare is a massive hindrance for the natives of Appalachia who maintain distinct communication and cultural differences from non-local physicians who migrate into the area. Most physicians are not equipped with the cultural training needed to communicate effectively with their Appalachian patients. Due to this, a grassroots effort would be most effective at addressing the health disparities of Appalachia. Such an effort would include a better appreciation and respect for the Appalachian language and culture, and for its inhabitants.

William Fenske, Dr. Bill Staddon (Mentor)
Metal and antibiotic cross-resistance among bacteria isolated from the Kentucky River
Little is known about metal and antibiotic cross resistance among bacteria in aquatic settings. Water samples were collected from six locations along the Kentucky River. Plate counting was used to quantify metal-resistant bacteria. Control and metal resistant isolates were transferred to plates containing antibiotics. Populations of cobalt, copper, silver, lead and chromium resistant bacteria were similar to the control. Cadmium and mercury resistant populations were significantly lower. Many isolates were resistant to ampicillin, cefamandole, sulfamethoxazole, penicillin, and vancomycin. Most inhibition of growth was seen with ciprofloxacin, doxycycline and rifampin. The results suggest there are much higher levels of metal resistance amongst the river bacterial isolates than expected.

Cheyenne Boone, Mentors: John May & Megan Combs
An in vitro Study on Skin Protection Across the UV Spectra
Skin cancer is the number one cancer in the United States. Lack of awareness of how harmful UV radiation is could be the cause of the over two million cases reported since 2012. It appears that there is not a lot information on the active ingredients used in sunscreens. Some of the compounds have been linked to birth defects, hormone disruptions, and the bleaching of coral reefs. Samples of commonly used sunscreens (both sprays and creams), cosmetic foundation, essential oils, lotions, and three pure organic actives were tested at specific concentrations and ran through a UV spectrometer. The results have shown that there is little to no protection being provided in the UVA spectra (320-400 nm) which makes up over 95% of the radiation that we are exposed to daily. Although UVB rays (320-290 nm) are considered to be the main source of sunburn and cancer, it cannot be ignored that UVA rays can produce the same outcome, especially since it penetrates the skin deeper than UVB rays. By producing active ingredients that effectively block UVA light and the lower end of the visible spectra (such as blue light), broad spectrum protection can be achieved.

Corey Mattic, Dr. Kazi Javed (Mentor)
The Effectiveness of Thin Layer SPin Coating - Sodium Acetate Solution
Spin coating is a technique that implies the coating of a substrate by spinning them. It is a quick and simple procedure that can uniform films, on the nanometer levels of thickness. Working with the University of Kentucky's Department of Chemical and Material Engineering, the effectiveness and most effective way of spin coating a Sodium Acetate film was able to be produced.
112. Imani Harris, Dr. Kazi Javed (Mentor)

Testing Nutrients Levels of Water from Kentucky River for Harmful Algae Bloom Forecasting

The research project was conducted during summer 2018 at Frankfort, KY. The main objective was to keep track of water qualities of Benson creek, Old Lawrenceburg River, and the Kentucky River to analyze the possibility of harmful algae blooms in these freshwater systems. Water samples were mainly collected during June and July. The water samples were tested for nutrient (nitrates, nitrites, ammonia, and phosphate) levels and for organic: inorganic content. The possible presence of harmful algal species was also assessed with microscopes and Polymerase Chain Reaction method. Based on our observations, there is little risk of harmful algae bloom in Kentucky River system in 2018.

113. Leisha Hopwood, Dr. Li Lu (Mentor)

Nutrient Export of the Kentucky River to Detect Possible Eutrophication

This eutrophication research project is aimed to compare nutrient concentration and water quality variables in the Kentucky River and its tributary Benson creek. Nutrient concentration and water quality variables are factors that cause algae to bloom. Getting a better understanding of nutrients and algae in freshwater will help to identify harmful algal blooms, predict where they may occur, and make efforts to avoid blooms. Water samples were collected from the Kentucky River and its tributary Benson creek in March and April, 2018. To explore eutrophication, the concentrations of nutrients such as nitrate, nitrite, ammonia, and phosphate were tested. Other parameters such as water pH, temperature, level of dissolved oxygen, and turbidity were also recorded. The data and the possibility of eutrophication in Kentucky River will be discussed. Future research may be needed to closely observe the water quality of Kentucky River.

114. Terion Taylor, Dr. Leigh Whittinghill (Mentor)

Broccoli Price is Right

Urban agriculture is the practice of cultivating, processing and distributing food in or around a town or city. For example, growing plants, crops and raising of animals around cities. The simple act of planting a garden can shape issues such as economics, health, and politics at the same time because food is an essential focal point of human activity. People in large cities or small towns use urban agriculture for multiple reasons such as: increasing food security, produces healthy food, fresh food, limiting food traveling distances, generates employment, recycles urban wastes, creates greenbelts, strengthens cities’ resilience to climate change as well as helping urban residents save money on food purchases. Urban agriculture can help families save money by saving gas going to the grocery store weekly and buying vegetables that could be grown at home. This savings money depends on which garden system is used. To determine if growing broccoli at home will be less expensive than buying fresh broccoli in Frankfort, KY area, budgets were conducted for growing broccoli either organically and conventionally in raised beds and in rows. Prices were collected from local and online stores. A goal is to grow broccoli at home on a low budget. Other data includes gathering prices from stores in Frankfort that sell fresh broccoli. Local stores for growing supplies and fresh broccoli included Lowes, Kroger, and Walmart among others. The at home budgets were compared to the store-bought prices. The hypotheses are that it will be cheaper to grow broccoli conventionally in a backyard than it is to buy fresh broccoli in a store and that growing conventional broccoli is cheaper than growing organic broccoli.

115. Deyshon Ward, Dr. Kazi Javed (Mentor)

Catalytic Deoxygenation of Model and Realistic Feeds to Fuel-like Hydrocarbons over Supported Nickel-Copper Catalysts

The goal was to make a renewable fuel by using catalysts to remove oxygen molecules from fats. This is a current issue that society faces today because nonrenewable fossil fuels hurt the environment more than they help it. There are two components that make up a heterogeneous catalyst, a support and a reduced metal active phase. The active metal phases Nickel, Palladium, Platinum have been studied in the
past on an alumina and carbon supports. We were investigating other supports using Nickel as the active phase component to determine the effect the support has on the catalyst removing oxygen of Tristearin (model lipid compound) in a semi-batch reactor at 260 degrees Celsius at a 3 hours reaction time. We believe that the 20% Nickel supported by Zirconia gave us the best results under these conditions. We want these catalyst supports to produce long hydrocarbons that can be converted into renewable fuels such as diesel. The 20% Ni/ZrO$_2$ had the highest diesel like hydrocarbon selectivity at 96%. The conversion rate of the catalyst support was 45 % which is rather successful compared to the other tested supports.

116. James Poullard, Dr. Narayanan Rajendran (Mentor)
**Correlation between meat spoilage bacteria and storage meat in connection with various thawing methods.**
The fresh meat and ready-to-cook meat products are safe for human consumption as long as maintaining its shelf life. However bacterial contamination in meat, caused by various bacteria, has tremendous impact on human health. One of the common practices, to reduce the bacterial contamination, is freeze-storage followed with meat thawing and processing techniques. Bacterial manifestation of meat could leads to change of color, faulty taste, odor, and meat texture. Storage of meat could make a difference in spoilage as well as the presence of bacterial populations in the meat. The impact of various thawing treatments used against meat can influence the quality of the meat. When optimal temperature favors the growth of bacteria its thawing process with high and low temperature makes it worse. Hot-pepper marinating strategies, vinegar, and other chemical treatments of meat have profound impact on meat and may extend the shelf life of the meat. In the past, several techniques were used to study the bacterial contaminants and meat spoilage. Understanding the total viable counts of bacteria by enumeration is a direct method to analyze the meat. They were focused on specific pathogenic contaminants like Salmonella and Campylobacter. In this study, we tried to investigate the combinatorial influence of various thawing methods and the cumulative bacterial loads as expressed in log CFU/g through selective and differential media cultural methods. With and without introducing a bias on selectivity of the media and characterization of the bacterial species present, we estimate the spoilage conditions, spoilage appearance, pressure selection on the microbial diversity, and behavior in the meat matrix and microbiota. We analyze bacterial variants and meat matters to improve the quality and safety of meat and thawing procedures including storage and transformation process.

117. John Bradley, Dr. George Antonious (Mentor)
**Effect of soil amendments on phenolic composition of tomato fruits**
Tomatoes are an important worldwide food source grown for consumption in nearly every country of the world. Phenolic compounds in tomato fruits are significant elements important for human health owing to their antioxidant properties. Studies have consistently linked tomato based phenolic compounds with lower rates of cancer and lower serum cholesterol. Studies have also examined beneficial effects of various phenolic compounds on human health and their impact on the deleterious effects of herbivore insects and some fungi. Increasing the total phenolic content of tomatoes through manipulations of the agricultural environment, particularly using animal manure as fertilizer is the focus of this investigation. At harvest, representative samples of tomato (Solanum lycopersicum var. Marglobe) fruits of plants grown in 42 experimental plots were collected for determination of their total phenols composition. The treatments were chicken manure, horse manure, sewage sludge, yard waste compost, worm castings, inorganic fertilizer and organic commercial fertilizers (replicated three times). The experimental plots were replicated with 10% biochar mixed with each of the seven treatments to make 42 plots (7 treatments × 3 replicates × 2 biochar and no-biochar plots). Using the Folin-Ciocalteau method for total phenols determination, our results showed that the concentration of total phenols in tomato fruits of plants grown in soil amended with sewage sludge mixed with biochar was significantly greater (4.4 µg/g fresh fruits) compared to soil amended with sewage sludge only (3.2 µg/g fresh fruits). These results indicate the role of biochar in increasing total phenols in tomato. Learning how soils amendments can affect total phenols in tomatoes will be a key for future research on exploring low cost, organic agricultural methods for developing healthy food and insect resistant agricultural products.
118. Cort Groathouse, Mentors: Jeremiah Lowe, Sheri Crabtree, & Dr. Kirk Pomper

Processed Pulp Recovery Rate in Two North American Pawpaw Cultivars Using Two Methods

The North American pawpaw (Asimina triloba) is the largest tree fruit native to the United States and is in the early stages of commercial production. The pawpaw fruit has a creamy, yellow-orange flesh and a flavor resembling a blend of mango, banana, and pineapple. The fruit has a short shelf-life. Difficulty with postharvest handling and storage presents a challenge for growers. Production of frozen pawpaw fruit pulp as a value-added product would be one solution to this problem of fruit perishability. However, pawpaw fruit pulp extraction is labor intensive due to rows of large, inedible seeds contained in the fruit that impede processing. Valuable pulp may be lost through ineffective extraction methods. The objective of this study was to determine 1) the processed pulp recovery rate of two pawpaw cultivars (Sunflower and Susquehanna), and 2) if recovery rate differed using two different methods. Three sets of five ripe fruit from each of the cultivars were extracted using either a modified food strainer and sauce maker or an automatic juicer. The sauce maker was modified by shortening the length of the fruit spiral and using a screen with 0.3175 cm (1/8”) holes. The juicer was unmodified. The fruit were cut in half. Pulp and seed were scooped out with a spoon and placed into each machine for pulp extraction. The pulp/seed mixture was run through the strainer 3 times to obtain as much processed pulp as possible. No significant difference was found for pulp yield between the two cultivars. A significant difference was found between methods with the juicer having a significantly higher yield (53.4%) than the sauce maker (41.7%).

119. Madankrishna Acharya, Dr. Kazi Javed (Mentor)

Automated Control System for Photo-bioreactor

At the University of Kentucky Center for Applied Energy Research, recent efforts have been made to optimize and reduce the cost of a unit designed to control an automated photobioreactor system in which microalgae is grown to reduce CO2 emissions. In contrast with a previously used system based on a compactRIO controller and NI LabVIEW software, a new optimized version utilizes an inexpensive Beagle Bone panel as a microcontroller that can be programmed through the use of Python software. Notably, the cost of the new control system was 1/10th of the price of the previous unit.

120. Aidan Thompson, Mentors: Jeremiah Lowe, Sheri Crabtree, & Dr. Kirk Pomper

Evaluation of Kentucky State University’s Pawpaw (Asimina triloba) Advanced Selections

The North American Pawpaw (Asimina triloba) is a tree fruit native to the eastern U.S. that is being produced in commercial orchards across the U.S. and internationally. Pawpaw has a small but growing market. Approximately 50 pawpaw cultivars are currently available, with many of these varieties producing low yields with fruit sizes of 120 grams or less. Pawpaw varieties with fruit weighing over 120 grams are considered to have a large enough fruit size for commercial sale and processing. New, high-yielding cultivars with excellent fruit quality would assist with the further development of the pawpaw industry. Kentucky State University serves as the National Clonal Germplasm Repository for Pawpaw. Two goals of the Repository research efforts are germplasm acquisition and evaluation. The repository contains over 2000 accessions from 16 different states; additionally, both open-pollinated seedlings from superior genotypes and crosses of superior selections have been incorporated into the repository collection. Fruit from three KSU advanced selections (G9-109, G9-111, and Hy3-120) were compared to fruit from the commercially available cultivar ‘Mango’ on the basis of fruit weight, percent seed, soluble solids, and Phyllosticta fungal spot coverage. The selection Hy3-120 had the largest fruit size, averaging over 200 grams per fruit, the lowest percent seed (6.33%), and the highest Brix level (25.26). G9-111 had the highest incidence of Phyllosticta fungal spot, with an average coverage of 14.13%. Hy3-120 shows potential to be a promising new release and has been budded onto seedling rootstock for further evaluation.

121. Dejuante Davenport, Mentors: Eric Turley & Dr. George Antonious

Nitrate and Nitrite: Two ions that we should monitor in vegetables and fruits

Nitrate (NO₃⁻) and nitrite (NO₂⁻) are naturally vital part of the nitrogen cycle in the environment. Nitrate is formed from animal manure, plants decomposition, and fertilizers used in agriculture. Human and animal exposure to nitrate is exogenous (originating from outside an organism) which occurs mainly from intake of vegetables and other foods. Investigators reported that NO₃⁻ in food is more toxic to humans than NO₂⁻ NO⁻
interacts with amides in the stomach and forms N-nitroso compounds, which have a carcinogenic effect on human and animal cells. Current trend in agricultural practices focuses on recycling animal waste for use as organic fertilizer due to the presence of organic matter and nitrogen in animal manure. Growers and scientists are seeking strategies for reducing anti-nutritional compounds like nitrates in food, while recycling animal waste. We investigated the impact of animal manure mixed with biochar (a product of wood pyrolysis) on NO$_3$ concentration in tomato fruits. Tomato (Solanum lycopersicum var. Marglobe) seedlings were planted in raised, plastic-mulch of freshly tilled soil of 42 plots (3 replicates × 14 treatments). These soil treatments were: 1) no-mulch untreated soil; 2) sewage sludge (SS); 3) horse manure (HM); 4) chicken manure (CM); 5) yard waste compost (YW); 6) inorganic fertilizer; and 7) organic fertilizer. Of the 14 treatments, seven treatments were mixed with 10% (w/w) biochar to make a total of 42 treatments. At harvest, our results showed that tomato fruits of plants grown in SS-no biochar amended soil contained the greatest concentration of nitrate (17.2 µg/g fruits), whereas fruits of plants grown in SS-biochar amended soil contained the lowest concentrations of nitrate (5.6 µg/g fruits). These results indicate the role of biochar in reducing nitrates in tomato fruits.

122. Cora Teets, Kristopher Grimes (Mentor)
Assessment of learning styles and learning retention among the elderly population in Frankfort, Kentucky
With the advancement of medical knowledge in the United States, people are living longer; therefore, the elderly population is growing. Due to this change in age dynamics, designing efficient and effective systems for delivering health services to older people is needed. One of the main concerns is the development of positive nutrition and lifestyle education, since many older adults have not received proper health education throughout their lives. Consequently, they are unaware of what qualifies as healthy practices. Upon receiving healthy lifestyle and diet education, elderly persons are more likely to practice proper diet and lifestyle practices. With newly gained knowledge, the elderly can care for themselves, improve their health status, and avoid unnecessary and costly nursing homes, hospitals, or in-home assistance. To fulfill this goal, educators must realize that older people do not learn the same way or process information the same as younger individuals. The elderly face many challenges, such as cognitive decline, chronic age-related diseases, and physical limitations including vision and hearing impairments. Educators must incorporate alternative teaching methods that can effectively engage and motivate elderly individuals to improve their diet and lifestyle habits. By using personalized learning methodologies that account for these physical, auditory, and visual impairments, through the use of: visual aids, loud speech, engaging games that correlate with lessons, and food demonstrations, we observed an increase in nutrition knowledge and diet modification attitudes. In conclusion, customized education is key for helping older adults maintain good health and independent functioning.

93. Anna Gdovka, Steve Chen (Mentor)
Collegiate Athletic Fans Perception of the Use of Social Media in Marketing
Over the last five years, social media has become the dominant tool for people to receive news and messages. Nowadays, sports fans also turn to the four main platforms of social media, Facebook, Twitter, Instagram and Snapchat, to receive marketing information, highlights, updates, and statistics while consuming sports content. Numerous studies indicated the greatest advantages for all levels of sports organizations using social media to promote the events and engage their fans. To fully understand the utilization of social media and its effectiveness for marketing intercollegiate athletic events, this study examined 149 event spectators’ (62% males and 38% females) preferable methods for obtaining athletic information and promotional messages of a regional collegiate athletic program in Appalachia. The results showed the respondents relied on social media as much as the official athletic website to obtain information and game content. They relied far less on the traditional means such as word of mouth, radio, and printed media. The use of Facebook (72%) was still more prevalent than the use of Twitter (43%) perhaps because a greater number of respondents (60%) were 45 years of age or older. Nevertheless, 56% of respondents were satisfied with the content received through social media. Practical strategies for increasing certain types of video content and messages to enhance student event attendance and engagement were addressed based on the analyses of this data. It is logical for athletic programs to create employment or internship positions to further generate and monitor promotional and informational content in social media platforms.
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The US Army Air Service and the Battle of Blair Mountain

In the late summer of 1921, 10,000 United Mine Workers (UMW) fought against a combined force of 3,000 volunteer troops and 27,000 state and federal authorities. What began as a decade-long struggle over the unionization of coal mines, the civil unrest escalated and became violent. Known as the Battle of Blair Mountain, this clash was the largest armed conflict to be fought on American soil since the American Civil War and resulted in the combined deaths of approximately 150 civilians and police. The Battle of Blair Mountain is also known for the combat use of airplanes often equipped with gas and explosive ordnance against civil targets. Though many scholars attribute aerial terror’s beginnings to the Spanish Civil War (1936–9), the US Army Air Service sent bombers to threaten the United Mine Workers and their supporters. After the UMW forces disregarded his threat, President Warren Harding sent in one of the Air Service’s most capable weapons: The Martin MB-1 bomber. The Martin MB-1 was an American bomber/reconnaissance biplane designed towards the end of World War One and carried a crew of three. Un fortunately for the Air Service, a reconnaissance mission failed when one Martin MB-1 crashed, leaving the crew dead and the bomber destroyed. New developments in battlefield archaeology, however, allowed us to study the crash site. Studying the site provided an opportunity to better understand how the bombers were used within the Battle of Blair Mountain as both a military tool and a symbol of federal power.

FDA labeling and consumer effects

Prior research reported that consumers obtain more information from over the counter medicine packaging when name and dosage of the medicine was located in the upper right hand corner of the package. However, this conclusion was recommended without any input from consumers. This inspired us to ask what information actual consumers would deem most important when buying over-the-counter medication. To answer this question, each participant was given a piece of paper containing a large blank rectangle representing a blank medication package. Contained within the large rectangle was a smaller blank rectangle that was located at the upper right corner of the larger rectangle. Finally, located below the large rectangle were 18 descriptors items that might be found on over-the-counter labels. The participants (N=53) placed items they deemed important inside the large rectangle and up to three items that they felt were most important inside the smaller rectangle. The frequency of where each item was placed on the
label in general and the frequency of which item was placed in the smaller box were analyzed. The most frequently listed item was purpose for the drug followed closely by drug name and dosage. In the small box, the most frequently listed item was dosage with the next two highest being drug name and purpose for the drug. This supports the decision that the authors of prior research made about what to put in the small box to an extent. Most medication labels have the purpose somewhere on them but this study shows that consumers view it as highly important and it should be highlighted as well as dosage and drug name. In subsequent experiments, we will place the most commonly listed items in a highlighted portion of a packaging label and test the knowledge that participants obtain from the packages.

96. Lori Porter, Dr. Thomas Pannuti (Mentor)

**XMM-Newton and VLA Observations of the Galactic Supernova Remnants G5.9+3.1, and G32.4+0.1**

While nearly 300 supernova remnants (SNRs) are now known to exist in our Galaxy, only a tiny fraction of these sources have been studied in significant detail at multiple wavelengths. To remedy this situation and to improve our knowledge of general properties of SNRs and SNR-related phenomena, we are analyzing a sample of pointed archival X-ray observations made of poorly-studied Galactic SNRs with the XMM-Newton Observatory. We present here our analysis of two of the sources in our sample – G5.9+3.1 and G32.4+0.1 – for which we have obtained complementary archival radio observations made with the Murchison Widefield Array and the Very Large Array. Our initial analysis indicates that the X-ray emission from G5.9+3.1 is thermal in origin that varies widely in spectral properties across the angular extent across the SNR. In contrast, the X-ray emission from G32.4+0.1 appears to be synchrotron radiation from cosmic-ray electrons accelerated by the SNR.

97. Annuet Soehnlen, Ann Wilkinson, Jen O’Keefe (Mentor)

**Toward Fingerprinting Kentucky Honey: Melissopalynology**

Kentucky is at the forefront of a nationwide movement against honey adulteration and misbranding. This movement was made more urgent by March 2018 FDA guidelines for the proper labeling of honey and honey products, including statements that honey must be produced from living plants, that honey may not be adulterated with other syrups, such as light sweet sorghum or corn syrup, and that any honey labeled with a floral source must have evidence to back up this claim. Traditionally, honey is “typed” using melissopalynology. Melissopalynology is the identification and quantification of pollen contained in honey. Trained melissopalynologists are scarce in the United States; at present this training is available at 3 universities, including Morehead State University. Morehead State University’s focus on undergraduate education and workforce readiness makes it uniquely suited to train students for this emerging career opportunity, especially as training can be incorporated into preparatory studies for careers in horticulture, county extension, ecology, and environmental studies. A major goal of ongoing melissopalynological work at Morehead State University is the development of a honey fingerprint for Kentucky. Here we present an example of how honey from out-of-state compared with honey from multiple in-state sources. The honey fingerprints under development can be used to identify regional honey, and also as a means of supporting sustainable urban and rural apiculture and implementation of the Kentucky Pollinator Protection Plan.

98. Miranda Johnson, Michele Paynter Paise (Mentor)

**The Effects of Music and Breathing Exercises on Tic Frequency**

Many people with Tourette Syndrome experience tics that disrupt daily activities. The purpose of this study was to examine the effects of breathing and music on adults with Tourette Syndrome. Using calming breathing exercises, carefully created playlists, and a simple musical work, the researcher led participants through guided exercises to determine if there was a correlation between tic frequency, stress, and music. Each participant completed reflections after each session and all sessions were video-recorded. After analyzing videos and reflections, the researcher looked for changes in tic frequency, both observed and perceived by each participant. Results of the study are reported and suggestions for future research made.
99. Tessa Collins, Tom Kiffmeyer (Mentor)

**Feminism in Appalachia: Origins and Evolution**

In the late twentieth century, modern feminism in Appalachia bloomed during the labor crisis created by the mechanization of the coal industry and the War on Poverty. Through organizations such as the “roving pickets” and local “welfare-rights” associations, women led social justice movements throughout the region that battled the political corruption of local county governments and the economic dominance of the coal industry. Poor black and white Appalachian women fought for a range of issues. These individuals were not just loyal wives of coal miners. Rather, they were activist caregivers of their families and communities. In 1975, for example, the Appalachian Women’s Rights Organization formed to fight for welfare and union rights. For the majority of these activists, the problems went beyond economics and labor and included racial and gender inequalities. This broader gaze influenced how Appalachian feminism evolved. In the twenty-first century, women are more specifically focused on direct social issues related to sexism and gender oppression rather than redistribution of wealth. The 2016 Presidential Election sparked the revival of feminism in Appalachia and throughout the nation. Women are continuing the legacy of Appalachian feminists through the resistance of oppression and sexism. Appalachian women are still fighting against the social oppression found throughout the region. The women of the 1970s laid the foundation but women of the twenty-first century are building a national community that will support and further women’s issues and concerns in the future.

100. Shelby Hester, Tom Kiffmeyer (Mentor)

**100 Years of Women’s Suffrage: From Laura Clay to Hillary Clinton**

The presidential election in November of 2020 will mark the 100th anniversary of Women’s suffrage in America. Ratified in 1920, the 19th amendment, which granted women the vote, represented a watershed event in United States politics and democracy. Thus, this is the perfect time to look back upon the history of the Women’s suffrage movement in Kentucky which began, in 1888, with Laura Clay. Laura was the daughter of Cassius Clay, a Kentucky Senator and a well-known abolitionist and political progressive. Angered by her father’s treatment of her mother during their divorce, Laura became aware of the “second-class” status of women in Kentucky and the nation. It was this anger that spurred her to become the voice of the Women’s Suffrage movement in Kentucky. Still, her father’s progressive political stances gave her the inspiration and courage to bring women’s rights to the forefront of Kentucky politics. Laura Clay became the president of the Kentucky Equal Rights Association in 1888 but did not stop there. Clay eventually joined the National Woman Suffrage Association in 1895. It was at this time that she broke with the national movement because she believed that women’s suffrage should come through state law rather than a national amendment. Clay’s disagreement would eventually force her to leave the National Woman Suffrage Association and return to Kentucky where she would continue her work with the Kentucky Equal Right Association and, following the ratification of the 19th Amendment, ran for Kentucky’s State Senate. Though Clay lost her race for the State Senate that did not stop her from becoming the first woman to have her name considered for the Democratic Party’s nomination for President in 1920.

101. Luke Sizemore, Dr. Kourosh Jenab (Mentor)

**Automatic Catheter Irrigation System (ACIS)**

In the medical field, there has always been a desire to prevent multiple types of infections. The purpose of this research project is to determine the marketability, design, engineering, and prototyping of the Automatic Catheter Irrigation System (ACIS) that will inherently prevent/minimizing catheter-associated urinary tract infections (CAUTI’s). According to recent statistics, the percentage of CAUTI’s among Americans has gradually increased and the problem has yet to be solved. Doctors are simply prescribing antibiotics continuously to fight the infections. The goal of the ACIS is to fight against the risk of CAUTI’s, and to minimize the over prescribing of vital antibiotics, save the patients time and money for constant hospital and urgent care visits, and provide home-health agencies with a device that can minimize the need for constant catheter changes and home visits. A detailed outline of this design project will include all blueprints, drawings, calculations, materials needed, patenting design potential, and marketing value.
102. Sydney Gordon, Dr. Michael Fultz (Mentor)

*Inhibition Efficiency of Lactobacillus acidophilus Bacteria on Candida albicans Growth*

Lactobacillus acidophilus is an abundant gram-positive bacterium commonly found in the gastrointestinal tract and in female reproductive tract. It is used as a probiotic and it is suggested that L. acidophilus may affect the ability of Candida albicans to adhere to vaginal cells and therefore decrease the chance of a yeast infection. Our project examined the effect of microgravity on of cultures of L. acidophilus and C. albicans. In our experiment, we utilized a dual-culture plating method to investigate the potential of L. acidophilus to impede the growth of C. albicans. Our experiment was flown to the International Space Station and incubated for 30 days. Our results indicate that L. acidophilus grown in microgravity produce larger colonies and had an increased growth compared to cultures at normal gravity. It also appeared that L. acidophilus may have an enhanced ability to prevent growth of C. albicans in a microgravity environment.

103. Kelsey Purdum, Dr. Kimberlee Sharp (Mentor)

*Elementary Teachers’ Experiences Using Informational Texts to Teach Social Studies in Eastern Kentucky*

One component of the United States’ public school curriculum core is social studies. Since the No Child Left Behind Act (2001), elementary social studies has been marginalized, and in some cases, eliminated from the school day in favor of increased time for literacy and mathematics instruction. Kentucky’s adoption of the ELA Common Core standards in 2010 set in motion an opportunity to re-position social studies status in the elementary school day. This opportunity, referred to as informational texts in the Common Core standards, emphasizes reading and comprehension skills of nonfiction. Has the use of informational texts provided elementary teachers more opportunity to teach social studies content? Are elementary teachers consulting state and national standards for teaching social studies when utilizing informational texts? This study seeks to understand these questions and whether the ELA Common Core is the impetus teachers need in order to revitalize social studies instruction in the elementary grades. This presentation will report on the research design, population, methodology, and literature review as it pertains to Eastern Kentucky elementary teachers’ experiences using informational texts to teach social studies.

104. Hannah Brewer, Mentors: Dr. Robert D. Boram & Dr. Wilson Gonzalez

*Factors Associated with Students Leaving Quantitative STEM majors. A Case Study.*

The process of selecting and changing any college major, including STEM, is a deeply personal process that is influenced by family, friends, mentors, geography, and discipline related experiences. More than half of the entering college freshmen who declare STEM majors switched out of them, especially in quantitative disciplines. This is described in the literature as STEM attrition. Many factors have been statistically associated with STEM attrition, including gender, race, high school preparation, faculty interactions, depth and pacing of college science courses, math ability, and others. This study used a case study methodology to identify what factors were associated with a college students’ decision to choose an original quantitative STEM major (physics, chemistry, space science or mathematics) and what factors were associated with a college students’ decision to switch out of their original STEM major at Morehead State University. The Office of Institutional Research provided a list of students who (a) declared a major in a quantitative science, (b) switched out to another major between 2012 and 2018, and (c) were still enrolled. The students (n ≈ 20) were asked to participate in this study via email, postal mail and face-to-face encounters, and were informed of their rights and responsibilities as research subjects. Participants completed a short demographic paper survey, and sat down for a 30-60 minute guided interview. The survey data was summarized using descriptive statistics. The interviews were recorded, transcribed, and analyzed using standard qualitative techniques to identify broad themes associated with STEM attrition at Morehead State University and similar universities. The study’s findings informed the brainstorming of strategies aimed at reducing STEM attrition and increasing graduation rates in these quantitative disciplines, both in regional and national contexts.
105. Allie Skaggs, Dr. Cheng Cheng (Mentor)

**A Multi-Variable Sensing Platform for Water Quality Monitoring in the Distribution Network**

It is critically important to public health and homeland security that water utilities have the potential to detect contaminants (either natural or artificial, and accidental or deliberate) in a distribution water system in near to real time. In order to be able to safeguard the public, there is a clear need to be able to rapidly detect (and respond) to instances of accidental (or deliberate) contamination, due to the potentially severe consequences to public health and safety. Despite recent advances in biological monitors and microsensor technologies, there is no universal monitor for water quality monitoring and contaminant detection. In this work, a multi-variable sensing platform is presented to monitor the quality of water in the distribution network. More reliable quality monitoring is achieved due to the large spatially distributed deployment and the possibility of correlating the quality measurements from various locations. This platform is controlled by Arduino ATmega2560 development board. Multiple sensors measuring the water temperature, pH, dielectric constant and electrical conductivity are integrated into the board. Water temperature and pH are evaluated by commercially available sensors, and dielectric constant and electrical conductivity are measured by a newly developed sensor. This innovative sensor utilizes integrated circuit (IC) ADuCM355 to add an AC signal on an interdigitated electrodes (IDE) that are immersed into water. Based on the measured impedance of water, dielectric constant and electrical conductivity can be extracted and measured. Therefore, by recording and documenting the measured data continuously, the spatio-temporal multi-parametric data collected can be fused and analyzed to reach complex decisions concerning the quality of drinking water.

106. Caitlin Haggard, Dr. Bernadette Barton (Mentor)

**Men's Understanding of Toxic Masculinity**

Hegemonic masculinity, more colloquially referred to as toxic masculinity, is a set of practices that promote the dominant social position of men, and the subordinate social position of women. Toxic masculinity socializes men to see masculinity itself in hierarchical terms, ranking men according to how well they embody and present as the alpha male: the toughest, strongest, and least emotional. Researchers find that toxic masculinity is responsible for a number of negative social consequences including dangerous risk-taking, acts of violence, and the numbing of empathy. Drawing on interviews with 10 male millennials, this research explores how aware men are of the concept and constraints of toxic masculinity while in college. We theorize time spent getting an undergraduate degree as a key turning point in men’s self-conception. Many men get to college and are enlightened by the openness and diversity among campus. This poster illustrates that young men have varying degrees of understanding of toxic masculinity, particularly as regards their own behavior. We find that subjects have an easier time seeing the negative consequences of toxic masculinity in others than themselves.

107. Christian Hensley, Steve Chen (Mentor)

**Females Serving as the Head Coach of Competitive Elite Male Sports**

Recent coaching employment of Becky Hammon and Kathryn Smith in the NBA and NFL inspires the discussion of the potential of witnessing the first female head coach hired in men’s professional basketball and football. Despite the presence of female leaders in many business and political realms, there still seems to be lack of gender equality in the employment of female administrators and coaches in the male dominant sports. This study investigate how women were perceived as an ideal head coach candidate in a male dominant sports based on 132 student-athletes’ responses (70 males and 62 females). An exploratory factor analysis was performed to address four areas of responses: (1) confidence in female coaches’ competency, (2) preferential level of female coaches, (3) female coaches’ unique trait and strength, and (4) actual opportunities that females receive. In general, the respondents moderately agree that females have the adequate abilities and knowledge as male coaches do to handle the coaching tasks; however, they still don’t feel very comfortable about having a female as their head coach. In agreement with several findings, the research found that male athletes are more likely to show disrespect toward female coaches, and question their desire to win. Additional constructive strategies were provided to support future females overcoming the perceived barriers for becoming a head coach, and improve existing hiring practices.
108. Susie Chaney, Blake Smith, Andrea Howard, Suzi White (Mentor)
An Evidenced-Based Protocol for Eliminating Errors associated with Intravenous Medication Errors
The purpose of our research is to decrease the number of IV medication errors. IV medication errors occur due to the wrong drug, wrong dose, wrong rate, wrong concentration, incorrect aseptic technique, known allergies, omitted medications, wrong time of administration, incorrect labeling, patient identification, and no order for the infusion. Nurses’ perceptions of why medication errors occur included physicians’ medication orders are not clear, the names of many medications are similar, pharmacy did not label the medication correctly, poor communication, lack of staff to patient ratio, fatigue from hard work, nurses’ heavy workload, and working night shift. This quality improvement project provides a step-by-step protocol of setting up, administering IV medications, and monitoring the patient after. A combination of standardized practice, technology improvements, and targeted education is required to reduce errors. It is hoped that this quality improvement project will inform nurses on how to prevent and reduce IV medication errors by focusing on the factors that cause this problem.

109. Joshua Webb, Sherif Rashad (Mentor)
Design and Implementation of an Innovative System for Automatic Recognition of ASL using Machine Learning
Deaf and hearing-impaired persons learn American Sign Language (ASL) as their natural language. There is a need for a new innovative technology that will enable deaf and hearing-impaired persons to communicate without difficulty, anytime and anywhere with persons who do not know ASL. We explore in this research project the problem of automatic conversion from ASL to speech using motion sensors and machine learning. The goal of this project is to design a smart system to capture and recognize hand gestures using leap motion sensors and machine learning algorithms. The new proposed system will be able to work in an adaptive way to learn new signs to expand and to improve the dictionary of ASL. This system will have a wide range of applications for healthcare, education, gamification, entertainment, and many other applications.

Murray State University

18. Taylor Davis, Dr. Bradley L. Almquist (Mentor)
A Brain-Friendly Approach to Music Literacy
The purpose of this study was to explore how the brain processes information, stores it in long-term memory and then applies that knowledge to teaching music in a classroom/rehearsal setting. We observed how the working memory, the system responsible for processing information from short-term and long-term memory can function with greater efficiency. We observed how the number of items available for processing in the working memory may be increased through a process identified as “chunking.” Chunking is when short patterns, or bits of information, are combined to form longer sequences. When applying these brain-friendly learning concepts to music, the instructor taught a series of short tonal and rhythmic patterns, graduating in difficulty. These patterns were combined to form longer phrases of melody or rhythm. The short patterns were extracted from a selection of repertoire being sung by the choir. They were pre-taught during the music literacy component of the warm-up sequence at the beginning of rehearsal. Once the students had learned the patterns aurally and stored them in long-term memory, the patterns were quickly recognized when they appeared in the music, often aurally first. The repertoire became much easier for the children to comprehend. Thus, the choir quickly and efficiently learned the music and performed it with ease and aesthetic awareness. These patterns, stored in long-term memory, allow the working memory to access them later and apply them to other repertoire. This application of knowledge is called transfer and is a necessary part of the teaching and learning process.
19. McKenna Morgan, Dr. I. P. Handayani (Mentor)

Soil Responses to One-Season Winter Cover Crops

In regions like western Kentucky where wooded lots are common there is a growing interest in how to utilize them so that land profits can be maximized. The frequently poor soils in wooded areas due to erosion and lack of ground cover vegetation often cause complications in the creation of pasture areas. Therefore, the objective of this study was to assess the effect of growing winter cover crops on soils to prepare for pasture systems in the spring. There were two parts in this experiment. Part one was the winter cover crop revegetation to prevent further soil erosion, add organic matter for the topsoil, and scavenge of nutrients from the lower soil horizons. The second part of the project involved the seeding of pasture forages appropriate for small livestock in the spring after the winter cover had been killed. Soil quality indicators such as soil organic matter, soil compaction, aggregate stability and water percolation were monitored to evaluate the progress of soil improvement. The focus of this research was to compare the soil quality before and after the revegetation. The results of this study will be beneficial for homeowners, foresters, agronomists and gardeners that face poor soil conditions associated with wooded plots.

20. Adam Martin, Mentors: Bommantha Loganathan & Susan Hendricks

Elevated Calcium Levels in Kentucky Lake: A Possible Emerging Problem with an Invasive Species

Zebra mussels (Dreissena polymorpha) are an exotic and invasive mollusk that have spread extensively through various rivers and lakes in the United States. These mussels are notorious for their “biofouling” capabilities costing billions of dollars in their removal from industrial, public, and power plant water supply lines. While having been present in the Tennessee River drainage with occasional small reproducing populations since the early 1990s, zebra mussels were never abundant or widespread. In 2017, high densities were found on structures and solid substrates throughout the lower portion of Kentucky Lake. Calcium is one of the essential elements that contributes to the growth and reproduction of zebra mussels. Calcium concentrations of 20-22 mg/L are considered the threshold for survival and reproduction of zebra mussels. The specific aim of this study was to determine if dissolved calcium levels in the lower reach of Kentucky Lake had increased and reached that threshold. Surface and bottom water samples were collected during Kentucky Lake Monitoring Program (KLMP) cruises as well from selected locations in the Ohio River and two tributary streams. Samples were filtered using 0.45 µm filters, acidified and analyzed for calcium using an Atomic Absorption Spectrometer. Calcium levels and long-term monitoring data on chloride levels in Kentucky Lake were examined for temporal trends. The results showed an increasing trend in calcium concentrations during the past decade. The higher levels of calcium are likely from increased use of road deicing brine, of which CaCl2 is a major component, over the past several years. Increasing levels of these calcium ions may play a role in the elevated occurrences of zebra mussels in Kentucky Lake.

22. Hannah Huckeby, Dr. David Eaton (Mentor)

Determinants of Parking Fees on College Campuses

The price of parking has recently been a hot topic around the Murray area, especially among the college students. Due to the drastic increase in parking pass prices there has been an abundant amount of discussion surrounding this idea of parking being a public good. Many individuals have been outraged which has brought up the questions of why there is a price tag on something that many people consider a public good. With that being said, this paper is going to take a deeper look into parking specifically pertaining to college campuses but also in the cities surrounding these institutions. All in all, the goal of this research will be to try and answer the question of, what determines the price of parking on a college campus. While conducting the research there will be a variable that will account for the different types of institutions such as 2-year degrees, 4-year degrees, public and private. There will also be some attention directed towards the location of the university, the amount of parking that is available, and what the average walking distance a student may have. These variables will enable the discussion to encompass a wide variety of institution types rather than just those similar to Murray State.
23. Meredith Mullins, Dr. David Eaton (Mentor)
*Roger Ebert vs. John Doe: An Examination of the Difference in Media Reviews*

The purpose of this research is to examine the variation in critic and audience reviews of films and determine the cause of this variation. When reviewing a film, the ratings of critics and audience members often differ, regardless of whether they are positive or negative. This difference may arise from the unique role critics possess in this market as agents and the incentives they face. As agents of the film industry, critics have expert knowledge concerning films that audience members do not possess and therefore, they review films with a different evaluative framework than audience members. Critics may look at a film’s composition or cinematography for their review, while an audience member may simply consider their own enjoyment. The hypothesis of this paper is that critics view media with different objectives than audience members and as such, their reviews may be focused on criteria other than the public’s focus. This hypothesis will be tested through the use of a regression of related explanatory variables. The importance of this issue lies more in how it applies to other markets. Similar impacts have been studied in markets ranging from real estate to auto repair to medicine. This research will lead to a better understanding of the economic impact of different information processing and use by experts and non-experts.

24. Samantha Peterson, Mentors: Dr. I. P. Handayani, Alyx Shultz, & Brian Parr
*Observing Soil Changes Under Common Cropping Practices in Kentucky*

Cropping production and tillage systems lead to loss of soil organic matter (SOM), lowering soil pH, and soil compaction in Kentucky. However, the magnitude of the changes varied among the soil properties. Therefore, the objective of this research was to evaluate the changes in SOM, soil pH, and soil compaction under different cropping systems like corn-soybean-tobacco rotation (Field #1), continuous corn field (Field #2), hemp field (Field #3), wheat field (Field #4), pasture with animal grazing (Field #5), and canola field (Field #6). The prominent soil textures in all fields are silt loam and silty clay loam. Disturbed soil samples were taken at the depth of 0-7 cm and 7-23 cm to measure SOM and soil pH. There were three replications from each field. The results indicated that the canola field which has been under no-till for over fifteen years had the highest SOM at an average of 4.2% in 0-7 cm. At similar depth, continuous cornfield had the second lowest amounts of SOM which was 2.8%. The canola field and the continuous cornfield had soil pH of 6.7 and 5.37, respectively indicating the highest and the lowest level of acidity. The averages of soil compaction from all fields were 159 psi in 0-7 cm, and 427 psi in 7-23 cm. The highest compaction was found in the field under animal grazing at 561 psi the lowest was under tobacco at 243.5 psi. The findings from this study revealed that SOM, soil pH, and soil compaction changed as affected by cropping practices.

25. Carly Middleton, Dr. Marcie Hinton (Mentor)
*Leap of Faith: Megachurches and the struggle to create a brand experience that sells*

As churches across the Commonwealth experience a decline in attendance, membership and giving, religious organizations are failing to connect with their audience and their organizational goals on social media. This exploratory content analysis evaluated the social media branding practices of Kentucky’s 20 megachurches and proposed areas of improvement. A megachurch is defined as a Protestant Christian congregation with an average of 2,000 weekly attendees, including adults and children across all worship locations. Kentucky megachurches were selected for study as the state is ranked No. 25 in the nation for number of megachurches, making the state saliently situated to be a resource for megachurches across the country. Facebook, Instagram and Twitter profiles were evaluated on follower-to-member ratio, post frequency, promotional materials, access of new-member information and other relevant branding factors. Results of the study found Kentucky megachurches need to significantly improve their branding practices in order to become aggressive participants in consumer marketing. In future research, the scholar aspires to measure these implemented suggestions through a case study.
26. Chloe Chaplin, Dr. Kathy Callahan (Mentor)  
*British Family Structure: Expressions of Power and Conceptions of Family*  
The goal of this research is to examine family structure in early modern Scotland and England though the use of written communication. The primary focus will be on aristocratic families with a secondary look at upper-middle class families. This is due primarily to availability of records, and also why I will mainly be using written correspondence rather than secondary analyses, as this field is still relatively new. By exploring the development of key familial relationships (e.g. parent-child, husband-wife, and in-law interactions) through private correspondence, larger insights can be drawn about gender and the nuclear family. Also, these central relationships guide discussions about marriage, the role of children, and the dynamics of a family economy. This study explores how families are created and how upper class families function in early modern Europe. The intersection between these select relationships and the larger societal roles will provide conclusions about the early modern aristocratic family.

27. Gabby Barnes, Mentors: Dr. I.P. Handayani & Dr. Steve Still  
*Variations of Soil Qualities in Urban and Rural Areas*  
The purpose of this study was to evaluate the variations of soil characteristics under different management practices in rural soils versus urban soils. In this study, soil samples from rural areas in Kentucky were collected from a woodland plot, a no-till plot, and a tilled plot. The soil samples from the rural were taken from two depths in order to better evaluate the effect of tillage on the soil. A shallow depth of 0-7 cm and a deep depth of 7-15 cm were used. Soil samples were also taken from urban plots in Memphis, TN. The sampled plots included were an animal shelter, a middle school, and a high school. The soils from the urban area were maintained for aesthetics only. In the urban area, samples were taken from the A Horizon. All the soil samples were analyzed for organic carbon, particulate organic matter, aggregate stability, pH, water holding capacity, field capacity, and macroporosity. The results show that various soil management practices and urban development significantly affect soil properties, however the magnitude of the effect differs.

28. Caroline Mikez, Dr. David Pizzo (Mentor)  
*World War I and the People of the Purchase*  
The extensive impacts of World War I pervaded society on a global scale during the early twentieth century. The United States officially joined the international conflict in April of 1917 by aligning with the Triple Entente composed of Britain, France and Russia in the fight against the central European powers of Germany, Austro-Hungary, and the Ottoman Empire. In a similar fashion as the other warring nations, the American war effort depended on the development of a national ideology and the mobilization of societal resources to support a newly created armed forces. This research project will explore the significant impacts of the American war effort during World War I on the Jackson Purchase home front in Western Kentucky and will also provide an assessment of rural Western Kentucky societal dynamics through an examination of prewar domestic issues, changes to local economic, political, and social processes, and the responses of western Kentuckians to wartime changes. Research for this project was primarily conducted through local public library and local genealogical repositories, as well as oral histories and other special collection materials housed in Pogue Library at Murray State University. Other areas of interest will include: urban/rural dynamic between Jackson purchase population centers and the surrounding counties, civic organizations, racial issues, prohibition, women’s suffrage, education, health care, and the outbreak of the Spanish flu. This project was inspired by the upcoming Centennial of the World War I Armistice signing on November 11, 2018 and the Bicentennial of the ‘purchase’ of the Jackson Purchase region on October 19, 2018. Many topics and issues covered in the paper are still relevant subjects in the twenty-first century.

29. Ella Potts, Jessica Stoner, Mentors: Alyx Shultz & Dr. I.P. Handayani  
*Impact of Aerobic Compost Tea on Growth of Lactuca sativa within a Peat-based Growing Media*  
Compost and compost tea have been shown in practice to be valuable soil amendments across many horticultural applications; however, little rigorous quantitative work has been completed. Researchers designed
a side-by-side trial with two replications to quantifiably study the impact of compost tea on the growth and vigor of soil-grown lettuce. A recycled poultry-litter-based aerobic compost tea was used for the treatment. Six lactuca sativa plants received each treatment or control. Researchers hypothesized the treatment plants would show more vigor and vegetative growth than control. The null hypothesis was treatment plants would be identical to control lettuce. Researchers failed to reject null hypothesis. Plants treated with compost tea were nearly twice the size of control plants. Researchers concluded compost tea was superior to water. Further research is warranted to delineate best practices for making compost tea and maximizing its effect on vegetative growth.

30. Tara Croft, Katelyn Foppe, Rhiannon Huffines, Bikram Subedi (Mentor)

**Consumption Profiles of Illicit and Neuropsychiatric Drugs in Urban and Rural Communities in Kentucky Using Sewage Epidemiology**

The drug overdose deaths in the USA increased by ~20% from 2015 to 2016 to the total >63,600 drug overdose deaths in 2016. Kentucky is among the highest rate of drug overdose death states in the USA. The current estimates of the prevalence of substance abuse are based on the self-reported surveys, overdose/toxicological reports, and drug-related crime statistics. Survey-based conventional approaches are not only cost and time-intensive but also underestimate the actual consumption of drugs. As “wastewater never lie,” the drug residues in raw wastewater collected from the centralized wastewater treatment plants were utilized to determine the consumption rate of 10 illicit and 26 prescribed neuropsychiatric residues in two urban communities in eastern Kentucky and two rural communities in western Kentucky. Communities investigated in eastern Kentucky had the ~10-fold larger population and ~2-fold higher per-capita income than in western Kentucky. Cocaine was the dominant illicit drug consumed in the eastern communities (~3-fold higher than in western communities) while methamphetamine controls the consumption profile in the western communities (2 folds higher than in eastern communities). However, venlafaxine and citalopram were the two major prescribed neuropsychiatric drugs consumed in all communities. While the opioid epidemic has been declared as a national public health emergency in the USA, codeine and hydrocodone were the most consumed prescription opioids. A cost-effective and semi-real time approach – Sewage Epidemiology – can provide authorities critical information for the identification of susceptible areas/populations for policy development, prompt intervention, and evaluation of the effectiveness of new drug treatment and prevention program.

31. Richard Thompson, Tyler Williams, Seth Pritchett, Tracy Whitlock, Dr. A. Yarali (Mentor)

**3D Wi-Fi Campus Coverage: Flying A Drone**

Everyone in a college environment is immersed in their electronic devices. Whether it be in the quad, the classroom, the library or their favorite nook by the windows, they all need a reliable Wi-Fi signal to get their work done. In this era most of the tasks that has to be completed require some sort of connection between electronic devices especially if the individuals require information located on the internet. The main method of accessing the internet is using Wifi technology which uses electromagnetic waves to propagate information across a certain area. Considering the properties of these electromagnetic frequencies it can be said that they can be affected by different variables within the environment. One major variable is physical obstructions that blocks, morphs, and reflects these electromagnetic waves. The characteristics of these obstructions also play a key role in how they change how these RF wave are affected. Such characteristics are the geometric shape of the obstruction and its density. Along with physical, tangible obstructions there are also unseen factors that affect electromagnetic waves from being effectively propagated. An example of this is noise. Noise is simply unwanted signals interfering with the desired signals. As we all know senseless noise is unwanted in any environment and its elimination poses a great obstacle to wireless network administrators. The purpose of our project is to model how electromagnetic waves propagate in the outside environment of Murray State University’s campus and then use that information to provide technical advice on how to address the issue of noise. The first step is to create a 3D model of campus using photogrammetry. Next, is to capture various information about the electromagnetic signals including its strength and where it is generated. The last step is to overlay the captured information onto the 3D model to get an accurate representation on how these signals are
propagating and obstructed based on the environmental features of the campus. At the end of the project we will be able to view the model via a user friendly interface and gather information that in turn will aid in the University’s technical staff’s ability to locate areas in which signals are interfering with each other. In other words the data collection will be a good resource to IT people on campus for analysis of propagated signals for any adjustment on their premises to optimize their signal quality, and coverage.

32. Ashley Robert, Alyx Shultz (Mentor)  
**Utilizing Municipal Compost and Equine Stall Waste as Potential Economic Alternatives in an In-Ground Pot-in-Pot Production System**

For Western Kentucky farmers, one viable income source could be a pot-in-pot nursery production. One of the highest costs of production in this system was the planting media that the plants were grown in. Economical alternatives to high-priced, non-renewable peat-based mixes were important to consider. Unique to this region, were two renewable soil amendments that may help farmers to widen their profit margin in a pot-in-pot system. This research looked at the economic viability of locally sourced horse stall waste and municipal compost as soil amendments to a traditional bark and peat based mix. Initial cost projections were favorable for both amendments. Further research was warranted on the agronomic suitability of the amendments to nursery stock production.

60. Isabella Roth, Jose Salazar, Yi Hu (Mentor)  
**Cloud Security**

With enterprises moving their IT infrastructure to the cloud using providers like Amazon Web Services (AWS), security problems have not been reduced. In fact, cloud computing brings new security challenges. Our research investigated better solutions to the security problems that come with using the cloud to store a companies data. The cloud is a general term for using the internet to receive some sort of data vs connecting directly to a server. This makes it easier to do things such as connecting to an online app to even retrieving information about your company such as the statics on all of the employs in your workplace. Storing information in the cloud is a lot cheaper than using a server to store certain information. Of course, however, it is relatively harder to secure and implement the cloud in the workforce. So we investigated which cloud solution would be easiest to implement in a workplace environment. We spent most of the summer working towards getting the cloud to communicate with a simple app we had created. This app would then use a third party, such as Facebook to verify and log you into the app. Due to the limited experience, we had when we began this project we had to fail many a time until we finally succeeded. I hope in the future we are able to explore more deeply into more complex versions of cloud security.

62. Charlotte Kalfas, Andrea Gazzaniga (Mentor)  
**Already Addicted: 200 Years of Opioid Use & Abuse in Literature**

When Thomas De Quincey’s Confessions of an English Opium Eater was published nearly 200 years ago, he wrote through a myriad of excuses, spending the first half of the narrative explaining the dire shape of his life that might cause him to abuse a substance. Nearly a century later, Dr. John Harrison Hughes follows with Autobiography of a Drug Fiend, on the tail end of a long line of De Quincey-inspired drug confessionalists. This work, while similar in tone, was written by a physician, not a literary author. In this project, I argue that the very same pathways to addiction that plagued De Quincey and Hughes are the ones that haunt us today. Both authors began taking opium and morphine, respectively, as a means of treating physical symptoms when, at the time, opiates were seen as the panacea of treatments. But they were surrounded by many other problems, those that are similar to ones we see in addiction today. I have consulted with many personal narratives of drug abuse in both America and abroad, as well as scholarly texts from Psychology, History, and Literature alike in order to demonstrate that substance use disorder has
always, and will always be intertwined with issues of race, socioeconomic status, patient-physician relationships, and sexuality. Until policymakers and treatment professionals acknowledge drug addiction as a complex and multifaceted issue, the opioid epidemic will likely continue for another 200 years. By examining the opioid epidemic through the lens of literary texts, we may achieve a fuller understanding of this issue.

63. Brett Torline, Dr. Justin R. Yates (Mentor)
**Blocking the Rewarding Effects of Amphetamines Using Ro 63-1908**
The abuse of psychostimulants has been a growing concern, especially among student populations. Drug diversion associated with attention-deficit/hyperactivity disorder (ADHD) medications is a large part of this problem. The goal of this study was to determine if the rewarding effects of psychostimulant drugs, specifically methamphetamine, can be blocked with the drug Ro 63-1908. Male rats (n = 48) were tested in a conditioned place preference (CPP) paradigm, where one environmental context was specifically paired with the rewarding effects of methamphetamine. In Experiment 1a, rats received either an injection of methamphetamine prior to being isolated in one colored compartment (white or black) or an injection of saline (i.e., salt water) prior to being isolated to the opposite colored compartment. Thirty minutes before receiving the methamphetamine/saline treatment, rats received an injection of saline mixed with 5% Tween 80. Experiments 1b and 1c were similar to Experiment 1a, with the exception that rats were injected with Ro 63-1908 (either 1.0 mg/kg or 3.0 mg/kg) 30 minutes prior to receiving methamphetamine. On the final day of testing (for each experiment), rats explored the white and black compartments of the CPP chamber for 15 minutes. The time spent in each compartment was recorded. The results showed that rats treated with Ro 63-1908 (3.0 mg/kg) prior to each methamphetamine injection spent less time in the methamphetamine-paired compartment. Importantly, the ability of Ro 63-1908 to block the rewarding effects of methamphetamine was not due to increased aversion to the drug (i.e., rats did not become sick following Ro 63-1908 treatment). Overall, these results suggest that Ro 63-1908 blocks the acquisition (i.e., early learning) of the conditioned rewarding effects of methamphetamine. Thus, targeting the receptor that Ro 63-1908 blocks may lead to the development of better treatment options for combating substance use disorders.

64. Mary Jo Wedding, Dr. Michael Baranowski (Mentor)
**Expanding Academic Proficiencies by eliminating Common Core Program Standards**
In an attempt to increase academic proficiencies, officials have eliminated various educational opportunities previously offered to K-12 students, such as skilled technical training, life skills and cooperative opportunities from their course options, in favor of a nationalized driven curriculum defined as the “Common Core Program Standards”. Academic subjects such as History, Civics and Science are taught on a level far below that of Language Arts and Mathematics, thus resulting in a society where the citizenry has limited knowledge of technology, culture, history and civic responsibility. For those students who do not pursue a career that requires a college education, work-based learning studies could prepare them to establish work ethics and proceed directly into the workforce. Statistics have proven that while the push for college preparedness has helped to increase high school graduation rates, it has had no impact on college completion rates or an increase in ACT test scores. Statistics have shown that as much as 33 percent of young adults either go to work at low-level, low paying jobs following high school graduation or do not work at all. There are many jobs that are unfilled across the nation due to a lack of skilled personnel, thus creating a strong case for high school reforms that recognize the value-added benefits of work-based learning, apprenticeships and other market strategies. Through academic proficiency data analysis, opinion polls, academic research and independent board of education interviews with board members from the highest rated school districts in the country, this empirical research shows that by implementing a broader approach to youth educational platforms, educators will have a more substantial impact on the development of a better workforce that empowers all types of students, those that wish to enter the workforce directly and those that wish to continue onto higher education programs.
65. Jamison Burchett, Dr. Michael Guy (Mentor)

*Using RNA Interference for the Identification of the acp3U Enzyme in Higher Eukaryotes*

Cellular enzymes form dozens of post-transcriptional tRNA modifications to increase tRNA stability and function. tRNA modification defects are linked to various diseases, including intellectual disability and cancer. The enzyme responsible for the 3-[(3-amino-3-carboxypropyl) uridine (acp3U) tRNA modification, which is found in animals and plants, but not in yeast, has not been identified. Because of its high conservation among plants and animals, acp3U is likely to be important for tRNA function. To identify the acp3U enzyme, we are silencing candidate genes in cultured Drosophila melanogaster cells by RNA interference (RNAi), analyzing acp3U levels on tRNA from treated cells using primer extension, and then verifying results using quantitative real time PCR (qRT-PCR). Candidate genes are identified through BLAST searches of predicted human methyltransferase genes of unknown function that are also found in D. melanogaster and plants, but not in yeast. To date, we have identified 30 candidate genes, treated cells with double stranded RNA (dsRNA) to induce RNAi for over half of these genes, and then analyzed tRNA from treated cells for the presence of acp3U by primer extension. To verify silencing of gene expression, qRT-PCR is being performed. Identification of the acp3U gene in animals, including humans, will increase our understanding of the link between tRNA modifications and disease.

66. Colin Hartman, Mentors: Dr. Joseph Mester & Dr. Alan Cohen

*Novel Inactivation of the Causative Fungus of White Nose Syndrome with Methoxsalen and Ultraviolet A Light*

White Nose Syndrome (WNS) is a newly recognized disease responsible for the rapid mass destruction of the North American bat populations. This study addressed the novel inactivation of fungal spores from *Pseudogymnoascus destructans*, the causative agent of WNS, using ultraviolet A (UVA) light at 365nm and methoxsalen, a photosensitizer from a family of compounds known as furanocoumarins. *Penicillium crustosum*, an environmental fungus, was studied as a comparator. Spore suspensions were soaked in specific concentrations of methoxsalen and subsequently exposed to UVA light. The plates were examined for both spore inactivation and resultant inhibition of colony growth. The results demonstrated that methoxsalen + UVA was an effective method for inactivating fungal spores of *P. destructans* and *P. crustosum*. The importance of this study is the potential control of WNS and other destructive environmental fungi.

67. Parker Kain, Dr. Kevin Kirby (Mentor)

*Using Deep Reservoir Computing to Solve Sequential Tasks*

In recent years, artificial intelligence has been dominated by neural networks. These systems potentially provide unparalleled accuracy to tasks thought to be unsolvable in the past. They are now are being applied in technologies such as self-driving cars and conversational software such as Alexa or Siri. Reservoir Computing is a more efficient form of neural network that can learn to solve hard problems quickly and with minimal computational power. In recent years they had been put aside in favor of more sophisticated "deep learning" models as computational speeds increased. In this project, we investigate Reservoir Computing in light of newer technological developments to see which situations it works well in, with particular attention to new Deep Reservoirs, which rely on special high-performance computing architectures. Beginning with simple code written in the Python language to explore these networks, we then scale up to employ Google's state of the art Tensorflow software. We then benchmark Deep Reservoir Computing (DRC) models on sequence data from the life sciences and compare it to results from other popular models such as Gated Recurrent Units and Long Short-Term Memory networks. We then characterize the type of problems that are well-suited to these efficient DRC models.

68. Andrea Shiverdecker, Samantha Hamilton, Cooper Pfalz; Mentors: Dr. Sharyn Jones & Dr. William Landon

*Multidisciplinary Approaches to Research and Abolitionism Through the Parker Academy.*

The Parker Academy (1839-1892) had a longstanding history of being a home for the abolitionist movement. Founded in 1839, the Parker family of New Richmond, Ohio created the first all-inclusive academy that provided education to students regardless of race, gender, political identity, or religious affiliation. Students from across the country attended the Academy. The multidisciplinary approach the Parkers used to facili-
tate inclusion aimed to establish an all-encompassing educational environment, which was not only fascinating, but uniquely ahead of its time. By closely networking with educators, artists, students, religious leaders, politicians, lobbyists and freedom fighters, the Parkers established a school of inclusiveness far exceeding the standard of the mid to late 1800’s. Spanning the ranges of scientific study from anthropology, archaeology, history and public history, to local historians and educators; researchers have been able to piece together groundbreaking discoveries of the underground abolitionist movement throughout the Ohio River Valley. Investigating the Parker Academy connections and networks through anthropological methods has allowed for new depths in the study of the abolitionist network to be reached. Through researchers’ efforts in applying the same multidisciplinary approach facilitated by the Parkers, it has taught us to utilize resources previously untapped by the constraints of our individual subjective disciplines. While opening our realms of research to new ideas and methods, a more holistic approach allows for a wider breadth of knowledge. For example, an accompanying art installation was composed using the Abby Warburg’s mnesmosyne concepts of memory to show and to emphasize the multiple aspects of research used.

69. Amanda Ramos, Dr. Kajsa Larson (Mentor)
Global Learning with Linguameeting

Global Learning with Linguameeting Abstract: This presentation discusses a new classroom approach to cultural learning with the use of technology and video conversations in an advanced Spanish course. Incorporating this type of learning allows for cross cultural experience and inclusion of the native language. During the course, Spanish History and Telenovela, the students also engaged in video conversation sessions with a native speaker using a program called Linguameeting. During each session, the coach would review information that was studied during the prior week with the students by asking questions and reviewing answers in the native language. This would allow the students to not only learn the subject matter, but bring each student closer to a project-based learning and expose them to cultural aspects since many cannot not physically travel abroad. These coaches would include personal accounts and information that perhaps were not addressed in class. Students responded to a post survey about the incorporation of Linguameeting in the course. Survey results support the outcome and the benefits of the use of Linguameeting for expanded “global learning” with hopes that this new approach to technology and video conversation will expand.

70. Rachel Pipes, Dr. Andrea Gazzaniga (Mentor)
Medical Malpractice Reform: A Research Study and Proposed Bill Revisions on Repeat Offenders within Kentucky’s Healthcare System

Because medical professionals have so much power, they easily escape any and all consequences for their actions. These doctors have people’s lives in their hands and should be held accountable for such. This research project consisted of observing the pros and cons of reforming medical malpractice law and determining whether or not it needs to be adjusted, specifically in terms of repeat offenders. I investigated Kentucky’s medical laws and how those correspond with federal medical laws. I approached this issue through legal research. Through the inspiration of several scholarly sources and documents it was determined that repeat offenders within our healthcare system were in fact being overlooked. Based on this conclusion, I determined that drafting a revised section of a medical malpractice bill was necessary, specifically in relation to the way repeat offenders are handled. The proposed section of the bill encompasses several solutions to reprimand repeat offenders and to aid the healthcare system in remaining objective.

71. Jacob Englert, Joe Nolan (Mentor)
Analyzing Outcomes of Non-Deterministic Events in Fluctuating Temporal Data

Statisticians often look to examine changes after a designated event of interest occurs. It is often the case that such an event eludes experimental control and must also be examined within the context of time. Analytic techniques must reflect the need to evaluate data where such events occur asynchronously in a non-deterministic fashion. In addition, hidden underlying temporal trends add substantial complexity. This research describes the methodology underlying a case study which incorporates a unique solution used to address data containing both an underlying trend over time and a pseudo-randomly occurring event in time.
72. Siriruay Methakitwarun, Kristie Vise (Mentor)
The Uncomfortable In-Between: Immigration and Identity

Each year, approximately one million people emigrate to the United States. On average, about 700 thousand of these immigrants go on to become US citizens. Yet, what we really don’t have is the information on how much the experience of being immigrated from an insider’s perspective through the expectation to assimilate completely shapes how the immigrants see themselves. Using the research method of autobiographical sociology, the author examines her own experiences immigrating to the US from Thailand at the age of 10 to address these questions: (1) How is cultural identity developed in immigrants (particularly children)? and (2) what influences the level to which an immigrant might assimilate to a new culture? The findings indicate that, although the author resisted assimilating to the host culture and maintained a seemingly strong identity as a "Thai person living in the US," a recent return visit to Thailand revealed the complexities of cultural identity for immigrants. This research sheds light on the ways in which the cultural identity of immigrant children evolves.

73. Kyle Houston, Dr. Nathan De Lee (Mentor)
Comparing Period Fitting Methods to Exoplanets in APOGEE

The APO Galactic Evolution Experiment (APOGEE) survey took high-resolution H-band, infrared, spectroscopy of 146,000 stars (as of SDSS-IV Data Release 12). Of these, 14,840 stars had at least 8 radial velocity (RV) epochs with baselines up to 3 years (~1000 days) making them suitable for orbit fitting. Of these, 14,840 stars had at least 8 radial velocity (RV) epochs with baselines up to 3 years, making them suitable for orbit fitting. In previous work, 382 of the 14,840 orbits were selected for inclusion in a gold sample of stars with well-characterized orbits. In our project, we have used both Lomb-Scargle and Fast chi-squared type periodograms to fit periods to APOGEE style simulated RV curves. Using these periods, we fitted a Keplerian orbit to each star and assigned it a semi-amplitude, eccentricity, argument of periastron, and epoch of periastron. We then compared these orbital elements to the known values for the simulated data to determine our detection efficiency. We then used these results to guide our interpretation of current fits to the gold sample.

74. Jessica Raines, Lauren Hawley, Onyinye Uwolloh, Mentors: Dr. Kimberly Breitenbecher & Dr. Kathleen Fuegen
The Effect of Nature on Pain Perception

The purpose of this study was to investigate the effects of nature on perception of pain. Previous research has indicated that focusing on pleasant stimuli leads to increased pain tolerance. Previous research has also indicated that patients in hospitals recovering from surgery had shorter stays and fewer surgical complications when their windows faced trees and nature in comparison to those whose windows faced a wall. We examined whether images of nature altered perceptions of pain more than pleasant non-nature images. Participants were randomly assigned to condition. Participants in the nature condition viewed a six-minute slideshow of pleasant nature images (e.g., trees, flowers, clouds). Participants in the pleasant, non-nature condition viewed a six-minute slideshow of pleasant, non-nature images (e.g., clowns, balloons, money). Participants in the control condition read neutral text from a style manual for six minutes. After completing this task, each participant was asked to submerge her hand in a refrigerated bath (water temperature = 4°C). The researcher recorded pain threshold (the elapsed time when the participant first felt pain) and pain tolerance (the total time the participant left her hand submerged). After removing her hand, the participant completed ratings of pain intensity, unpleasantness, and distress. We hypothesized that pain threshold and pain tolerance would be greatest among those who had viewed the pleasant, nature slideshow. We hypothesized that pain threshold and pain tolerance would be lowest among those who had read the neutral text. These results show that it may be beneficial for hospitals to incorporate more nature scenes such as windows or indoor plants into their facilities to improve patients’ pain perceptions while hospitalized. This study provides evidence for the effectiveness of a non-pharmacological method of pain management.

75. Shelby Diener, Dr. Bethany V. Bowling (Mentor)
Impact of PBTL on the Success of Underserved Students in Undergraduate Biology Courses

The use of active learning techniques in science courses has been shown to increase student success, particularly students coming from underserved backgrounds. More recent research has begun to focus on specific
ways to optimize active learning. In this study we analyzed the impact of problem-based team learning (PBTL) on underserved populations including first-generation college (self-reported), low-income (determined by Pell grant eligibility), and/or under-represented minority (self-reported) students. PBTL increases student engagement and teamwork, while reducing lecture time. We compared the percentage of underserved students who received a D, F, or W grade in a genetics course in the semesters before (2010-12) and after PBTL was implemented (2013-15). From the analysis it is clear that PBTL had a positive impact on student success rates overall, however there was not a disproportionate impact on underserved students. To further the research, data is currently being analyzed from an introductory biology course to determine the impact of PBTL. The goal of this research is to improve student success in undergraduate science courses and disseminate impactful practices.

76. Andrea Marroquin, Dr. Trent Garrison (Mentor)  
**Attitudes in the geoscience community on climate change in Kentucky**  
In the Fall of 2018, the Geology 294 Science and Policy class at Northern Kentucky University conducted a survey of all full-time geoscientist educators in the state of Kentucky who fall into the category of Lecturer, Instructor, Assistant Professor, Associate Professor, and Professor (adjuncts were not included). The purpose of which was to get a sense of attitudes on climate change in the geoscience community in Kentucky. The total number of geoscience educators that fit these parameters was 41. A Google Form was used to create the survey, which included six questions: name (for identification purposes only), academic rank, views on climate change, institution, sub-field of geologic research, and any other comments not covered. An email to all educators was sent in October of 2018. Respondents were allowed two weeks to complete the form and provide any feedback. Pending acceptance, results will be displayed in written and graph form at Posters at the Capitol on February 21, 2019. The hypothesis is that a majority of geoscience educators fall into the category of “climate change is occurring and human-caused emissions are to blame.” Results are pending.

**University of Kentucky**

1. Aaron Silverstein, Daimen Stolz, Emily Huffman, Dr. Warren Alilain (Mentor)  
**Exploring Approaches to Promote Respiratory Motor Plasticity Through Varied and Fixed Interval Intermittent Hypoxia**  
In the human population, spinal cord injury (SCI) most commonly occurs at the cervical level. Interruptions of descending pathways here can result in breathing motor deficits through paralysis of the diaphragm, sometimes necessitating mechanical ventilation for survival which greatly decreases patients’ quality of life. Fixed interval intermittent hypoxia (FIH) treatment is utilized in rat models to attenuate breathing motor deficits resulting from cervical SCI. FIH consists of the repeated, alternating exposure of a subject to consistent and equal durations of hypoxic and normoxic conditions. Specifically, this treatment induces a prolonged increase in phrenic motor output, a type of respiratory motor plasticity known as phrenic Long Term Facilitation. FIH exhibits similarity to the psychological construct of operant conditioning in which the increased incidence and persistence of a desired, spontaneous behavior is trained through reinforcement. As such, each interval of hypoxia can be construed as the period during which the subject responds with heightened respiratory drive and is subsequently reinforced by an interval of normoxia. Provided that FIH procedure is a form of operant conditioning, it can be optimized. Using the fixed or variable duration of the hypoxic interval as our independent variable, we hypothesize that Varied Interval Hypoxia (VIH) treatment will induce a greater, more prolonged increase in phrenic motor output than FIH. To test this hypothesis, we utilized electromyographic recording to assess our dependent variable of diaphragmatic activity. Rats treated by VIH after C2 Hemisection injury exhibited diaphragmatic output achieving 33.87±7.29% of maximum induced by nasal occlusion, compared to 19.20±5.63% in FIH treated animals. These data suggest that VIH may induce greater recovery than FIH after injury, though this trend is insignificant by unpaired t-test (p=0.1588). Further exploration will focus on timepoint of treatment post injury and on the greater optimization of FIH using ratio schedules of normoxic reinforcement.
2. Hannah Thompson, Dr. Janice Fernheimer (Mentor)

*Louisville Jewish Hospital’s “Tikkun Olam”: A Case Example of Continuity for American Jewish Hospitals*

According to Mary Wagner, the author of *Jewish Hospitals Yesterday and Today*, Jewish Hospitals emerged in the mid-19th century in the U.S. for several reasons: the Jewish American community's need to combat anti-Semitism, to provide services for its large and then-growing immigrant population, and to establish a place for Jewish medical professionals to work, since anti-Semitism prevented them from being employed elsewhere. Although, American Jews became increasingly more accepted as part of the broader American social and political milieu throughout the early 20th century, Jewish Hospitals persisted in cities across the U.S. until the 1970s. To date roughly 22 of originally 113 Jewish hospitals remain. Among them, is Jewish hospital in Louisville, KY, first established in 1903 by a group of Jewish physicians and the Jewish community of Louisville. This study considers Louisville Jewish Hospital as an unusual case example of a Jewish hospital that continues to exist and preserve its Jewish heritage by using Jewish concepts to guide its principles of care, despite a shrinking local Jewish population. Although Louisville’s Jewish Hospital faces economic hardships it continues to impact the global medical community through its medical advancements, such as the nation's first hand transplant. To carefully investigate the way Jewish Hospital Louisville connects its Jewish values to its medical innovations, we conducted three original oral history interviews with leaders of Jewish Hospital to determine how Jewish Hospital had impacted the local community by following the Jewish concept, Tikkun Olam, in their mission for social justice, advocacy, philanthropy, and medical advancement. The primary source interviews with Rabbi Dr. Nadia Siritsky, Dr. Gerald Temes, and Mr. Robert Waterman call attention to the ways Louisville Jewish Hospital adjusted to new pressures, while honoring its Jewish heritage, thus providing a useful case example for other U.S. Jewish hospitals.

3. Megan Woodrum, Mentors: Dr. Joao Costa & Melissa Cantor

*Using an implantable microchip for measuring body temperature in dairy calves*

Rectal temperature is commonly used to measure the fever response accompanying illness, but is a labor intensive procedure. The objective of this study was to validate a location site for a passive temperature reading microchip against a rectal thermometer temperature in pre-weaned dairy calves. Before calf enrollment, a water bath study validated temperature readings between and within microchips against rectal thermometer readings. Holstein bull-calves (n=12) were implanted with passive radio frequency identification (RFID) microchips in three locations: subcutaneously behind the ear (EAR), subcutaneously by the upper scapula (SCAP), and intramuscularly in the trapezius muscle (NECK). One week after implantation, microchip temperature readings were recorded using a RFID reader hourly for 24 hours; a tympanic and rectal temperature were simultaneously taken. Pearson correlations between the microchip readings, the rectal, and the tympanic temperatures were performed. For the water bath, microchips readings were strongly correlated against the rectal thermometer (r = 0.963; P < 0.001). For the observational study, rectal temperature had negligible correlations to tympanic, EAR, NECK, and SCAP with the highest correlation between rectal and tympanic temperature (median r = 0.19; P ≤ 0.81). The correlations between the microchips SCAP vs NECK (median [Q1, Q3] r = 0.75 [0.60 – 0.84]; P < 0.02) and EAR vs NECK (r = 0.78 [0.73 – 0.84]; P < 0.003) were high. SCAP vs EAR were moderately correlated (r = 0.58 [0.45 – 0.73]; P < 0.44). These results suggest that an implantable microchip temperature readings are related independent of location, but not highly correlated with rectal temperature. Further research should investigate the implantable temperature reading microchip in large herd settings.

4. Hannah Newberry, Dr. Janice Fernheimer (Mentor)

*‘Pa-jew-cah’: Reclaiming the History of Paducah’s Jewish Community*

When imagining Kentucky's religious heritage, most people picture churches, not synagogues. Yet historian Lee Shai Weissbach demonstrates that Kentucky's first synagogue was built in Louisville in 1849, and Jews had been living in the Commonwealth almost as long as it existed. Kentucky’s Jewish heritage is rich and varied as illustrated by Arwen Donahue’s *This is Home Now: Kentucky’s Holocaust Survivors Speak*, Deborah Weiner’s *Coalfield Jews: An Appalachian History*, and Amy Shevitz’s *Jewish Communities on the Ohio River: A History*. While each of these texts refers to Paducah as an early and important Jewish settlement, none offers exclusive scholarly attention to what is now Kentucky’s third largest Jewish population center.
Supported by the Jewish Heritage Fund for Excellence and the UK Jewish Studies Summer Undergraduate Research Award, this study seeks to fill this gap in scholarship and provide more visibility to Jewish Kentucky generally, and specifically, Jewish Paducah. The author conducted three original oral history interviews, two with individuals who had lived memory of the Paducah Jewish community and one who is an active participant in that community. By closely analyzing the extant scholarship to contextualize first-hand accounts of Paducah’s Jewish community, we call attention to a history that few know about. This study seeks to promote understanding of one of Paducah’s most historically important ethnic groups, and thus show how Paducah’s, as well as Kentucky’s, heritage is far more diverse and inclusive than outsiders often realize.

5. Daimen Stoltz, Aaron Silverstein, Emily Huffman, Dr. Warren Alilain (Mentor)  
Balancing Neuroprotection with Functional Recovery: The Role of the Perineuronal Net in Preventing Excitotoxicity after Spinal Cord Injury  

In spinal cord injury (SCI), initial mechanical trauma causes debilitating primary damage to neural cells and blood vessels. Following this, secondary cascades of downstream events occur, including inflammation, ischemia, and excitotoxicity — an increase in intracellular Ca2+ concentration from overactive glutamate (Glu) receptor activity leading to cell death. Additionally, there is an upregulation of the perineuronal net (PNN), a lattice-like structure of the extracellular matrix which modulates neural communication and homeostasis. The PNN is partially composed of negatively charged chondroitin sulfate proteoglycans (CSPGs). While the PNN and CSPGs can support plasticity and neuronal growth during development, after injury these ECM molecules are inhibitory to regeneration, sprouting and plasticity. However, administration of the bacterial enzyme chondroitinase ABC (ChABC) can digest these inhibitory factors and promote functional recovery. What remains unknown is the impact of removing these inhibitory factors soon after injury. We hypothesize that negatively charged CSPGs are upregulated after SCI as a neuroprotective response that attenuates excitotoxicity by acting as a sink for Ca2+. To test our hypothesis, we induced excitotoxicity by injecting rats with a threshold dose of Glu with or without ChABC utilizing the well defined respiratory motor system. 59% of SCI occurs at the cervical level, and leading causes of death and restriction of independence in these cases stem from mechanical ventilation. Therefore, we administered the dose intraspinaly at the C4 level and paired treatment with intrapleural injection of cholera toxin-B to retrogradely label the phrenic motor neuron pool which innervates the diaphragm. our early findings suggest that animals treated with both Glu and ChABC had more extensive cell death. We believe this implies that following SCI, the body’s main focus is to survive and not necessarily to preserve function. CSPG upregulation could promote survival and CNS tissue preservation at the expense of plasticity and functional regeneration.

6. Sarah Anderson, Mentors: Dr. Kristen Ashford & Dr. Lisa McGee  
Quality of Care Strategies and the Subsequent Improvement of Kangaroo Care Incidence Rates in Premature Infants  

The benefits of kangaroo care (KC) has long been studied and proven. Despite the research, incidence rates of KC are low in the neonatal ICU at the Kentucky Children’s Hospital. Some barriers to KC exist in our NICU and this study strives to address them. This study aims to develop and implement strategies to increase utilization of KC from 41% to 75% for eligible infants. KC occurrence was monitored in 364 infants with birth weight ≤ 1250 grams. Strategies implemented were education of nurses, improved nurse-to-patient ratio, emphasis of KC in multidisciplinary rounding, improved documentation, obtaining securement devices to prevent dislodgement of invasive lines, involvement of respiratory therapists in transferring intubated infants, and providing pamphlets and one-on-one education to parents. Weekly KC occurrence was reviewed on all NICU infants with birth weight ≤ 1250 grams. KC utilization was analyzed in two separate periods- August through December 2016 and January through May 2017. The mean utilization for the 2016 period was 41% and the mean utilization for the 2017 period was 61%. This reflects a 20% increase in occurrence following the measures implemented to improve KC rates (p=0.02, t-test for independent variables). Increased use of KC occurred due to implementation of a variety of measures. These measures and results indicate that establishing kangaroo care as a standard of care in very low birth weight infants is obtainable. Audits will continue being collected each month to verify a continued increase.
7. Brittany Auvil, Susan Barron (Mentor)

*Can Solidago Nemoralis Reduce Deficits Following Prenatal Ethanol Exposure in a Rodent Model*

Alcohol ingestion during pregnancy can be detrimental to developing fetuses and can result in Fetal Alcohol Syndrome Disorder (FASD). FASD presents itself via behavioral, learning and cognition deficits and facial abnormalities. Existing studies suggest that drugs including Solidago nemoralis can reduce the effects of FASD by acting as an agonist on the alpha-7-nicotinic-acetylcholine-receptor. In the present study, ethanol was administered during a period of CNS development that overlaps the third trimester “brain growth spurt” of human pregnancy. ETOH (6g/kg/day) was given to Sprague-Dawley rat offspring on post-natal days (PND) 1-7. On PND 8, offspring were given either Solidago nemoralis or saline injections. To test for spatial learning and memory, a water maze paradigm was used in which the subject had to use external cues and an internal map to find a platform hidden under the water surface conducted on PND 40-45. The group that received ETOH paired with the Solidago nemoralis showed fewer deficits than the group that received only ETOH. The results in this study support the hypothesis that “third trimester” ETOH exposure impairs spatial learning and that a single administration of ETOH can result in deficits. It also showed that deficits associated with fetal alcohol exposure can be treated with Solidago nemoralis to help reduce effects of FASD and, in some cases, eliminate effects of FASD. The possible role of the alpha 7 in effects of prenatal ETOH exposure may also suggest that Solidago nemoralis has antioxidant properties. Further research is needed to understand the underlying mechanisms.

8. Umair Bhutto, Dr. Robin Cooper (Mentor)

*Pharmacological identification of cholinergic receptor subtypes in modulation of neural circuits in Drosophila melanogaster*

Acetylcholine (ACh) is an abundant neurotransmitter and neuromodulator in many species. In Drosophila melanogaster ACh is the neurotransmitter used in peripheral sensory neurons and is a primary excitatory neurotransmitter and neuromodulator within the central nervous system (CNS). The receptors that facilitate synaptic transmission at cholinergic synapses and beyond are divided into two broad subtypes: the ionotropic nicotinic acetylcholine receptors (nAChRs) and the metabotropic muscarinic acetylcholine receptors (mAChRs). This receptor classification is shared in both mammals and insects; however, both the pharmacological and functional characterization of these receptors within the Drosophila nervous system has lagged behind its mammalian model counterparts. In order to identify the impact of ACh receptor subtypes in regulating the performance of select neural circuits within the larval CNS, we have used a behavioral and electrophysiological approach to assess cholinergic modulation of locomotion, feeding, and sensory-CNS-motor (sensorimotor) circuit activity. We have exposed intact 3rd instar larvae to ACh agonists and antagonists to observe modulation of these behaviors and also expose an intact nervous system directly to solutions containing these compounds to address their influence on sensorimotor circuit efficacy. We reveal that chronic ACh exposure enhances locomotion but reduces feeding behavior and acute application excites a sensorimotor circuit. Nicotine exposure reduces activity through suspected rapid receptor desensitization. Moreover, chronic muscarine exposure reduces locomotion and feeding, but acute exposure enhances sensorimotor circuit activity. These results suggest a role for both nAChRs and mAChRs in modulating these select circuits and illuminates important pharmacological properties of cholinergic receptor subtypes in vivo.

9. Usman Hamid, Dr. Michael T. Bardo

*Effects of Naltrexone on Alcohol and Nicotine Use in Female P Rats*

Alcohol is the most commonly abused substance worldwide. It is often co-abused with nicotine, which increases the difficulty of cessation of both alcohol and nicotine. Despite having similar mechanisms of action, there is no single medication to treat the co-abuse. The objective of the current study is to analyze the effects of the opiate antagonist naltrexone on alcohol consumption and the co-use of alcohol and nicotine in female alcohol-prefering (P) rats. Six female P rats were trained in two phases. During Phase 1 (ethanol access), subjects had 2-bottle choice sessions with 0% (water) and 15% ethanol. In Phase 2 (concurrent access), rats still had access to ethanol bottles, but were also given access to nicotine (0.3 mg/kg/infusion, i.v.) using a standard 2-lever procedure (active vs. inactive levers). Naltrexone (0.15, 0.3, or 0.6 mg/kg s.c.) treatments were administered to determine its effects on alcohol and nicotine consumption. Half the ani-
mals received naltrexone treatments during Phase 1, and half received treatments during Phase 2. During Phase 1 (ethanol access), naltrexone had no significant effect on ethanol or water consumption. Results from Phase 2 (concurrent access) showed that naltrexone dose-dependently reduced ethanol consumption, and reduced water consumption at the highest dose (0.6 mg/kg). Naltrexone did not have any significant effects on active lever presses for nicotine, but reduced inactive lever presses only at the lowest dose (0.15 mg/kg). Naltrexone is more effective in treating alcohol use when tested in combination with nicotine rather than when tested alone.

10. Sydney Adkisson, Dr. Sabrina Brown (Mentor)
**Contributing Factors leading to Suicide in Children: Kentucky 2005-2016**
Suicide regularly ranks among the top ten leading causes of death in the United States. In ages 10 to 24, suicide is the second leading cause of death. The purpose of this study was to develop a coding scheme to determine reoccurring contributing factors in child suicides from 2005-2016 in Kentucky. Research is limited in the United States on suicides in children and more specifically precipitating circumstances leading to a child dying by suicide. We used the Kentucky Violent Death Reporting System data from 2005-2016. A subset of cases was generated that included all child suicides in children aged 10-21. A mixed method statistical approach is being used; the first step is a thematic qualitative using the narrative reports from death scene investigators. Once themes have been identified, and a coding scheme developed, reoccurring contributing factors to suicides were coded for further quantitative analysis. Suicide is a widespread public health issue. With rates of suicide rising education and raising awareness about contributing factors to suicide in children and young adults is critical. The general public, specifically parents, guardians, family members, educators, and other mandatory reporters should be aware of the signs and factors that could contribute to a suicide, in order to prevent these tragic deaths.

11. Cierra Waller, Dr. Dhananjay Ravat (Mentor)
**The Undeniable Attraction of Lunar Swirls**
Lunar swirls are complex patterns on the Moon with distinct brightness signatures and magnetic characteristics. Current research has suggested that the formation of lunar swirls relies on local magnetic fields to shield impinging solar wind, based on a shift in electromagnetic wavelength peaks related to solar radiation and space weathering. Our research combined recent models and methods to characterize these anomalies at the surface of the Moon, exploring the effects of field strength and position. We have produced a high resolution map of a famous swirl named Reiner Gamma using magnetic dipole modeling. These maps and models are considered when examining lunar landing locations and potential colony locations on the Moon.

12. Caroline Miracle, Lindsey Fay (Mentor)
**Perceptions of Changing from an Open Bay NICU Design to Single Patient Family Rooms**
Advancements in evidence-based design and a greater focus on patient and family-centered care, the inclusion of single patient rooms, and improvements in technology, have led to the implementation of single-family rooms versus the traditional open bay NICU design. The single-family room system was implemented with the goals of increasing privacy for families, offering better control over environmental stimuli, and reducing infections. However, these changes have additionally been found to have a significant impact on staff perceptions of the environment relative to satisfaction and efficiency of care. The challenge now remains to weigh the implications of these changes in the patient-care process relative to satisfaction and design. Prior research reflects an increase in staff satisfaction with the change from open bay to single-patient rooms. In a study by Bosch, Bledsoe, & Jenzarli (2012), staff rated the single-family (NICU) room more positively relative to quality of work environment, quality of patient care, job quality, safety and security, interaction with technology, and overall satisfaction. An interdisciplinary team has conducted a multi-phased pre- and post-occupancy evaluation of a clinical unit, NICU, moving from the open bay system to single-family rooms. The concerns for the staff centered in on safety, quality of care, staff safety and visibility to babies. Data collection includes focus groups, behavioral mapping, room usage, time studies, and pedometer measurements, for post-occupancy of each space, in order to yield quali-
tative and quantitative outcomes. This study has important implications for understanding efficiency in healthcare design. This data would expose both positive and negative attributes of the single-family room design versus the open bay system. This study would influence future design considerations in NICU design solutions.

13. Shelby Buckman, Dr. William Hoyt (Mentor)
Effects of Shifts in the Local Tax Base on Economic Outlook: Evidence from Kentucky Cities
Taxes are mostly viewed as a necessary burden to fund public goods, but the optimal level of taxation is subject to much debate. Oftentimes this debate centers around the burden imposed on taxpayers and the subsequent benefits provided by the public services and amenities their taxes finance. Too often taxpayers and elected officials focus wholly on the short-term impacts of changes in tax rates and do not fully consider the possible long run effects. The City of Henderson, Kentucky recently passed a new ordinance which increased the occupational payroll tax rate and simultaneously decreased the real estate tax rate. This shift is projected to be neutral in terms of net revenue. My purpose here is to gain an understanding of how the composition of revenue might affect economic growth and the industrial composition of a city. As there is no change in net tax revenue, I expect little or no impact on economic growth. For this research project, a city’s economic growth is measured by population and employment in the city limits. To test this, panel data was gathered on other similar Kentucky cities to control for economic and demographic variables that otherwise might account for the changes in economic growth. My finding show limited or weak evidence of significant impacts of shifts in local tax rates on economic growth. Overall, it appears that while local taxes have a statistically significant effect on a city’s economic growth, they do not have a large enough impact to be considered economically significant. While the two-way fixed effects models serve as a basis on how shifts in local taxes may impact the economic development of Kentucky cities, more work will have to be done in the future to definitively prove causation.

14. Caiti Griffiths, Jenna Jodts, Elizabeth Lorch (Mentor)
Comprehension Self-Efficacy Following a Narrative Structure Intervention
Attention Deficit Hyperactivity Disorder (ADHD) includes inappropriate levels of hyperactivity, inattentiveness, and impulsivity. Children with ADHD encounter reading comprehension problems more often than their peers. Although medications prescribed for ADHD can improve attention during school, they do not address deficits in higher-order functioning. Children with ADHD often experience academic failure, which may influence self-efficacy, or belief of their ability to succeed academically. They tend to rate themselves higher than their peers in self-efficacy, but they are quicker to give up when faced with difficult situations. We examined the change in self-efficacy following participation in one of three interventions: a Narrative Structure (NS) intervention targeting specific comprehension problems exhibited by children with ADHD, a Reciprocal Teaching (RT) intervention focusing on comprehension strategies effective for all struggling readers, and a Social Problem-Solving (PS) intervention to teach pro-social behaviors and emotional self-regulation. Participants were 64 third and fourth grade children who were at risk for ADHD and judged by their teachers to have narrative comprehension deficits. All were randomly assigned to participate in one intervention. Pre-test and post-test measures included ratings of self-efficacy related to each intervention topic. Participants in all interventions answered “I can do it by myself” to comprehension-related statements (NS subscale) at an increased rate from pre-test to post-test and the increase was greatest for participants in a comprehension skills intervention (NS and RT). The NS group showed the largest increase for NS subscale ratings from pre-test (M = 59.63, SD = 26.78) to post-test (M = 75.15, SD = 24.44), and RT participants’ NS subscale ratings also increased from pre-test (M = 55.71, SD = 24.70) to post-test (M = 70.95, SD = 25.85). The PS group showed the smallest NS subscale increase from pre-test (M = 51.95, SD = 18.36) to post-test (M = 58.44, SD = 22.55).

15. Emily Huffman, Daimen Stoltz, Aaron Silverstein, Dr. Warren Alilain (Mentor)
Clearing Up the Phrenic Motor Neuron Survival Debate After Cervical Spinal Cord Injury
The diaphragm is the major muscle involved in breathing. Innervated by the phrenic nerve, it is controlled by phrenic motor neurons (PMNs), which receive descending inputs from the medulla. When these bulbospinal connections are spared, the PMNs can survive for long periods after a cervical spinal cord injury. However, the mechanism responsible for their survival is not well understood. Several hypotheses have been proposed, including the idea that the sensory input from the remaining spinal cord facilitates survival of the PMNs. In this study, we investigated the role of sensory input in phrenic motor neuron survival after cervical spinal cord injury. We used a rat model of cervical spinal cord injury and measured the survival of phrenic motor neurons using an in situ hybridization technique. Our results showed that sensory input is not necessary for the survival of phrenic motor neurons after cervical spinal cord injury. Instead, we found that the survival of phrenic motor neurons is dependent on the integrity of the lower motor neuron pool. This finding has important implications for understanding the mechanisms of phrenic motor neuron survival after spinal cord injury and for developing strategies to promote survival of these neurons in clinical settings.
nal-pathways are damaged or severed in spinal cord injury (SCI), the external effects of injury are seen immediately, as the diaphragm becomes paralyzed and the individual loses the ability to breathe. However, the effect of injury on the internal circuitry, specifically PMN survival, is largely unknown. Contradictory evidence has surfaced, suggesting that there is large PMN death after injury, or conversely, that there is an absence of PMN death. However, histological techniques utilized in these studies have exposed the data to factors through which certainty cannot be guaranteed. These discrepancies are important to parse out because characterization of PMN survival is integral to studies of plasticity. The present study attempted to bridge this gap in knowledge and used XClarity clearing methods to accurately determine PMN survival after cervical SCI. XClarity transforms the tissue into a transparent medium. This allows for the whole spinal cord to be analyzed without tissue loss, as is common in other histological techniques. In this study, Sprague-Dawley rats were hemisected at the second level of the cervical spinal cord (c2Hx), which is a common experimental model of cervical SCI. Animals were divided into three groups: naïve, two weeks post-c2Hx, and five weeks post-c2Hx. Before perfusion, these animals were intrapleurally injected bilaterally with CTB-488, a retrograde tracer that labels PMNs. Depending on their group assignment, animals were perfused at five weeks post-injury, two weeks post-injury, or immediately after CTB-488 uptake. Cords were then processed with XClarity and PMN survival was characterized with Lightsheet microscopy. Analysis of PMNs is ongoing, however, preliminary data suggests that XClarity techniques are the preferable route to characterize PMN survival after injury.

16. Kenyatta Mitchell, Anastasia Curwood (Mentor)

Civil Rights Coalitions during the 1960s in Mississippi

Over the past century, African Americans took part in building organizations to bring about equal rights and social change. Many organizations formed before Jim Crow but reached prominence during the civil rights movement. The Civil Rights movement of the 1950s and 1960s were built on long-term strategies for gaining the right to vote, education, housing, and freedom from discrimination. Through organized nonviolent protests, the civil rights movement broke the pattern of segregation and began to help bring social change at the national level through the Civil Rights Act of 1964 and the Voting Rights Act of 1965. Throughout this time period, African American groups came together to combat racism and inequalities. Prior to the Civil Rights Era, the National Association for the Advancement of Colored People (NAACP) was founded in 1909 to advance justice for African Americans. One of the organizations, founded in 1957, was the Southern Christian Leadership Conference (SCLC), established by Martin Luther King Jr. The Congress of Racial Equality (CORE), founded in 1942, got excited about the student activism and invited students to form their own organization called the Student Nonviolent Coordinating Committee (SNCC) founded in 1960. These organizations came together in a Council of Federated Organizations (COFO) by 1962 in Mississippi; Council of Federated Organizations (COFO) is the primary focus of my research. My findings include campaign strategies from coalitions for citizen involvement, letters written to companies demonstrating discrimination against African-Americans, and details of meetings that prepared for events during Civil Rights. Dialogue and persuasion were very intentional in my research, the information was very detailed and civil rights participants had to prepare to be arrested or die. Coalitions knew that it was better to unite themselves than to try and accomplish things on their own. People who brought national change were civilians who had no national platform.

17. Bryan Kirshe, Sherali Zeadally (Mentor)

Analysis of Vulnerabilities of Internet of Things (IoT) Devices Online

In the last decade, we have witnessed an exponential growth in various types of devices (smartphones, wearable devices, smart televisions, and so on) which have become an integral part of our daily lives. Advances in hardware and software technologies have made many of these devices smaller, more powerful and affordable. The majority of devices incorporate networking and sensing technologies that enable them to communicate and exchange information with other networked objects also referred to as the Internet of Things (IoT). IoT systems and devices have been deployed in various application domain including the home, agriculture, transportation, military, industry, and many other sectors. The connectivity of IoT devices to the Internet make them vulnerable to attackers if they are not properly configured and secured. Using
an IoT search engine called Shodan along with Common Vulnerabilities and Exposures (CVE’s), we investigated and analyzed various vulnerabilities (such as public key disclosure, buffer overflow, insecure Wi-Fi, unauthenticated router access) associated with IoT devices currently being used in critical infrastructures (e.g., industrial control systems), home IoT (e.g., web cameras) and networking devices (e.g., routers). Our results revealed that over 153,280,000 IoT devices are connected to the Internet in the United States out of which at least 3,200,000 are vulnerable to future attacks. In the State of Kentucky, over 525,000 devices IoT devices are connected to the Internet at least 2,100 were found to be vulnerable. Most of the vulnerabilities were associated with routers, and the Secure Shell (SSH) protocol. The outcomes of this work shed light on how vulnerable current IoT devices are and the importance of securing them in order to mitigate future cyberattacks.

University of Louisville

33. Maria Shields, Dr. Christopher J. Frost (Mentor)

**Determining the Cyanogenic Potential of Two Land Races of Lima Bean, Phaseolus lunatus**

Plants use a variety of chemical mechanisms to defend themselves against insect herbivory. One example of a potent chemical defense is cyanide, which occurs in a number of plant higher taxa, including various legume species. In these plants, cyanide is stored in undamaged plant cells as cyanogenic glycosides (CG), in which cyanide is conjugated with a hexose monosaccharide; cyanide is released when plant tissue is damaged and the CGs interact with beta-glucosidase. The purpose of our study was to determine the cyanogenic potential (CP) of two cultivated varieties of lima bean, Phaseolus lunatus. We have adapted a previously established CP protocol for use with small sample volumes. We were able to establish a wide concentration range of linear responses for the CP protocol, and initially have shown CP of ~150 micromoles per gram in field lima bean leaves. We are now using this protocol to assess whether CP is inducible in lima bean plants attacked by two different species of insect herbivores, the beet armyworm (Spodoptera exigua) and the velvetbean worm (Anticarsia gemmatalis). Quantifying plant defense chemistry is essential for understanding ecological interactions and their impact on human health.

34. Garrett McGrady, Dr. Kevin Walsh (Mentor)

**Embedding Sensing Capabilities in FDM-Printed Objects**

The objective of this work is to demonstrate how the flexure properties of ABS plastic in a 3D printed object can be exploited to enable embedded pressure sensing capabilities. Designing non-static 3D printed parts broadens the scope of fused deposition modeling (FDM) to include printable ‘smart’ objects that utilize their intrinsic material properties to act as microphones, load sensors, accelerometers, etc. This research undertakes the task of developing a 3D printed pressure sensor to show proof-of-concept for non-static prints. Sensors with diaphragms of 1mm thickness deform more sensitively than 2mm diaphragms at >1psi. Securing a strain gage directly on top of the diaphragm traced a reference pressure more closely than diaphragms with the strain gage embedded halfway into the diaphragm. An additional strain gage was suspended above the secured gage, inside a 3D printed cavity. The additional gage allowed for a half-bridge circuit in lieu of the quarter-bridge circuit; furthermore, the half-bridge circuit minimized drift due to temperature change. The ABS diaphragm showed no signs of elastic hysteresis or nonlinear buckling. When sealed with 100% acetone, diaphragms leaked ~50x slower than control sensors. Each of the ‘optimal’ sensors showed precision to themselves when exposed to sustained pressure. However, consistency from sensor to sensor was lacking—an expected symptom of FDM. The self-precision of each of the final generation sensors indicates that ‘smart’ objects printed using an FDM process could be individually calibrated to make repeatable recordings. This work demonstrates a concept overlooked previous to now—FDM printed objects are not limited to static models. Altering FDM’s bottom-up process can allow for easily embedding sensing elements that result in printed objects which are functional on the mesoscale.
35. Lloyd Bartley, Dr. Chi Li (Mentor)

**A CRISPR platform for rapid and inducible genome editing in human non-small cell lung cancer cells**

Non-small cell lung cancer (NSCLC) accounts for about 85% of lung cancer, which is the leading cause of cancer death in the world. High mortality rate associated with NSCLC is partially attributed to the limited understanding of NSCLC as well as ineffective therapeutic treatments. The initiation and progression of NSCLC involves genetic changes leading to alterations in the control of tissue development and homeostatic maintenance. Better knowledge about these genetic abnormalities is imperative for developing new chemotherapeutic drugs for NSCLC. Recent research demonstrates that the expression of paraoxonase 2 (PON2), a lactonase/arylesterase with anti-oxidant properties, are markedly enhanced in cancer tissues of NSCLC patients compared with corresponding adjacent non-tumorous tissues. Importantly, increased PON2 expression likely contributes to the resistance of NSCLC cells to classical anti-NSCLC therapeutic drugs. We found that stably reduced PON2 expression by siRNA reduced the proliferation of NSCLC cells but not their untransformed epithelia counterparts. To further elucidate the role of PON2 in NSCLC cell proliferation, we applied two newly developed gene-editing systems, TALEN and CRISPR/Cas, in the NSCLC cell line NCI-H1299. Our data indicated that Cas9 expression was induced by exogenous doxycycline in NSCLC cells in a reversible fashion. The goal of this study is to establish an efficient and scalable experimental approach interrupting the expression of a gene (e.g. PON2) in NSCLC cells, which provides a platform to investigate how changes in gene expression modulate NSCLC cell proliferation.

36. Noela Botaka, Mentors: Susana Perez-Martinez, Dr. Liang Bao, Parul Singh, & Dr. Mark Running

**Prenylation in the Moss Physcomitrella patens**

Protein prenylation is a post-translational modification that involves the addition of lipid groups to the end of a target protein and is necessary for protein activity. Prenylation has important roles in the cell: targeting and localizing proteins to subcellular compartments and promoting protein-protein interactions. Recently, we have found Protein Prenyltransferase Alpha Subunit-like (PPAL), which shares structural similarities to known prenylation enzymes. However, the biochemical function of PPAL is still unknown. PPAL is present in a single copy in other plants examined to date but is present in two copies in moss. Knockouts in our lab of either PpPAL1 or PpPAL2 in moss P. patens has proven to be lethal, suggesting that PpPAL1 and PpPAL2 are essential for survival. Our past study using plant Arabidopsis revealed that PPAL is required for sugar metabolism and development. This study was designed to expand our preliminary study across plants and explore the role that PPAL1 and PPAL2 play in growth, development, and sugar metabolism in moss P. patens. Gene knock-down approaches was used to reduce the function of PpPPAL1 and PpPPAL2 for in-depth phenotypic studies. By synthesizing an inducible artificial microRNA and growing the PpPPAL1 and PpPPAL2 amiRNA moss transformant in DMSO/BETA-estradiol medium, we reduced the expression levels of PpPPAL1 and PpPPAL2. Phenotypic changes were examined under the microscope and the results showed that PpPPAL1 and PpPPAL2 knockdowns had fewer gametophores and fewer caulonema, structures that are required for reproduction and polar cell elongation respectively. Ultimately, our data reveals PpPPAL1 and PpPPAL2 knockdowns exhibit reduced growth and propagation, although knockdown lines are still viable, suggesting that further exploration of metabolic processes is needed. Studying PPAL1 and PPAL2 can provide us more information as to conserved prenylation mechanisms and their function, which in turn has applications to biofuels and developmental diseases.

37. Kennedy Walls, Leah Siskind (Mentor)

**Repeated administration of cisplatin increases EGFR/EGFR activation and renal fibrosis in Kras4bG12D lung adenocarcinoma-bearing mice, but kidney injury is further exacerbated with erlotinib/cisplatin combination treatment**

Cisplatin (CDDP) is a first-choice therapy for many cancers, but 30% of patients develop acute kidney injury (AKI), which can progress to chronic kidney disease (CKD). Currently, there are no therapeutic interventions for CDDP-induced AKI or CKD. Clinically, only cancer patients receive CDDP, and it is administered in repeated, low doses to curtail CDDP nephrotoxicity. Previously, we optimized a repeated dosing regimen of CDDP (7mg/kg 1x/wk for 4wks), which causes CKD in mice, but the effect of cancer in this model has yet to be examined. Our goal was to determine how incorporating cancer into our mouse model of CDDP nephrotoxicity may alter kidney injury. We utilized a Kras4bG12D transgenic mouse that develops lung adenocarcinoma and treated non-cancer and cancer mice with repeated CDDP dosing. Indices of kidney injury, function, and renal
fibrosis were obtained using ELISAs, qRT-PCR, and IHC staining for repeated CDDP and subsequent erlotinib studies. CDDP-treated cancer mice had lower survival and worsened fibrosis as indicated by Sirius red staining and myofibroblast levels compared to CDDP-treated non-cancer mice. Western blot analysis indicated CDDP-treated cancer mice had increased EGFR/pEGFR Y1068 levels. Thus, we hypothesized treating cancer mice with erlotinib (EGFR inhibitor) in combination with CDDP would decrease EGFR activation and subsequently renal fibrosis. Administration of erlotinib as a renoprotective (25mg/kg 1x/day for 7 days) with one dose of 7mg/kg CDDP caused severe AKI compared to CDDP-only group. Additionally, we used erlotinib as an injury-ameliorating agent by administering erlotinib (25mg/kg 1x/day for 30 days) after repeated dosing of CDDP in cancer mice. Using a lung-adenocarcinoma model with our mouse model of CDDP kidney injury, we have shown cancerous mice have worsened AKI/CKD when treated with CDDP. Additionally, targeting EGFR with erlotinib further exacerbated renal injury. Results obtained using erlotinib post-CDDP treatment to ameliorate renal fibrosis will require follow-up studies.

38. Alisha Deshmukh, Shirish Barve (Mentor)

**Histone Deacetylation is the Primary Epigenetic Mechanism for Silencing of Tumor Suppressor Gene - Tissue Factor Pathway Inhibitor-2 in Hepatocellular Carcinoma Cells**

Hepatocellular carcinoma (HCC) is the third leading cause of cancer related mortality worldwide. With a survival rate of less than 5 percent, a therapeutic treatment is desperately needed to manage this disease. Many epigenetic mechanisms that underlay HCC are being identified. A frequently silenced pathway tissue factor pathway inhibitor-2 (TFPI-2) is a critical tumor suppressor gene. In HCC, inactivation of TFPI-2 leads to tumor growth. Recent research indicated Fas L plays a major role in apoptosis as part of HCC. For the purposes of this study, the phychochemical Curcumin was explored to observe its possible effects on the epigenetic mechanisms underlying HCC. HCC cells underwent curcumin treatment and were examined via real-time polymerase chain reaction (Real-time PCR) chromatin immunoprecipitation (ChIP). Real-time PCR was used to inspect cellular mRNA and protein levels, while ChIP PCR assays were used to check promoter-associated chromatin modifications. As suspected, curcumin effectively reactivated TFPI-2 and upregulated FasL gene expression. Upon further investigation, histone H3 acetylation, which actively correlates with gene transcription, was noticed as well. Overall, curcumin was found to effectively reduce the invasiveness of HCC and cell capability.

39. Caleb Bridgewater, Dr. Haixun Guo (Mentor)

**Development of a PD-L1 PET Imaging Biomarker**

Immunotherapy strategies are very promising treatments for cancer patients. Specifically, Immune checkpoint inhibitor therapy focusing on the PD-1/PD-L1 pathway shows long-lasting positive results in many cancer patients. Unfortunately, not all the patients can benefit from this highly effective treatment. Hence, there is a great need for predictive biomarkers. Immunohistochemical (IHC) staining has been used as a way of predicting patient response, yet shows many problems. For example, IHC utilizes an invasive biopsy and sample fixing, which creates an incomplete and delayed picture of the patient’s biochemistry and the tumor microenvironment, consequently ignoring metastases. The purpose of this study is to develop PET imaging biomarkers for predicting immunotherapy outcomes. To synthesize the PD-L1 PET imaging biomarker, a F(ab’)2 antibody fragment was created by pepsin digestion of IgG anti-mouse PD-L1 antibody. This product was purified via SEC FPLC and characterized by SDS-Page. Then the chelator Deferoxamine-SCN (Df) was covalently conjugated onto the F(ab’)2 fragment. To create a viable imaging agent, the Df-F(ab’)2 protein was radiolabeled with Zirconium-89. This radiolabeled 89Zr-Df-F(ab’)2 protein was then injected into naïve and B16F10 melanoma mice for imaging and biodistribution to determine the imaging contrast and pharmacokinetics of the developed biomarker. The radiolabeled antibody fragment PET imaging biomarker, 89Zr-Df-F(ab’)2, was successfully synthesized with high radiochemical yield and PD-L1-specificity. 89Zr-Df-F(ab’)2 showed superior imaging contrast in B16F10 melanoma-bearing C57 black mouse models at 2 hours post-injection when compared to the full antibody counterpart. Biodistribution data showed a significant reduction in liver uptake of the fragmented imaging agent as well. The PD-L1 PET imaging biomarker 89Zr-Df-F(ab’)2 was successfully synthesized, purified, and characterized. In the B16F10 melanoma C57 black mouse model the developed 89Zr-Df-F(ab’)2 shows superior imaging contrast over its full antibody counterpart. This novel biomarker offers the ability to monitor PD-L1 levels in live animal models, and potentially cancer patients for a more personalized immune checkpoint inhibitor treatment.
40. Sabrina Collins, Dr. Laura Moyer (Mentor)
Perception of Discrimination in the Legal Profession

Historically, the legal profession has been dominated by white men. Over time, the barriers hindering diverse participation have been somewhat lifted. In recent years, law schools enrolled equal percentages of men and women, and the number of minority students has also increased. So, how has the legal profession adapted to these changes? The hiring of women and minorities in the field of law does not reflect the increasing diversity seen in law school. Today, only 36% of lawyers are women and less than 10% of the American Bar Association represents racial minorities. While existing research shows discrimination present in the field of law, few studies have examined the relationship between an attorney’s practice area and experiences of discrimination. In general, literature suggests that masculine-typed specializations may be seen as more prestigious than feminine-typed practice areas. Such differences in prestige were hypothesized to impact employee’s job satisfaction within gendered specializations. It is expected that masculine-typed areas of law create less inclusive work environments; therefore, we hypothesized that individuals of minority groups working in these specializations would report more race, age, and gender discrimination as well as lower job satisfaction relative to attorneys in feminine-associated areas. Using an existing data set of practicing attorneys in North Carolina, we explored the degree to which reported levels of job satisfaction and perceived race, age, and gender discrimination varied across gendered areas of law. Our analysis contributes to the scholarly dialogue about intersectionality by demonstrating how age intersects with other identities to create unique experiences. The findings of our study can help us understand how the complexities of employment discrimination are not captured well by legal protections that view race, gender, and age discrimination as unconnected phenomena.

41. Joshua Stewart, Dr. Deborah Yoder-Himes (Mentor)
Inhibition of Gram-Negative Cystic Fibrosis Pathogens by Stenotrophomonas maltophilia in Co-culture Biofilms

Cystic Fibrosis (CF) is one of the most common lethal genetic disorders in the Caucasian population with an incidence of 1 per 3,000 live births and a median predicted survival of only 47 years. Respiratory failure due to repeated pathological insults to lung tissue by infection is the ultimate cause of mortality in the majority of patients. The lung microenvironment created by CF highly favors colonization by opportunistic pathogens like Pseudomonas aeruginosa, Staphylococcus aureus, Stenotrophomonas maltophilia, Acinetobacter xylosidans, and Burkholderia cenocepacia. Biofilm formation by multiple bacterial species contributes to the chronic, persistent, and difficult to treat nature of CF infections. This study seeks to further our limited understanding of what polymicrobial biofilm interactions may be occurring in the CF lung. Survival assays of bacterial cells grown in biofilm-forming conditions demonstrated that no detectable growth occurred for B. cenocepacia or A. xylosidans in co-culture with S. maltophilia. Further experimentation including supernatant screens, treatment with cell-lysate, pH measurements, and laser scanning confocal microscopy have elucidated further hints about the mechanisms of this S. maltophilia-mediated inhibition. Characterization of these interspecies relationships may further our understanding of how flora composition influences pathogenesis in the CF lung and has the potential to influence therapeutic approaches.

42. Sarah Benton, Dr. Sarah M. Emery (Mentor)
Soil function assessment of urban prairie restoration.

Prairies restoration entails the rehabilitation of the plant and animal communities in addition to the biogeochemical processes needed to maintain the health of the prairie. Soils play important roles in regulating ecosystem processes in these restoration but are not widely studied. Understanding the drivers of soil health are key to the development of best management restoration practices. We evaluated biotic and landscape factors influencing soil health in urban prairie restoration. Seventeen restored prairie sites in and surrounding Jefferson County were selected to assess soil health and function. Soil samples collected were tested for differences in water holding capacity (WHC), total nitrogen, total phosphorus, average organic matter, pH, and abundance of arbuscular mycorrhizal fungi (AMF). A field survey of prairie vegetation was conducted using total diversity of plant species and average m2 plant diversity. Landscape factors were calculated using soils data in ArcGIS. AMF was found to not be related to differences in soil function. Plant
diversity was positively correlated to higher WHC but not higher organic matter. Landscape factors like impervious surface and parent material were found to be more important predictors of soil function. Land managers interested in restoring soil health should note that some biotic factors do appear to have an effect in the short term in addition to landscape and local geology. However, the development of long term restoration practices will require continued inquiry to better understand the synergistic effects of both biotic and landscape factors.

43. Bailey Beery, Amanda J. Leblanc (Mentor)
Adrenergic Reactivity and Coronary Flow Reserve of SVF Cell Types
Past studies in our lab showed that an intravenous injection of adipose-derived stromal vascular fraction (SVF) cells into old rats improved the adrenergic and increased the coronary flow reserve in vivo. Going forward, we wanted to determine which specific cell population in the SVF could be the mechanism of action. Our hypothesis was that the cells from the SVF, causing the increased coronary flow and improved adrenergic function was a resident immune cell type (CD11b+), which regulates leukocyte adhesion and migration to areas of inflammation. Three groups of 24-month old Fischer 344 female rats were used: old control (saline treated), CD11b+ enriched (), and CD11b- depleted (). The rats received cardiac ultrasound measurements at baseline and four weeks post-injection. After heart explant, the left anterior descending (LAD) coronary arterioles were isolated and treated with dobutamine (), norepinephrine (), and norepinephrine with 2atenolol (Luminal diameters of the pressurized vessel were measured. The in vivo ultrasound studies showed a 69.7% increase post-injection in aged rates treated with CD11b- cells (p=0.013). There were no significant differences between the groups at baseline or at 4-weeks. There was no difference in the isolated vessel studies to adrenergic agonists in any of the groups. Contrary to our hypothesis, the CD11b+ enriched cell type from SVF is not the cause of the increased adrenergic reactivity or CFR in our cell-treated aged rats. The CD11b-depleted cells resulted in increased CFR, but did not alter isolated coronary vessel function. Future studies will determine which cell type(s) of the 11b-fraction contributed to both increased adrenergic reactivity and coronary blood flow.

44. Keegan Curry, Dr. Jill M. Steinbach-Rankins (Mentor)
The development of hybrid lipid-polymer nanoparticle architectures for the sustained-release of small hydrophilic molecules
Polymeric nanoparticles (NPs) have been utilized as drug delivery vehicles for a variety of applications. However, achieving sustained-release of small hydrophilic agents is a primary challenge for their use in prolonged delivery applications. This study investigates how novel lipid-polymer hybrid particle architectures can be used to improve the release profile of small hydrophilic encapsulants. Here, PLGA NPs were produced via electrospraying and emulsions. Particles with a core-shell architecture were produced via coaxial electrospraying and the ability of this architecture to sustain release was examined. In addition, we combined polymeric core-shell NPs with a lipid coating to improve biocompatibility, biofunctionalization, and particle release kinetics. PLGA NPs incorporating rhodamine B (RhB) as a model small molecule hydrophilic agent, were produced using electrospraying and double emulsion techniques. The PLGA NPs were coated with a lipid layer using either gentle hydration (post-synthesis, two-step), or self-assembly through emulsion (in situ, one-step). The total loading of RhB and the release profiles were determined via fluorescence spectroscopy, while physiochemical characteristics were investigated via scanning electron microscopy. Polymeric and lipid-polymer hybrid particles formed via emulsion were relatively monodisperse with diameters ranging from 100-400 nm, while particles formed via electrospraying were more polydisperse with diameters ranging from 100-1000 nm. Electrosprayed coaxial and lipid-coated NPs sustained the release of RhB and demonstrated high encapsulation efficiency (EE) (~90%). In contrast, emulsion particles had a lower EE of ~70%, with the two-step lipid-coated particles exhibiting RhB leaching and a significantly lower EE of ~25%. Our data suggest that the novel polymeric core-shell lipid coated NP architecture shows promise to sustain the release of small molecule hydrophilic agents, and we look forward to conducting functionality experiments with chemotherapeutic agent. Future work will also evaluate NP morphology using scanning transmission electron microscopy (STEM) and energy dispersive x-ray spectroscopy (EDS).
45. Satya Moolani, Elvin Irihamye, Mentors: Dr. Michael Smith & Jerry Munroe
L-Serine Reduces Reactive Oxygen Species Yield in Cisplatin Treated Zebrafish Utricles
Cisplatin is a chemotherapy compound effective against a variety of cancers. However, it can act as an ototoxin and cause hearing loss by promoting reactive oxygen species (ROS) production in auditory tissues. The antioxidant amino acid, L-serine has been hypothesized to lower levels of cisplatin-mediated ROS. In this project, we investigated whether L-serine can reduce cisplatin-mediated ROS production in auditory tissue and potentially act as an otoprotectant during cisplatin chemotherapy. We used a zebrafish utricular tissue culture system and fluorescent ROS indicator dye to spectrophotometrically measure if L-serine could decrease reactive oxygen species levels in cisplatin-treated tissues. We found that cisplatin treatment increased ROS yield in the utricular tissue while L-serine treatment alone did not alter ROS levels. Interestingly, we also found that equimolar L-serine treatment with cisplatin restored ROS to control levels. These results could be due to L-serine acting as an ROS scavenger. However, it is possible that L-serine could chemically inactivate cisplatin in these tissues. Future experiments are needed to see if L-serine can act as an otoprotectant in auditory tissue without mitigating the effects of cisplatin in cancer cells.

46. Emma Moore, Ahmet Ozkan Ozer (Mentor)
Creating a computational tool to simulate vibration control for piezoelectric devices
Piezoelectric materials have the unique ability to convert electrical energy to mechanical vibrations and vice versa. This project takes a stab to develop a reliable computational tool to simulate the vibration control of a novel “partial differential equation” model for a piezoelectric device, which is designed by integrating electric conducting piezoelectric layers constraining a viscoelastic layer to provide an active and lightweight intelligent structure. Controlling unwanted vibrations on piezoelectric devices (or harvesting energy from ambient vibrations) through piezoelectric layers has been the major focus in cutting-edge engineering applications such as ultrasonic welders and inchworms. The corresponding mathematical models for piezoelectric devices are either heuristic or mathematically oversimplified differential equations. Moreover, their “unjustified” approximated reductions consider only the first several vibrations on these devices. In this project, a novel partial differential equation model, accounting for all vibrational modes, is analyzed to provide new insights for a cost-efficient sensor feedback design. Therefore, the sensor feedback signals are not allowed to be contaminated by the residual modes. Our primary goal is to develop reproducible computational tools by an emerging stable approximation technique, so-called filtered Finite Difference Method, which is proved to provide faster and reliable computation. Filtering in the approximation is necessary since the spurious vibrations, due to the blind application of the Finite Difference Method, provide a false stability result. To see the efficiency of the algorithm, we compare the approximation to the one obtained by the Finite Element Method based on the Galerkin’s approximation, which is a common technique being used in the engineering literature. The mathematical techniques and computational tools developed in this project are essential to provide new insights into the active controlling of piezoelectric devices. Improving the efficiency of active controlling enables us to take better advantage of piezoelectric technology change since one-time design and fabrication may be unavoidable for many applications such as cardiac pacemakers or NASA/commercially-operated inflatable space antennas. Our state-of-the-art partial differential equation model and its stable approximations will be adaptable for a large class of piezoelectric devices.

47. Ethan Conkin, Timothy Abbott, Tyemirlan Murat, Shahnaz Aly (Mentor)
Community Brought Together
A community is a small or large social unit (a group of living things) that has something in common, such as norms, religion, values, or identity. Communities often share a sense of place that is situated in a given geographical area (e.g. a country, village, town, or neighborhood) or in virtual space through communication platforms. Are we hiding behind selfies and negative social media behavior instead of promoting human interaction and kindness? “For the past decade community has been slowly disappearing. Are we too busy for community, trying to earn and spending our time on electronic devices? In San Jose, California, our neighborhood coffee shops and independent bookstores have been replaced by franchises and online merchants. Mission City Coffee Roasting, a meeting place for students, artists, and writers and site for weekend folk con-
certs, is gone now, replaced by another Starbucks, and there is only one independent bookstore left in San Jose. Have we become too busy for community? With our days filled with electronic gadgets, longer work hours and commutes, few of us know our neighbors, which can be unhealthy and unsafe.” - Diane Dreher Ph.D. It’s time to put down the cell phone, scrolling through our social media accounts and get to know the community around us. Through the built environment, communities can come together face to face and learn about each other. Our research focused on the interactions of communities in environments such as community centers and religious gathering spaces. The diverse population of Bowling Green, Kentucky gave us the opportunity to apply our findings about community interaction. Our designs took gathering spaces and transformed them into environments suitable for today’s community, making the use of technology beneficial instead of destructive.

48. Lawrence Madriaga, Mentors: Dr. Ivan Novikov & Dr. Morteza Nurcheshmeh

Prediction of Metal Sample Failure from Scanning Electron Microscope images using Deep Learning Neural Network

We present the preliminary results on using a deep learning neural network to predict a metal sample failure based on a set of images obtained with a Scanning Electron Microscope. Various metal alloy samples were prepared according to ASTM E8/E8M-11 standards for a tensile test. Each sample was prepared for circle grid analysis and then stressed on a tensile machine. Stress and strain values were obtained for each position along the sample by measuring dimensions of each elongated circle. Increasing stress and strain values were used to determine a failure likelihood for the sample at each position. Multiple SEM images of the failed steel sample were taken at various locations. SEM images were taken using Large-Chamber SEM (LC-SEM) at the NOVA Center, WKU. All SEM images were tagged with previously obtained stress and strain values for each circle, correlating position of the circle and position of the image. Using obtained set of SEM images, we trained neural network to classify SEM images based on their stress/strain values. The predicted values were used to analyze the failure likelihood of each sample.

49. Anas Gondal, Dr. Ajay Srivastava (Mentor)

A Genetic Screen for Proteins Involved in ASP Invasion

Fruit flies (D. melanogaster) are ideal genetic model organisms that can closely replicate human genetic anomalies and characteristics. The invasion of the Air Sac Primordia (ASP), an organ analogous to the human lung, into the Wing Imaginal Disc (WID) of larval fruit flies is closely related to tumor metastasis in humans, as both processes use similar mechanisms to break down the basement membrane. By studying genes responsible for ASP invasion, researchers may be able to identify analogous genes in humans responsible for tumor metastasis. A genetic screen, using 65 protein trap lines, was conducted to find genes expressed in ASP and potentially involved in ASP invasion. The protein trap lines tagged endogenous proteins with a Green Fluorescent Protein (GFP) to indicate tissue localization of selected proteins under a fluorescent microscope. WID were isolated from 10 third instar larvae of each line and imaged using fluorescence microscopy. Thirteen of the 65 lines screened exhibited GFP expression in the WID, but not in the ASP. Only one of the 65 lines exhibited GFP expression in the ASP. The gene responsible was Apontic (apt). Apontic’s role in ASP invasion will be further investigated using RNA interference to knock down the gene. The screen is ongoing and we hope to be able to identify more genes expressed in the ASP.

50. Aref Ranjbar, Dr. Ajay Srivastava (Mentor)

Characterization of a Basement Membrane Associated Protein Encoding Gene in Drosophila melanogaster

Basement Membranes (BM) are important for normal development and tumor progression. In order to get a better understanding of BM dynamics we identified genes that encoded BM interacting proteins. One such gene is predicted to be involved in vesicle-mediated transport in Drosophila melanogaster. Here we characterize this gene by utilizing molecular biology techniques like immunohistochemistry, RNA in situ hybridization, and Western blot analysis utilizing antibodies generated in the laboratory. Western blot analysis identified this protein to be ~30.8 Kilo Daltons in size. Anti-body staining indicates tissue and cell
specific localization pattern for this protein. This pattern is similar to RNA in situ hybridization pattern observed in various tissues. Data related to this proteins’ involvement in vesicle-mediated transport will be presented.

51. Alex Henson, Dr. Sanju Gupta (Mentor)
Polymer nanocomposites are significant for modern and future technologies (aerospace, defense, water purification etc.) due to their tailored properties, lightweight and low cost. However, ‘forward’ engineered polymer (host matrix) composites with smaller size nanoparticles (guest) providing desired properties targeting specific applications remains a challenging task as they depend largely on nanoparticles size, shape and loading (volume fraction). This study develops polymer nanocomposites impregnated with ‘organic-inorganic’ silsesquioxane nanoparticles and graphene nanoribbons, and investigates microscopic structure and dynamics of interfacial layer to predict macroscale properties. The nanocomposites consist of poly(2-vinylpyridine) (P2VP) polymer (segment ~5nm) with spherical silsesquioxane nanoparticles (diameter ~2-5nm) and planar nitrogenated graphene nanoribbons (lateral dimension ~5-10 nm), both with attractive (hydrogen bonding and electrostatic) interactions. This approach reinforces the role of molecular parameters controlling the structure and dynamics of interfacial layer in predicting properties. The transmission electron microscopy will reveal microscopic structure and the lattice bonding, interfacial stress transfer and conjugation length are determined from micro-Raman spectroscopy. The glass transition temperature, $T_g$, obtained using differential scanning calorimetry reveals positive shift in $T_g$ values with nanoparticles loadings. We used temperature dependent broadband dielectric spectroscopy to gain fundamental insights into the interfacial layer and diffusion dynamics above and below $T_g$ and to establish quantitative microstructure-property correlations. KY NSF EPSCoR REG funding is acknowledged.

52. Jacob Dobler, Taylor Robinson, Dr. Sanju Gupta (Mentor)
Recent development of two-dimensional layered materials including graphene-family and related nano-materials have arisen as potential game changer for energy, water and sensing applications. While graphene is a form of carbon arranged hexagonally within atomic thin sheet, MoS2 is becoming a popular, efficient, and cost-effective catalyst for electrochemical energy devices, in contrast to expensive platinum and palladium catalysts. In this work, we electrochemically desulfurize few-layer molybdenum disulfide (MoS2) and aerogels with reduced graphene oxide (rGO) prepared under hydrothermal conditions (P< 20 bar, T< 200 oC), for improving hydrogen evolution reaction (HER) activity via point defects (S-vacancy). Moreover, the interactions between rGO and MoS2 components create emergent heterostructures with desirable physicochemical properties (specific surface area, mechanical strength, faster diffusion, facile electron and ion transport) enabled by chemically bridged (covalently) tailored interfaces. We demonstrate that with an optimized number defect density, particularly by exposing the edges of MoS2 layers and nanowalls in graphene-MoS2 ‘hybrid’ aerogels, interfacial processes during catalytic reactions are accelerated. To understand the effects of defects on HER activity, we varied the applied potential and operating duration for optimized defect density. This study offers a unique method for tuning the properties of layered MoS-2 and hybrids as promising, cost-effective and efficient nanocatalysts and establishes the structure–catalytic activity relationships via scanning electrochemical microscopy at electrode/electrolyte interface besides mapping electrochemical (re)activity and electro-active site distribution.

53. Kyla Scanlon, Lily Popova Zhuhadar (Mentor)
This paper investigates the effects that 12 different terrorist attacks had on consumer sentiment, using data scraped from Twitter to determine a broad based emotional stance. This was inspired by my previous research that worked to determine the impact that terrorism had on the stock market. The goal of this research is to determine a more qualitative impact of terrorist attacks. I utilized Rapid Miner for data processing, and the Global Terrorism Database as my data source. The project began by examining the rise and fall of keywords and hashtags through sentiment analysis to measure reaction over time. The text was
then clustered into keyword families to determine the key conversation topics. Finally, the text was analyzed to determine the evolution of polarity (the transition from negative to positive sentiment over time). The results from this analysis concluded that most of the messages were overwhelmingly negative, but shifted more towards a neutral stance as time passed after the attack. The number of tweets per day actually increased after the attack, with most tweets occurring in the early morning hours, and declining around 5 pm. An analysis of the clusters reveals a relationship between different keywords, with political keywords (i.e. Trump, Violence, Terror) often forming the strongest cluster. Consumer sentiment seemed to neutralize over time, suggesting the possibility of desensitization or a numbing effect.

54. Lea Mitchell, Mentors: Dr. Jason Polk, Rachel Kaiser, Ethan Givan, & Kegan McClanahan

*Mirror Mirror: A Look into Muscle Dysmophia* (Mentor)

Muscle dysmophia is a subcategory of body dysmophia. There is an extreme desire to gain body mass, and this is characterized by many psychological and behavioral symptoms. Previous research has found that mirror checking is a symptom of muscle dysmophia. The purpose of this study is to continue the investigation into mirror checking as a diagnostic symptom of muscle dysmophia. Our hypothesis is that participants who score higher on a scale of muscle dysmophia will spend more time looking in a mirror than those who score low on the scale of muscle dysmophia. Participants were males enrolled in psychology courses at Western Kentucky University. Participants were placed in front of a mirror and completed three questionnaires regarding levels of muscle dysmophia, as well as completed one distractor task. The session was recorded in order to code mirror checking behavior. With our findings, we hope to determine the relation between mirror checks and presence of muscle dysmophia in participants. Data collection is still ongoing and is projected to be finished by December.

55. Olivia Parker, Jamie Scott, Dr. Fredrick Grieve (Mentor)

*Longitudinal Study of Water Quality in Jennings Creek, Bowling Green, KY: Urbanization Impacts on Karst Groundwater* (Mentor)

Karst groundwater systems, which occur in areas where caves, sinkholes, and underground rivers dominate the landscape, are vulnerable to pollution from surface contaminants. In urban areas, like Bowling Green, KY which is home to extensive caves and groundwater supplies, the immediate transport of heavy metals, organic waste, chemicals, and other pollutants from surface activities into groundwater poses a serious threat. This research project was done to examine the water quality of urban karst sites in Bowling Green, KY at Jennings Creek, which is a local river primarily fed from springs; the water quality of Jennings Creek was never tested before this project, although it is an input to the Barren River, the area’s primary drinking water source. Weekly water samples were taken at five sites for six weeks over the summer. Each sample site was selected based on its proximity downstream from a primary spring input with a known drainage area and land use. The samples were tested each week for forty-three different parameters related to water quality, which included alkalinity, total organic carbon (TOC), cations, anions, metal concentrations, dissolved oxygen, total chlorine, and E. coli, among others. The results of the data collected indicate different pollutant concentrations based on land use in the area surrounding the spring inputs, with major detrimental changes occurring at the largest spring inputs. The sites in mixed land use areas (agricultural and residential) had more nitrates and phosphate, while urban areas suffered from more industrial waste and metal contamination. Overall, nearly every site exceeded the EPA drinking water quality standard for several parameters, including nitrates, E. coli bacteria, and several metals, indicating that more research is needed to address the primary causes of these contaminants and better practices to mitigate their input into the groundwater system.

56. Pranay Agrawal, Dr. Uta Ziegler (Mentor)

*Performance of the Parallelized Monte-Carlo Tree Search Approach for Dots and Boxes* (Mentor)

The Monte-Carlo tree search (MCTS) is a method designed to solve difficult learning problems. MCTS performs random simulations from the current situation and stores the results in order to distinguish decisions based on their past success. MCTS will then select the best decision and finally repeat the process.
Parallelizing the MCTS means to divide the learning process among independent learners. Then, after a fixed number of simulations, the data is shared and combined. Past research has shown that this approach is faster than non-parallelized approaches. Therefore, we anticipated that the time reduced from dividing the learning outweighs the potential costs from redundant learning. Since it is often difficult to determine the effectiveness of algorithms in complex environments, it is sometimes more advantageous to develop strategies in simple environments such as games that can then be translated for use in broader real-life fields. In this project, we explored how controlling various resources affected the win-ratio performance of the game Dots and Boxes learned through a parallelized MCTS approach. The factors that we manipulated included the number of simulations, the number of independent learners, the amount of information shared from these independent learners, and how frequently the independent learners share. The win-ratio performance was determined by taking the number of wins over the number of total games. An algorithm is presented with our findings, along with details and results of our modified Monte-Carlo tree search implementation.

57. Britt Fugmann, Rachel Tinius (Mentor)
Are dietary factors and exercise levels related to fertility status?
Infertility is a major public health concern as it affects up to 25% of couples in Western Countries. While there is some evidence that diet and exercise may be linked to fertility, there is no official dietary or exercise guidance for couples when trying to conceive. Additional information regarding the relationship between diet, exercise, and fertility is needed to better inform the development of guidelines for couples trying to conceive. The purpose is to examine the relationships between diet, exercise, and fertility among women. Participants were selected from an ongoing pregnancy study (N=33). All participants went on to have healthy pregnancies. Participants completed a survey regarding how long it took them to conceive, what methods they had to employ, if they ever had to seek treatment, and any other pertinent information regarding their fertility status prior to conception. In addition, they were asked detailed information regarding their dietary and exercise habits while trying to conceive. In addition, information on their significant other was collected. The amount of time it took to conceive (TTC) ranged from 1 month to 6 years. TTC and sedentary time were positively correlated (r=0.569, p=0.002), while light, moderate, and vigorous activities were not correlated to TTC. Regarding diet, TTC was positively correlated with total calories consumed (r=0.376, p=0.048) and total carbohydrates consumed (r=0.716, p<0.001). Women hoping to conceive should consider decreasing time spent sedentary as well as their total caloric intake and total carbohydrate intake in order to conceive sooner. This study supports the idea that diet, activity level (or lack thereof), and fertility status may all be closely related. These topics should be carefully discussed with a health care provider when trying to conceive.

58. Joseph Williams, Anthony Graham, Milton Ochoa, Shahnaz Aly (Mentor)
Revitalization: Creating new architecture from remnants
While it may seem appropriate to overlook the old for the new, is it possible to sustain our ecosystem in this manner? The choices we make impact our environment and those within it. Instead of relying on the novelty of the new, we should look to our inadequacies to give us greater opportunities. For we can achieve this through revitalization. By using revitalization, we have the opportunity to imbue something with new life and vitality. Revitalization in architecture can serve as a means to stabilize and perform for the greatest benefit to our ecosystem. We should look to revitalization in architecture as part of any design solution. It is our responsibility to imbue a decaying community with the chance at a new beginning. It is our responsibility to examine the existing framework of our cities as a solution to our design challenges. This is the design doctrine that we explored in our senior capstone projects. One approach to revitalization is an integrated urban remodeling concept that meets the complex needs of an area. Another approach is to shift the associated function of inoperative infrastructure into a commodity for community and ecosystem. Another approach explores the unification of modernity and historic memento to elicit the resurgence of the architecture’s potential. These approaches showed that revitalization is a viable part of architectural design.
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