UNDERGRADUATE RESEARCH WEEK

at Mizzou

UNDERGRADUATE RESEARCH & CREATIVE ACHIEVEMENTS FORUM

Spring 2021
April 21 - 27

Exhibited online through a collaboration of the
University of Missouri Libraries &
Office of Undergraduate Research

University of Missouri

Office of Undergraduate Research

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Will Costigan, Biochemistry
Maddy Creach, Biological Sciences
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Lauren Tigner, Speech, Language & Hearing Sciences
Micah Turrell, Biological Sciences
Alex Vanover, Biochemistry
Delanie Vinzant, Biological Sciences, Economics

Office of Undergraduate Research

Vision
Mizzou strives to advance a culture where all interested undergraduates engage in a quality research or creative scholarship experience.

Mission
The Mission of the Office of Undergraduate Research is to foster and support mentored undergraduate research, scholarship and creative activity in a premiere research environment.

Goals
- Fostering growth of the practice of undergraduate research and creative scholarship
- Maximizing the student experience and enhancing quality of the experience
- Increasing visibility of the opportunities and outcomes of undergraduate research
- Serving as a central resource for MU students, mentors, programs, and departments

Contact us

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2020-21 Undergraduate Research Advisory Committee

We would like to thank our Advisory Committee for their insight, support and continued engagement with Undergraduate Research and our office.

Pamela Brown, Biological Sciences
Nicole Campion-Barr, Psychology
Elizabeth Chang, English
Roger Fales, Engineering
Jerry Frank, History
Shari Freyermuth, Agriculture, Food & Natural Resources
Lee Ann Garrison, Visual Studies
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Jeannette Pierce, University of Missouri Libraries
Chad Rose, Special Education
Lisa Scheese, TRiO Student Support Services

UNDERGRADUATE RESEARCH WEEK

at Mizzou

April 19-24, 2021

To recognize the scholarship and research being conducted by undergraduate students on the Mizzou campus, as well as the faculty who take great care and time to mentor them, Undergraduate Research Week at Mizzou will highlight and showcase many of the projects and works being conducted on the MU campus.

With a variety of events and programming, the Office of Undergraduate Research welcomes everyone at MU to join us in celebrating the students and the faculty who make Mizzou a Tier 1 Research Institution.

The Spring Undergraduate Research and Creative Achievements Forum will be the main event of URW@ Mizzou (Undergraduate Research Week at Mizzou); however, we are proud to introduce a new component of the Forum as part of URW@Mizzou – the Humanities Symposium. The Humanities Symposium is a specific arena for scholarship in the humanities (Black Studies, History, Archaeology, English, Art, Digital Storytelling, and Classical Studies to name a few fields) to be presented in a manner that is conducive to those disciplines.

SEEK. SOLVE. SHOW.

2021 Spring
Undergraduate Research &
Creative Achievements Forum

Exhibited online through a collaboration of the
University of Missouri Libraries &
Office of Undergraduate Research

Join us in celebrating the 200 students presenting scholarship by viewing the Forum at: **https://dl.mospace.umsystem.edu/ mu/islandora/object/mu%3A426146.** The Forum will go live on April 21st and will communicate scholarly projects completed in a variety of disciplines from across the Mizzou campus.

We would like to thank all of the students, mentors, faculty, and administrators for their time and effort in making this digital exhibition of scholarly works possible.

It is our hope, that all involved will find this to be an engaging educational experience.

- Office of Undergraduate Research

Humanities Symposium

Interdisciplinary Perspectives on Health

MU Women's and Gender Studies
University of Missouri

WGST is proud to sponsor the first Humanities Symposium with the theme "Interdisciplinary Perspectives on Health". Department Chair, Dr. Linda Reeder, has been integral in collaborating with the Office of Undergraduate Research to make this happen. Humanities research across a variety of disciplines, including arts, literature, history, cultural studies, women's and gender studies and black studies, has helped us understand the cultural meaning and history of health, disability, mental illness, and disease. The insights from the humanities and social sciences help medical professionals to understand the diverse cultural impacts of their institutional power as they encounter patients' bodies and minds.

UNDERGRADUATE RESEARCH WEEK

at Mizzou

With the exception of the VADS art installation, all events will be conducted online. To learn more about these events and to get the Zoom links, please visit the Office of Undergraduate Research website at undergradresearch.missouri.edu

SCHEDULE

All Week - April 19 - 24th
2021 Visual Art & Design Showcase Winning Projects on Display at the Columbia Art League ~ 207 S. Ninth St (next to the Missouri Theatre.)

Monday, April 19th
1 p.m. ~ Exploring Research Communities @ Mizzou: «Research in the Arts»

4:30 p.m. ~ Putting Research on Your Resumé

Tuesday, April 20th
1 p.m. ~ Panel Discussion: «Models of Outstanding Research Mentorship at Mizzou»

April 19-24, 2021

Tuesday, April 20th - Continued
4 p.m. ~ Humanities Symposium:
Interdisciplinary Perspectives on Health

Keynote Speaker: Dr. Kaleea Lewis
Dr. Lewis is an Assistant Professor in the
department of Public Health and Women's
and Gender Studies. Her research broadly
explores how systems of power and oppression
emerge in the lived experiences of Black emerging
adults and impact their mental health and
mental health help seeking behaviors.

Thursday, April 22nd
3:30 p.m. ~ Humanities Symposium: Student Panel

Friday, April 23rd
3:30-5 p.m. ~ Closing Ceremony for Undergraduate Research
Week at Mizzou.
Speakers include:
>Dr. Jim Spain, Vice Provost for Undergraduate Studies
>Dr. Thomas Spencer, Interim Vice Chancellor for Research
>and Economic Development

2020-21 Recognitions to Include:
>Freshmen in Plants cohort
>Undergrad Research Ambassadors
>S.T.A.R. Awardees
>UM System Undergraduate Research at the State Capitol Students

Announcements to include:
>People's Choice Award for the 2021 Visual Art & Design Showcase
>Faculty Mentor Awards for the 2021 Visual Art & Design Showcase
>Faculty Mentor of the Year Awards
>Outstanding Abstracts and Artist Statements

SEEK. SOLVE. SHOW.

S★T★A★R

Student Training for Advancing Research (S.T.A.R.) is a recognition program created by the Office of Undergraduate Research. Started in Fall 2020 when many students may not have had access to lab or scholarly activity participation, S.T.A.R. provides students a means to learn and take part in workshops that will inform and enhance their skills for when they are able to get involved with a lab or scholarly group. The students listed have earned their STAR as of April 20th!

Spring 2021 S.T.A.R. Awardees

Roberto Arcia
Brooke Cirenza
Bryanna Counts
Bailey Crabtree
Logan Deal
Jake Engelbrecht
Gracie George
Anna Hanley
Allison Harris
Philip Horn
Lydia Jefferson
Natalie Koelling
Emilie Maas
Aleea Magras

Alicia Mitchell
Emily Pestka
Jeffrey Pollmann
Nisha Ravikumar
Emily Schroeder
Nick Stark
Mackenzie Stegura
Abby Stetina
Kathryn Vanden Hoek
Allie Walter
Erin Walton
Aidan Wirrick
Cole Yager

MIZZOU

About the Forum

The Forum is geared towards student research and creative scholarly projects that may be multi-semester projects, senior honors/capstone projects, or other faculty-mentored scholarly activities. Projects are typically shared in a 'display' format; however, with the transition to online presentations many students are also choosing to include video presentations for the digital Forums.

2021 Spring Undergraduate Research & Creative Achievements Forum

Student Presenters

Zayd Al Rawi

Columbia, MO

Faculty Mentor: Dr. Christian Lorson, Veterinary Pathobiology

AAV9-IGHMBP2 gene therapy ameliorates the severity of the SMARD1 mouse model

Zayd M. Al Rawi, Caley E. Smith, Sara Ricardez Hernandez, Mona Kacher, Monir Shababi, and Christian L. Lorson

Spinal muscular atrophy with respiratory distress type 1 (SMARD1) is a rare infantile motor neuron disease with the primary clinical symptom being respiratory distress due to diaphragmatic paralysis. SMARD1 is caused by loss of function mutations in immunoglobulin helicase μ DNA binding protein 2 (IGHMBP2). Defects in IGHMBP2 lead to increased vulnerability to motor neuron death, leading to downstream effects including reduced muscle fiber size and innervation deficiencies. Currently there is no treatment for SMARD1, and patients rely on palliative care measures such as mechanical respiratory ventilators. Recently, we developed a mouse model on the FVB background that represents the first patient-derived missense mutation D564N ($Ighmbp2^{D564N/D564N}$). The homozygous D564N mutant mice display severe phenotypic and cellular pathology defects such as reduced lifespan, motor deficits, selective muscle vulnerability to denervation, and respiratory defects.

Objective: Our goal is to determine if gene replacement therapy is an effective means to rescue the D564N homozygous mice. We utilized a single stranded adeno-associated viral vector carrying human full-length IGHMBP2 administered through an intracerebroventricular injection at postnatal day 2. Treated D564N mice show a significant correction in phenotypic defects including an extension in lifespan, increased weight, and regained motor function through behavioral tests such as Rotorod and grip strength. Additionally, AAV9 has shown protective effects in cell pathology including motor neuron restoration, innervation improvement, and increased myofiber size. Analysis of whole-body plethysmography was conducted and showed that treatment significantly improved the respiratory rate and tidal volume. These results are preliminary and my work will focus upon quantitatively determining the phenotype of the gene therapy-rescued SMARD1 mice. This work should provide the first insight into the viability of gene therapy in a patient-based model of SMARD1 and provide a foundation for additional pre-clinical studies.

Anna Al-Sayed

Cape Girardeau, MO

Faculty Mentor: Dr. Stephen Whitney, Educational, School & Counseling Psychology

Critical Time Periods in Reading Development

Anna Al-Sayed, Taylor Kroupa, Elise Buchert, Danielle Schneider, and Stephen Whitney

Reading is a fundamental aspect that supports all future education and understanding how to allocate scarce resources to support reading comprehension is of paramount importance. Previous research has shown the large impact that socio-economic status and race have on process of reading achievement. Our research examines if there are critical timepoints during reading education based on socio-economic status and race. Data for the study was taken from the nationally representative longitudinal study ECLS K-8 which follows 17,911 Kindergarten students through 7 waves of data starting in 1998 and ends after their 8th-grade year. For the current analysis the sample was grouped based upon race and SES. To simplify the analysis we examined two races, Black and White students, and three levels of SES, Poor, Middle class, and Rich samples. In the model Reading IRT (Item Response Theory) reading scores is used as the outcome during kindergarten, first, and third grade. Biological Sex is included within the groups as a control variable and group means differences were tested using an independent sample t-test. Our main findings show that the growth rate for reading is higher for students in 1st-3rd grade than with students in K-1st grade. Our findings also show that in K-1st male, Black students have a growth rate that is significantly less than white male students, but there was no difference amongst the female populations. However, across all genders and classes in 1st-3rd grades, black students, including black female students, grew significantly less in their reading achievements than white students. This research and finding points to important allocations in schools and future research.

Grace Anderson

Hillsboro, IL

Faculty Mentor: Lesleighan Cravens, Plant Sciences

Funeral For One

Grace Anderson, Amberlee Gandy, and Lesleighan Cravens

Whether it be losing a loved one, being isolated from family and friends, or witnessing the horrors of COVID-19 firsthand as a frontline worker, it is impossible to come out of this pandemic without being personally affected by the illness.

    Our floral artwork conveys the lonely scene of a COVID-19 patient nearing death. Blooms of carnations, roses, gerbera daisies, and delphinium in tones of fuschia, marigold, sky blue, and peony pink were placed closer to the window to convey vitality before transitioning into more neutral earthy tones, symbolizing that they are about to be laid to rest. Using manipulated chicken wire, a human body was constructed on a resting surface. The constructed body was covered in severed fresh roses, baby's breath and mums as well as dried artichokes and hydrangeas in tints, tones, and shades of brown, gold, and burnt orange to represent someone passing alone. One last thought of human connection to our patient was the lone arrangement on the bedside table.

We were inspired to create this installation after our own family members were hospitalized due to COVID-19. We wanted to use this platform to showcase the feelings of hopelessness, anxiety, and loneliness that our family members felt in and outside of the hospital. In true COVID-19 fashion, we were the only two people to see the exhibit and had to deconstruct it as quickly as we constructed it.

Ifeoma Anunoby

Jefferson City, MO

Faculty Mentor: Dr. Mihaela Carmen Cirstea, Physical Medicine and Rehabilitation

Motor system GABAergic tonic inhibition early after stroke - a pilot study

Ifeoma Anunoby and Carmen M. Cirstea

Objectives: Stroke triggers a complex series of neurobiological events that leads to acute functional impairment and, over a longer time-frame, results in the specific functional outcome and complications for individual patients. One such event is the cortical tonic γ-aminobutyric acid (GABA) inhibition dysfunction, i.e., enhanced tonic inhibition. On a physiological level, reversing such overactivation may improve functional outcome, e.g., arm motor function. The current knowledge is derived largely from preclinical studies. We aimed to study here the GABAergic inhibition changes and their functional relevance at admission to rehabilitation in stroke survivors exhibiting arm motor impairment (n=3).

Design: Survivors of a single subcortical infarct (66.3 [10.1] years old, 2 males) with mild clinical impairment (NIHSS=6 for all) were recruited at 22.2 [2.0] days after acute event. GABAergic inhibition was measured via MR Spectroscopy (MEGA-sLASER) in 2 motor areas controlling the paretic arm function: motor (M1) and premotor (PM) cortices in injured (ipsilesional) and uninjured (contralesional) hemispheres. GABA levels in each area were compared to those in matched healthy controls (n=3). Patient recruitment ended in March 2020 due to COVID-19.

Results: Relative to controls, we found in patients a trend toward higher GABA levels across all areas, most prominent in the ipsilesional areas (ipsilesional vs. left hemisphere in controls: M1, $p=0.2$, PM, $p=0.08$; contralesional vs. right, M1, $p=0.6$, PM, $p=0.2$). Due to the small sample size and similar impairment, the relationships between GABA levels and hand impairment were not assessed.

Conclusions: Our preliminary data have shown there is a trend toward increased tonic GABAergic inhibition early after stroke. If this trend is further demonstrated in larger sample size, this knowledge will provide evidence of a robust biological substrate, possibly underlying early motor recovery, offering the basis for conducting clinical trials for mechanistic restorative therapies in this population.

Adam Arand

Jefferson City, MO

Faculty Mentor: Dr. Victoria Shaffer, Psychological Sciences

Applied Narrative Intervention on College Student Attitudes of Abusing Prescription Stimulants

Adam Arand and Victoria Shaffer

A recurring problem on college campuses is the frequency of off label stimulant drug usage. Said stimulants are generally misused for some perceived academic benefit, with little perception or acknowledgement to potential ramifications or social taboo(Kilmer et al., 2014 ; Varga et al., 2012). One such recurring predictor of adderall misuse is lack of health literacy and aforementioned downplaying of harm (DeSantis et al., 2009; Stewart et al.,); We hypothesize that if an applied narrative intervention that indicates many potential dangers of abusing said stimulants on college campuses has any effect on incoming Psych 1000 student's attitudes surrounding use of prescription stimulants. Participants were randomly assigned to one of two conditions, a narrative condition and a control condition. Participants in the narrative condition read a fictitious story about a male freshman who used Adderall to cope with the stresses of college and the psychological and physiological consequences that followed. Participants were informed that it is a fictitious story based on typical symptoms experienced, typical exposures to the drug(s), and local news reports. The control condition read a non-narrative fact-based article about the consequences of using prescription stimulants for academic benefit. This is a pre-post design where the primary outcomes are measured both prior to and after the intervention. We ran our data analyses through Spss statistics software, looking for significant variance in item responses between condition, or pre/post intervention. We did not find significant variance from our control variable, or pre/post the intervention. These findings could imply that narrative interventions are not necessarily an effective method of engaging or changing attitudes of drugs; however, there are many limitations to our study, and we maintain that future studies should emphasize a more controlled environment with a less controversial topic. (Shaffer et al., 2017; Miller-Day et al., 2013).

Brendan Ball

O'Fallon, MO

Junior
Biological Sciences; Psychology

Faculty Mentor: Dr. Habib Zaghouani, Molecular, Microbiology and Immunology

Evaluating Environmental Influence On T-Cell Development In Type One Diabetes

Brendan M Ball, Alexis N Cattin-Roy, Tobechukwu K Ukah, and Habib Zaghouani

T1D, otherwise known as juvenile diabetes, is a chronic autoimmune disease in which the pancreas produces little to no insulin. This happens with the damaging of the beta-cells, insulin-producing cells, in the islets of Langerhans by the immune system. This immune system attack leads to apoptosis of beta cells, thus establishing insulin deficiency and hyperglycemia which can lead to major health concerns such as ketoacidosis (buildup of acids in the bloodstream), kidney failure, heart disease, stroke, and blindness. Type One Diabetes (T1D) currently affects about 1.6 million people in the United States with about 64,000 new cases diagnosed every year. Although the genetic factors of patients play a huge role in their diabetes susceptibility, there are significant environmental implications that play a role in diabetes susceptibility in patients. Factors in the environment, such as parasitic infections, induce chemical mediators called cytokines. IL-4 is a cytokine that is known for having ties to preventing autoimmunity. If we inject IL-4 cytokines to act as an environmental factor in the thymus, then that will alter central tolerance and stop the targeting of beta cells by escaped autoreactive T cells. This led us to test the hypothesis that intra-thymic IL-4 will tighten central tolerance in the NOD and reduce the number of autoreactive cells in turn leading to less disease. To test this, we used the non-obese diabetic (NOD) strain of mouse, which is a model that is able to develop spontaneous autoimmune diabetes that shares a lot of similarities to T1D in human subjects, such as pancreas-specific autoantibodies, autoreactive $CD4^+$ and $CD8^+$ T cells, and genetic linkage to the disease. We injected IL-4 into the thymus, as well as saline for our control group, to test if this affects T cell development and to see its effects on diabetes. We have multiple experimental readouts including sequencing the variable regions of the T cell receptors to look at the T cell repertoire and also check blood sugar as the mice get older. Early results indicate that we are able to alter the T cell repertoire and have one that is consistent with a healthy immune response (No beta-cell autoantigen specific receptors and good diversity). This study shows that IL-4 aids in the production of thymic cells that perform central tolerance thus tightening T cell selection. Future directions include analyzing how many T cells are actually left in the thymus, if any, that are capable of eliminating insulin producing cells. These findings may have translational implications that can be tried in human studies to provide therapeutic approaches to preserve central tolerance.

Luke Baxter

Columbia, MO

Faculty Mentor: Dr. Aaron Stoker, Orthopaedic Surgery

Comparison Of Basal And Cytokine Stimulated Metabolism Of Tendon Autografts For Anterior Cruciate Ligament Reconstruction

Luke Baxter, Luke Troyer, Richard Ma, Patrick Smith, James Cook, and Aaron Stoker

INTRODUCTION: Over 200,000 anterior cruciate ligament (ACL) reconstruction surgeries are performed annually in the U.S for treatment of ACL ruptures. Patellar tendon (PT), quadriceps tendon (QT), and hamstring tendon (HT) are common autograft choices for ACL reconstruction (ACLR). Understanding how tendon autograft tissue responds to the pro-inflammatory environment of the injured knee may provide insight into mechanisms of failure after ACLR. This study was designed to identify the metabolic responses of the different tendons to pro-inflammatory stimulation. It was hypothesized that the metabolic profiles for each graft type would not be significantly different without cytokine stimulation, but that pro-inflammatory cytokine stimulation would incite production of significantly higher levels of inflammatory and degradative biomarkers from PT grafts when compared to QT and HT grafts.

METHODS: With IRB approval, tendon normally discarded after surgery was collected from patients undergoing ACLR (PT n=16, QT n=30, and HT n=9). Two 4mm explants were created from the tendon of each patient and cultured in media with or without rhIL-1β After 3 days of culture, media was collected for biomarker analysis. Biomarker concentration was standardized to tissue weight. Significant differences between IL-1β treated and untreated controls for each tissue type were determined using Mann-Whitney Rank sum tests. Significant differences among tissue types with or without stimulation were determined using a Kruskal-Wallace test with post-hoc analysis. Significance was set at $p<0.05$.

RESULTS: PT and QT autografts increase production of inflammatory and degradative biomarkers in response to cytokine stimulation at a similar level, while HT autografts overall did not. PT and QT autografts' basal production of inflammatory and degradative biomarkers were similar to each other, but significantly different from HT autografts.

CONCLUSION: It is not yet clear whether the heightened metabolic response seen in the QT and PT will improve or inhibit the healing of the graft after ACLR surgery. Ongoing studies in our lab will relate these observations to graft healing in patients and compare these responses to clinical measures in order to improve outcomes for patients undergoing ACLR.

Alex Becks

Naperville, IL

Faculty Mentor: Dr. Anand Chandrasekhar, Biological Sciences

Evaluating Neuronal Migration in Celsr1 and Wnt5a Double Mutants

Alex Becks, Devynn Hummel, and Anand Chandrasekhar

Defective neuronal migration during development can contribute to several brain disorders, including epilepsy. The goal is to understand the mechanisms of neuronal migration to help remedy these human brain disorders. Since the migration pathways of the Facial Branchiomotor (FBM) neurons are well-studied and an evolutionarily conserved process, this system will be used to examine phenotypes. The current model proposes that the function of the chemoattractant Wnt5a is blocked by the membrane receptor Celsr1 to prevent inappropriate rostral migration. Previous studies with *Wnt*-soaked beads showed that excess *Wnt5a* can induce rostral migration. In addition, *Celsr1* knockout mutants exhibited a rostral migration phenotype, suggestive of a role for Celsr1 in suppressing chemoattractant activity. To further test the model, both the *Celsr1* and *Wnt5a g*enes will be knocked out, and the migration phenotype in embryos' hindbrains will be examined. Double heterozygous *Celsr1+/KO Wnt5a+/KO* mouse lines have been generated, and preliminary findings are consistent with the proposed model.

Jessica Beetner

Rolla, MO

Faculty Mentor: Dr. Deborah Anderson, Veterinary Pathobiology; Dr. Rachel Olson, Veterinary Pathobiology

Production of Interferon Beta by Toll-like Receptors during Yersinia Pseudotuberculosis Infection

Jessica D. Beetner, Rachel M. Olson, and Deborah M. Anderson

The plague, a deadly disease caused by the gram-negative coccobacillus *Yersinia pestis*, has caused millions of human deaths around the world. Upon infection, an extreme inflammatory response is triggered that causes further damage to the body. When Toll-like receptors (TLRs) recognize *Y. pestis* bacterium they induce an intracellular signaling pathway that leads to the production of cytokines like Type I Interferon that signal this inflammatory response. Our lab has confirmed that during *Y. pestis* infection the optimal production of Interferon Beta (IFNβ), a subtype of Type 1 Interferon, is dependent on the presence of TLR7 yet not on myeloid differentiation factor 88 (MyD88), its only known signaling adaptor. This indicates a non-canonical TLR7 mechanism in *Y. pestis* infection. We have also observed that wild type mice infected with *Yersinia pseudotuberculosis*, the closest evolutionary relative of *Y. pestis*, have a higher survival rate than *tlr7-/-* mice, indicating that TLR7 may not have the same inflammatory activity during a *Y. pseudotuberculosis* infection. To test the hypothesis that the TLR7 pathway activity in a *Y. pseudotuberculosis* infection is unique from that during a *Y. pestis* infection, wild type and *tlr7-/-* mice were challenged with *Y. pseudotuberculosis* and tissue and blood samples were taken at 5 and 10 days post infection. These samples were analyzed with an ELISA to quantify the levels of INFβ and other cytokines. The results indicate that *Y. pseudotuberculosis* TLR7 are not activated during infection to produce INFβ at the selected time points. Our next step is to test INFβ levels at earlier time points to confirm that there is no immediate TLR7 response and then to confirm which of the well described differences between the two bacteria, *Y. pestis* and *Y. pseudotuberculosis*, is responsible for this difference, revealing more about the non-canonical TLR7 mechanism of *Y. pestis*.

Julianna Bell

Chesterfield, MO

Faculty Mentor: Dr. Nicole Campion-Barr, Psychological Sciences

Birth Order and Gender Differences in Family Members' and Observers' Rating of Parent-Adolescent Interactions

Julianna Bell, Marie Tweedie, Yue Guo, and Nicole Campione-Barr

Previous research focusing on outsiders' views and insiders' views of family interaction ratings have found that there have been low correlations of ratings between family members and observers (Surra & Ridley, 1991), yet family members' reports have been both positively and significantly correlated (Schwarz, Barton-Henry, & Pruzinksy, 1985). Because most of the studies have focused on single dyadic subsystems, previous research may have glossed over the fact that different dyadic relationships do not occur in isolation (Dekovic and Buist, 2005) and that each parent-child dyad impacts the other family subsystems (Cox & Paley, 1997). Other findings suggest that these interaction ratings could be affected by both birth order and gender differences within the family. Some research suggests that second-borns were found to have more decision-making autonomy than firstborns, particularly during early adolescence (Campione-Barr, Lindell, Short, et al., 2015), which may affect the ways that first-borns and second-borns interact with their parents (and the quality of those interactions) during adolescence. Gender also plays a role in family dynamics, as female-only dyads (e.g., mother-daughter, sister-sister) tend to be more effectively intense than all other combinations (Campione-Barr & Smetana, 2019). Therefore the present study aimed to investigate the differences in ratings between observers, parents, and adolescents during a semi-structured adolescent disclosure task, and whether those ratings are affected by adolescent birth order and gender.

This study evaluated 123 families with at least two children (n = 246 parent-adolescent dyads), predominately White (85%) and 2-parent families (72%). The majority of the parents come from well-educated and upper-middle class incomes. First-born adolescents were on average 13.93 years old and second-born adolescents were an average of 11.47 years old. Results of a 3 (Rater: observer, mother, and adolescent) X 2 (Birth order: first- vs. second-born) X 2 (Adolescent gender: girls vs. boys) mixed model ANOVA will be presented.

Mandar Bhoyar

Chesterfield, MO

Faculty Mentor: Dr. Kristy vanMarle, Psychological Sciences

Can babies remember poor caregiving?

Mandar Bhoyar and Krsity vanMarle

Purpose: Attachment is an enduring emotional bond that an infant develops with their primary caregiver[1]. Insecure attachment in infancy poses risk for poorer peer relationships, externalizing problems, and internalizing symptoms into adulthood[2]. According to attachment theory, infants develop internal working models (IWMs) to represent their experiences with caregivers[3] encompassing representations of self, others, and the nature of relationships that are carried forward into future interpersonal contexts[4]. We asked whether infants expect an individual will behave responsively towards a crying infant, whether infants will develop a preference to responsive (R) versus unresponsive (U) individual, and, whether infants' expectations and/or preferences are modulated by their attachment security, indexed using maternal responsiveness questionnaire (MRQ)[5].

Procedure: Thirty-two 12-to-13-month-old infants and primary caregivers are being recruited. Infants are familiarized with four pseudo-randomized videos (two adults act responsively or unresponsively to a crying baby). At test, infants view headshots of the adults in pseudo-randomized order. Looking time is measured for both events. The primary caregiver completes the (MRQ)[5] which assess their responsivity to distressed infant.

Results: We adapted to and piloted an online data collection format due to the covid-19 pandemic, hence the current dataset consists of only 5 babies. Therefore, none of the findings so far are significant. Although, currently, infants are looking longer on average at the unresponsive events (M=47.54 sec, SD=19.99) than the responsive events (M=40.41 sec, SD=18.66) during familiarization which means the unresponsive act is an unexpected event. If this result holds once data collection is complete, it will be important to determine whether this expectation derives from infants' own experiences, or whether it may be a core expectation that is innate or emerges with minimal modification from experience. We will be able to determine this once data collection is complete by correlating infants' MRQ scores with their looking time preference score.

Abby Blenk

Cincinnati, OH

Sophomore
Digital Storytelling; Computer Science

Comparing Emotional Responses when Viewing Death and Dying Related Video Art

Abby Blenk, Shelby Ryan, Faith Fleming, Peter Helm, and Katina Bitsicas

The ASH Art of Death Digital Storytelling Research Team analyzed viewer perception of death and dying when viewing death related video art, and whether targeted media can alter emotional responses to death-related stimuli. Previous research from the ASH team has indicated that viewing metaphorical footage of death evokes positive responses ("Beauty", "Peace", and "Positive Emotions") in participants and primes them to think about mortality and discuss death comfortably.

To build on these findings, the team created two video art pieces, collectively named *Points of View*. The study of *Points of View* examines how the metaphorical footage affects death anxiety and perception of death.

Points of View is a two-stage video art experience of death as a physiological and emotional process. The first stage features an animation depicting the scientific process of death as a self-contained piece, while the second combines this animation with a video background reflecting emotional responses to death.

Participants (N=TBD) viewed the videos in sequence through an online survey conductor (mTurk). The factual animated depiction of death was shown first, immediately followed by a baseline survey. This measured participants' mental response and perception of death as a physiological process. Participants then viewed the combined animation and video artwork. Afterward, participants answered the same questions again, as well as three additional questions about the viewing sequence. Finally, participants were asked to select whether each element of the artworks elicited specific emotional responses.

Data collection is still in process and results will be finalized by the beginning of April 2021. The expected result of the project is that participants will experience less death anxiety after viewing the combined footage and animation than after viewing only the animation.

Nicolette Bowman

Independence, MO

Sp21-076

Junior
Early Childhood Education

Faculty Mentor: Dr. Chad Rose, Special Education; Dr. Stephen Whitney, Educational, School & Counseling Psychology

Developing Evidence-Based Bullying Prevention Tip Sheets for Parents, Students, and Educators

Nicolette Bowman, Jillian Marino, Katherine Graves, Steven Whitney, and Chad Rose

Bullying is a pervasive issue throughout the world and can cause immense challenges within the school environment. Thus, it is critical to continue developing support structures for parents, educators, and students to combat this problem. In recent years, the general populace has increasingly interacted with social media applications and this platform may be an effective tool to use for informing people about the issue of bullying and preventative strategies. This study was a collaboration by the University of Missouri Bully Prevention Lab, the International Bully Prevention Association, and Facebook. The purpose of this study was to develop succinct and empirical guidelines for parents, students, and educators to help them prevent and respond effectively to bullying by disseminating evidence-based advice through Facebook. The authors developed three separate tip sheets targeted at each group of primary stakeholders related to the issue of bullying: parents, students, and educators. A literature review was conducted to identify suggestions for each of the three common roles involved in preventing bullying mentioned previously. For each of the three categories, the top tips were chosen based on how frequently each recommendation was found throughout the literature search. At the time of this publication, the final products have been distributed by Facebook through a soft launch limited to certain regions and will remain part of Facebook's anti-bullying campaign. The prevalence of bullying in schools can have a severe impact on students' learning as well as physical, mental, and emotional health. Therefore, it is vital to continue connecting the general population with accessible tips and strategies that will enable them to more effectively prevent bullying.

Lillian Bradshaw

St. Louis, MO

Short-Term Immune Response of Largemouth Bass (Micropterus salmoides) to Crude Oil Exposure

Lillie Bradshaw, and Don Tillitt

In North America, crude oil is transported through pipelines and by rail in ever increasing amounts. Often, the railways and pipelines follow or cross major rivers. Furthermore, in 2019, approximately 1,000 tons of oil were spilled into water systems throughout the world, the largest collective tonnage occurring in North America. But the impacts of oil spills in freshwater systems, particularly sub-lethal effects on fish and other aquatic organisms, are significantly understudied. Therefore, to fundamentally improve our understanding of how oil spills affect freshwater fish, we designed and conducted an experiment to develop an immune response timeline for largemouth bass exposed to crude oil. The goal was to evaluate largemouth bass response at three specific time points: 2, 7, and 14 days post-exposure. Largemouth bass were exposed through intraperitoneal injections of a 10% crude oil solution or dimethyl sulfoxide alone as a control. Fish were held in flow-through tanks and euthanized at sampling. Immune responses were evaluated by differential white blood cell composition in peripheral blood and macrophage aggregates in the spleen histology. The observed changes in immune status included a shift in white blood cell composition from greater numbers of lymphocytes and fewer numbers of granulocytes and monocytes (normal, healthy status) to a state of decreasing lymphocyte numbers and increasing numbers of granulocytes and monocytes. In addition, we observed increases in the numbers of macrophage aggregates present in the spleens of exposed bass over the observation period after exposure. Changes in both endpoints occurred at 2 days post exposure and continued until 14 days post exposure. These changes in peripheral blood cell composition and macrophage aggregates indicate a change in immune status in response to crude oil exposure. Moreover, these results clarify the temporal changes that occur in largemouth bass immune responses after an oil spill.

Elise Buchert

St. Louis, MO

Faculty Mentor: Dr. Stephen Whitney, Educational, School & Counseling Psychology

Critical Time Periods in Reading Development

Elise Buchert, Anna Al-Sayed, Taylor Kroupa, Danielle Schneider, and Stephen Whitney

Reading is a fundamental aspect that supports all future education and understanding how to allocate scarce resources to support reading comprehension is of paramount importance. Previous research has shown the large impact that socio-economic status and race have on process of reading achievement. Our research examines if there are critical timepoints during reading education based on socio-economic status and race. Data for the study was taken from the nationally representative longitudinal study ECLS K-8 which follows 17,911 Kindergarten students through 7 waves of data starting in 1998 and ends after their 8th-grade year. For the current analysis the sample was grouped based upon race and SES. To simplify the analysis we examined two races, Black and White students, and three levels of SES, Poor, Middle class, and Rich samples. In the model Reading IRT (Item Response Theory) reading scores is used as the outcome during kindergarten, first, and third grade. Biological Sex is included within the groups as a control variable and group means differences were tested using an independent sample t-test. Our main findings show that the growth rate for reading is higher for students in 1st-3rd grade than with students in K-1st grade. Our findings also show that in K-1st male, Black students have a growth rate that is significantly less than white male students, but there was no difference amongst the female populations. However, across all genders and classes in 1st-3rd grades, black students, including black female students, grew significantly less in their reading achievements than white students. This research and finding points to important allocations in schools and future research.

Emma Burton

Columbia, MO

Faculty Mentor: Dr. Amanda Rose, Psychological Sciences; Dr. Ashley Groh, Psychological Sciences

Respiratory Sinus Arrhythmia Reactivity in Adolescents: Gender Differences and Implications for Friendship Quality

Emma Burton, Christine Schulze, Daniella Reyes, Sarah Borowski, Ashley Groh, and Amanda Rose

Friendships are important relationships during adolescence but little research considers interrelations between physiological functioning and friendship functioning (Murray-Close et al., 2013). Respiratory sinus arrhythmia (RSA) reactivity indexes changes in parasympathetic nervous system activity and has important implications for functioning in close relationships (Porges 2001; 2009). Decreases in RSA in response to stressors is thought to reflect adaptive regulation (Beauchaine, 2001). Although research has not examined RSA reactivity in relation to adolescent friendships, one study found that adults who were primed to think about friendships demonstrated greater RSA reactivity to stress when they had high quality friendships (Carlisle et. al, 2012).

The current study considers the effects of positive and negative friendship quality on adolescents' RSA reactivity during friendship interactions. Data collection is ongoing. Participants are same-gender friend dyads in 8th, 9th, and 10th grades. The adolescents completed the 18-item Friendship Quality Questionnaire (Rose 2002 revision of Parker and Asher 1993) which assesses positive friendship qualities (e.g., trust) and negative friendship qualities (e.g., conflict). The adolescents also engaged in a 3-minute resting baseline task and a problem talk interaction task with their friends while linked to physiological sensors monitoring heart rate, respiration. RSA reactivity will be computed by taking the difference between the average RSA during the resting task and the interaction task. We expect to find that greater levels of friendship quality will be related to greater RSA reactivity (i.e., decreases in RSA relative to resting conditions). Gender differences will also be tested. Given that previous research has found stronger links between friendships and adjustment for girls (Demir and Urberg, 2004), we hypothesize that there will be stronger links between friendship quality and RSA reactivity for girls than boys.
Previous studies have examined RSA and its relationship to adolescent friendships and found that priming new relationships with positivity was associated with significant RSA decreases during stress This implies that existing relationships with positive friendship quality could have similar effects on RSA reactivity and provide an indicator of how adolescent friendships impact physical and emotional health.

Elizabeth Busch

Washington, MO

Faculty Mentor: Dr. Elizabeth Chang, English

"Neither of woman nor of man": Gender, Drag, and Theatrical Costume in Charlotte Bront*é's* **Villette**

Elizabeth Busch and Elizabeth Chang

In Charlotte Brontë's 1853 novel *Villette*, schoolteacher Lucy Snowe unexpectedly dresses in drag, wearing both masculine and feminine articles of clothing to perform a male role in her boarding school's amateur theatrical production. Through this scene and others involving construction of character, this nineteenth-century novel brings a new attention to the complexity and stability of identity, which for this novel, like many other nineteenth-century works, is closely linked to gender performance. This research analysis paper examines the subversive effects of drag and costume on gender through a multi-faceted analysis of theatrical costumes in *Villette*. I argue that during the theatrical performances of the main character Lucy Snowe and the contrasting theatrical scenes spotlighting the professional actress Vashti, the novel's use of prescriptively masculine and feminine elements of costume transgresses the binary system of gender and proposes gender as a societal construct, rather than an inherent core of being. I use three main strategies to complete this analysis: (1) close readings of relevant passages from Charlotte Brontë's *Villette*, (2) an application of Judith Butler's theory of gender performativity, and (3) an application of historical context about nineteenth-century theatre and dress. This paper challenges interpretations of Lucy and Vashti's theatrical performances that ignore the historical context surrounding their costumes and the implications of their use of both prescriptively masculine and feminine costume. My proposed historical and theoretical perspective on these characters' onstage performances will not only give specific insight into how they subvert gender, but also provide the reader a historical, theoretical, and critical lens through which they can read and analyze drag, costume, and the stability of gender and identity throughout the novel *Villette*.

Kate Bushnell

Columbia, MO

Art of Death: Can Religious Artwork Manage Existential Concerns of COVID-19?

Kate Bushnell, Jee Eun "Jenny" Park, Erin Zimmerman, Megan E. Edwards, Madhwa Galgali, Peter J. Helm, and Jamie Arndt

The human awareness of mortality perpetuates the potential for death-related anxiety. Terror Management Theory proposes that people use cultural worldviews to cope with this existential crisis, finding that people increase their reliance on cultural beliefs (and decrease openness towards other beliefs) when mortality is salient. Historically, many forms of art have displayed cultural beliefs, thus viewing worldview affirming artwork after reminders of death may return an individual to equilibrium. This study asked: can religious themed artwork help people manage existential concerns elicited by COVID-19? If threatening aspects of COVID-19 increase thoughts of death, and if worldview consistent art offers psychological protection, then Christians will rate Christian paintings more positively than Hindu paintings after reading threatening COVID-19 headlines (vs. benign headlines). Atheists were selected as a control group who should not be comforted by any religious art. An online survey recruited and randomly assigned participants (N = 390) to read threatening or nonthreatening COVID-19 headlines. Afterwards, participants rated previously piloted Christian and Hindu paintings, and reported their openness to experience.

Results indicated that threatening COVID-19 headlines increased thoughts of death. However, there was no interaction between participant religion and COVID-19 condition on painting ratings. Christians rated Christian paintings highly and Atheists rated paintings poorly regardless of condition. Interestingly, further analysis revealed a participant religion by COVID-19 condition interaction predicting openness to experience. Christians' openness remained constant regardless of condition, while Atheists' openness decreased in the threatening COVID-19 condition. Results suggest that existential threats may lower openness to experience, and worldview consistent artwork may offer psychological protection enabling people to maintain openness to experience. Specifically, Atheists' decreased openness after threatening COVID-19 headlines may be attributed to a lack of exposure to worldview affirming art. Additional studies will seek to better understand this possibility.

The Effect of Passage on the Metabolic Profile of Osteoarthritic Chondrocytes

Allyson B Caisley, Spencer E. DeLucia, Anna N. Sellentrup, James L. Cook, and Aaron N Stoker

Introduction

Clinically, there is significant patient to patient variability in the progression and development of Osteoarthritis (OA). Previous studies have shown that there is also patient-to-patient variability in the metabolic responses of OA chondrocytes during initial monolayer culture. This study was designed to determine the effect of culture passage on the metabolic responses of OA chondrocytes, by comparing biomarker production levels of cells at passage 0 (P0) and passage 1 (P1). We hypothesized that when comparing P0 to P1, high producing cells at P0 would be high producers at P1, correlations between biomarkers at P0 would be maintained at P1, and that there would be strong positive correlations between P0 and P1 for relative biomarker production levels.

Methods

With IRB approval and informed patient consent, chondrocytes were recovered from 10 patients undergoing TKA surgery. Once the cells in P0 and P1 were 90% confluent, media was changed and collected 3 days later for analysis of inflammatory and degradative biomarkers. Cells were grouped into upper and lower 50% production groups at P0, and a Mann-Whitney Rank Sum test was used to determine significant differences between groups at P1. A Kruskal Wallace test was used to group biomarkers into high, mid, and low producing groups at P0 and P1. A Pearson's correlation was used to identify correlations between biomarkers at P0, P1 and between P0 and P1.

Results

When group at P0 biomarker levels, there was not a significant difference between groups at P1, indicating that the cells did not maintain this stratification in biomarker production P1. There was more variability in biomarker production level observed at P0 compared to P1. There were few similar biomarker production correlations observe between P0 and P1.

Discussion

Data from this study suggest that there is significant change in the metabolic output of OA chondrocytes in vitro after just one passage and patient-to-patient variability is lost. Going forward, these passage-based changes may be used to identify key cellular pathways associated with the pathobiology of OA.

Brianna Carman

Eldon, MO

Faculty Mentor: Dr. Jeffrey Johnson, Psychological Sciences

The effect of repetition-related neural pattern similarity on subsequent episodic memory retrieval

Brianna D. Carman, John Scofield, and Jeffrey D. Johnson

Two competing hypotheses are often referenced when considering the conditions that lead to formation of lasting memories. Whereas it is sometimes argued that thinking about an event in a variety of ways (i.e. encoding variability) leads to memory improvement, the repeated and similar retrieval (i.e. reactivation) of an event can also enhance memory durability. We examine the possible mechanisms of reactivation versus variability by using high-resolution functional magnetic resonance imaging (fMRI) to track neural similarity during memory encoding. Patterns of fMRI activity across multiple encoding instances, particularly focusing on regions of the medial temporal lobe and hippocampus, are used to relate similarity to performance on a subsequent test of memory retrieval. Young adults (N=19) were presented with 120 words corresponding to objects. The words were repeated across three encoding blocks that each required a distinct judgment: How pleasant/unpleasant is it? How likely is it to be found indoors/outdoors? How large/small is it relative to a shoebox? Subjects were then presented with the encoded words intermixed with new words and had to judge the quality of their memory for each. One response option indicated that specific details about the word were retrieved (remembered); in the absence of such details, subjects judged old/new confidence on a four-point scale. High-resolution fMRI data (~1.7-mm voxels) was acquired during encoding and pre-processed using standard protocols. Subjects were highly accurate at old/new discrimination, with the majority of old words associated with remembering details, indicating that the repetitive and elaborate nature of encoding produced durable memory traces. For the fMRI analysis, our preliminary results indicate a slight positive correlation between correct RTs and neural pattern similarity(r=.036), supporting the hypothesis that encoding variability leads to improved access during later retrieval.

Skyler Carter

Columbia, MO

Faculty Mentor: Dr. Jamie Arndt, Psychological Sciences; Dr. Peter Helm, Psychological Sciences

All Mixed Up: Multiracial Identity & Existential Isolation

Skyler Carter, Tyler Jimenez, Peter J. Helm, and Jamie Arndt

Multiracial individuals can experience adverse psychological consequences related to their racial identity. It can be difficult for their monoracial counterparts to categorize and accept them as one of their own race, contributing to feelings of "otherness" and perceptions of racial ambiguity (Root, 1990). We hypothesized this process may lead to feelings of existential isolation (EI; Pinel et al, 2017), the subjective feeling that other people do not understand your experience or perspective. EI has been found to predict worse mental health (Helm et al., 2020) and lower well-being (Helm et al., 2019). Three studies assess this general prediction. Study 1 found that multiracial students do report higher levels of EI than monoracial individuals (M = 3.48, SD = .99), F(1,2819) = 6.60, p = .006, d = .11. Study 2 further investigated if experiences of being miscategorized would explain this relationship. Results support this hypothesis. Racial identity indirectly predicted EI via the experience of being miscategorized, indirect effect = .28, 95% CI [.05, .54]. Specifically, multiracial identity predicted greater experience of being miscategorized, which then predicted higher EI. Study 3 is ongoing and uses an experimental design to test whether multiracial participants who are miscategorized will report greater EI than those not miscategorized. With a growing population of this marginalized group, it is important for research to foster understanding of the challenges multiracials may face as a result of their unique experiences by understanding the mechanisms underlying "otherness" can we create tools to navigate obstacles and improve their well-being.

Fallon Caruth

Peoria, IL

Senior
Psychology; Sociology

Faculty Mentor: Dr. Rebecca Scott, Sociology

Marginalization of Black Students at Predominately White Institutions: Different Experiences of Black Students at MU

Fallon Caruth and Rebecca Scott

This research is a qualitative study that examined the experiences of current black undergraduate and graduate students attending the University of Missouri. The study includes experiences of black students who recently graduated from the university within the last year. The data for this research was collected through semi-structured interviews via Zoom. The interest in this research stemmed from the exploration of different types of experiences black students encounter while attending predominately white universities. Today, college admissions leaders at predominantly white institutions are trying to recruit more and more minority students in order for their institutions to appear inclusive and racially diverse. The efforts to recruit black and minority students reflect how these institutions of higher learning have been historically white spaces. With this information, it is important to analyze the ways in which black students find a sense of belonging on campus, if they find the black community and organizations beneficial to their experiences, and the degree to which they are exposed to instances of racism. In general, adjusting from high school to college can be challenging time for all young adults. However, it is important to consider the positions of black students at PWI's because they often experience race related stressors such as racial discrimination, feelings of isolation, and microaggressions.

Melanee Castillo

Plainfield, IL

Faculty Mentor: Dr. Sherri Ulbrich, Nursing

Evidence-Based Fall Prevention Strategies for MU Healthcare

Melanee Castillo, Katrina Schache, Savannah Valeria, Chloe Cobb, Jessica Tompkins, Kate Stieglitz, Sophie Gordan and Sherri Ulbrich

Patient falls are a significant problem in every hospital unit because they contribute to poor patient outcomes and increase length of stay and cost. The Fall Council at MU Healthcare collects monthly data, and data from the last year revealed an increase in in-patient and out-patient falls. The National Database of Nursing Quality Indicators sets goals for the number of patient falls per 1,000 patient days and ranks hospitals by percentile. Currently, 38% of MU Healthcare's in-patient units are performing above the 50th percentile, and 81% of the out-patient units are performing above the 50th percentile. The goal of this project is to review the literature for evidence-based fall prevention strategies and present the findings with an associated recommendation to MU Healthcare's Fall Council.

The research question examines the impact of conducting post-fall debriefs on preventing further falls in the hospital setting. The research team conducted literature reviews for each of the following areas: general medical-surgical, critical care, emergency, perioperative, psychiatric, pediatric, and perinatal. Decreasing the number of falls that occur in each of these departments in MU Healthcare is a priority for enhancing patient safety and classifying the institution with magnet status. Initial findings support the hypothesis that post-fall debriefs are an effective strategy in reducing the number of repeat falls and establishing improved safety culture and communication among staff. Post-fall debriefs were found to be most effective when strong and positive leadership runs the debrief meeting and when the team has strong group safety norms. The recommendation based on evidence-based research is that MU Healthcare creates a post-fall debrief tool and initiates post-fall debriefs after each fall with all staff present on the unit at the time of the fall.

Chloe Cobb

St. Louis, MO

Faculty Mentor: Dr. Sherri Ulbrich, Nursing

Evidence-Based Fall Prevention Strategies for MU Healthcare

Chloe Cobb, Melanee Castillo, Katrina Schache, Savannah Valeria, Sophie Gordan, Kate Stieglitz, Jessica Tompkins, and Sherri Ulbrich

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Archer Cole

Webb City, MO

Faculty Mentor: Dr. Amanda Rose, Psychological Sciences; Dr. Ashley Groh, Psychological Sciences

Adolescent Friendship Quality: Analyzing the Impact of Temperament, Emotional Reactivity and the Role of Gender

Archer Cole, Catherine Everett, Gabrielle Scott, Hannah Holladay, Allie Spiekerman, Sarah Borowski, Ashley Groh, and Amanda Rose

Positive friendships relate to better psychological health. (Stotsky et. al, 2018). During adolescence, dyadic friendships become more important than peer acceptance (Demir & Urberg, 2004) and have consistently related to different indices of adjustment. It is important to consider individual differences that might influence the quality of friendships, such as emotional reactivity. Temperament has been shown to be stable throughout development, and influences individuals' emotional reactivity within friendships. Temperamental characteristics (e.g., emotional intensity) are considered to have significant implications for children's peer relationships (Rothbart & Bates, 1998). Better temperamental reactivity has been found to predict positive friendship quality (Gleason et. al, 2005).

Research on the relation between emotional reactivity and friendship quality among adolescents is limited. The purpose of the current study is to examine the association between emotional reactivity and friendship quality. Two measures of emotional reactivity are considered: trait emotional reactivity (i.e., temperament) and state emotional reactivity (i.e., change in negative emotions from before to after an interaction task). Participants in the study include 180 adolescents (62 boys, 118 girls) in the eighth, ninth, and tenth grade. They completed a series of surveys on Qualtrics as well as a negative valence task (problem talk). Measures include the Early Adolescent Temperament Questionnaire (Capaldi & Rothbart, 1992; Ellis & Rothbart, 2001), which assesses the extent to which adolescents tend to experience negative affect or negative reactivity. The Positive and Negative Affect Scale (Watson et al., 1999) assessed positive and negative effects before and after task. Lastly, the Friendship Quality Questionnaire (Rose, 2002) assessed positive and negative qualities of the adolescents' friendship. Analyses will be conducted to determine whether there are associations among trait emotional reactivity, state emotional reactivity, and friendship quality. Gender differences will be considered in all analyses.

Courtney Colench

Rolla, MO

Junior
Biological Sciences

Faculty Mentor: Dr. Dawn Cornelison, Biological Sciences

Don't Get it Scrambled: Growing Muscle Goes 3D

Courtney Colench, Alexandra Diller Costello, and D Cornelison

The relationship between blood vessels and muscle fiber generation can be described with the well-known metaphor about the chicken and egg; the question being, what comes first? Does the regeneration of blood vessels cause the growth of muscle fibers; or does the regeneration of muscle inherently induce the growth of vasculature? The answer to this question is one of the aims and motivations for the engineering of an in vitro 3D model of skeletal muscle. Utilizing primary mouse cell culture and tissue engineering, this 3D model serves as a real-life example of cellular self-organization and muscle regeneration. Compared to previously studied methods, our 3D tissue culture using primary cells differs as it contains all of the cell types that are present within muscle, consequently portraying a more realistic model of functional muscle. We ultimately hope to gain a better understanding of the effect of vasculature on muscle fiber development in this in vitro "mini muscle", which is theoretically translatable to applications in human skeletal muscle in vivo. To accomplish this, we have derived fabrication methods to engineer a plate with the ability to sustain muscle growth. This plate is made by laying a plastic base with a dog-bone shaped indentation, which is where muscle development occurs. After harvesting, isolating, and seeding cells from the tibialis anterior muscle into the plate we supply the culture with different proliferation and differentiation media. During the two weeks of allotted time for regeneration, we utilize time lapse microscopy to determine how this growth is affected respective to these different media. Continuing with this project, our next goals include determination of the best growth conditions for muscle fiber and vascular regeneration, optimizing the cell isolation protocol to maximize yield of even rare cell populations, and establishing functionality of the regenerated "mini muscle".

Luci Cook

Camdenton, MO

Faculty Mentor: Dr. Scott Garson, English

Gaspings of a Miracle: Poetry of Identity and Terminal Illness

Luci Cook and Scott Garson

These poems are taken from a larger collection included in the chapbook I wrote for an Advanced Poetry class in the Spring of 2020. The work centers around my twenty-three years of living with a terminal illness and undergoing three heart transplants, other operations, procedures, sicknesses, lengthy hospital stays, and the disorienting fluctuations between sickness and health throughout. Exploring these experiences using poetry as a medium with no boundaries, I am able to expose the otherwise ineffable underlying structure of my own identity, desires, and memories, and the ways in which they are–and are not–connected to my body and the more preternatural aspects of being a multiple organ transplant recipient. On the page, this poetry often takes strange forms, meandering across spaces and utilizing erasure, enjambment, and lack of punctuation to evoke the feelings of disorder, uncertainty, and confusion that my experiences exude. Although that effect is less pronounced in my oral readings, I make use of alliteration, consonance, and other sound work to try to bring those feelings from my audience's eyes to their ears. Many of my individual poems are best able to be understood within a collection, where they can communicate with other work and be given context. This proved challenging for choosing which poems to include in my reading, but I settled on a few that I feel best represent the overall body of work, and that I feel best encompass the wide range of emotions and forms present in my poetry.

Luci Cook

Camdenton, MO

The Art of Death: Recognizing Links between Sex and Death in the Visual Record

Luci Cook, Javier Cuenca, Nathan Furnas, Peter Helm, and Benton Kidd

Throughout history and across mediums, the eternal themes of sex and death have long been paired in the literary and visual records. In our research, we used examples of modern and historical art representing sex and death to question how such subjects influence the thoughts and feelings of viewers. Do respondents recognize a link between sex and death, and if so, is the link positive or negative? Are there connections between a participant´s sexual identity, religion, etc., and their perspective on sex and death? To investigate these questions, we surveyed respondents to gauge erotic and violent overtones in the images. We conducted two identical surveys, the first of which utilized Amazon's MTurk, targeting respondents of all ages; the second study targeted students 18-25 on the Mizzou campus. In the first study, individuals (N = 450) completed personality and individual difference measures regarding their perceptions of various forms of death, violence, and eroticism in visual art. In the second study, students (N = 40) took the same survey, but the group was evenly divided between heterosexual and non-heterosexual participants on MU's Campus. The images used in both surveys illustrated the themes in question and neutral control images. Analyses of the data also revealed whether engaging with images led respondents of different sexualities, religion, etc., to reflect further on death-related feelings towards sex and violence, and whether they recognized a link between sex and death.

Grace Cooper

Wentzville, MO

Faculty Mentor: Dr. Kristin Bilyeu, Plant Sciences

Molecular Resources to Improve Breeding of Food Grade Soybeans

Grace Cooper and Kristin Bilyeu

Soybean is a critical crop for most of the world. Yellow hilum soybeans, sometimes referred to as clear hilum soybeans, are especially prized for human consumption. Despite the many pages of research generated each year in soybean genetics and genomics, little is known about the mechanisms that control seed coat color and hilum color in soybean. These mechanisms were explored using GWAS (Genome Wide Association Studies) comparing different phenotypes of soybeans to find the most highly-associated SNPs, or single-nucleotide polymorphisms, linked to a change in the hilum color. The objective is to find a proxy SNP or SNPs that can be used to identify yellow hilum in soybean with a high accuracy rate without cloning. GWAS was run comparing all accessions with 50k data and the phenotype yellow hilum to accessions with 50k data and the phenotype black or brown hilum. Similar GWAS were run comparing yellow hilum to black or brown seed coat, black hilum to gray hilum, and black hilum to green hilum. From these GWAS, the top-associated SNPs identified were ss715602777, ss715602754, ss715602756. More experimentation must be performed to determine if these SNPs, together or separately, can predict the yellow hilum phenotype in soybeans.

Haley Coward

Spring Grove, IL

Faculty Mentor: Dr. Laura King, Psychological Sciences

Dogs, Cats, and Meaning in Life

Haley Coward, Hope E. Rose, and Laura A. King

Pet ownership is related to well-being and personality traits (Boa & Schreer, 2016). Research has not examined the potential link between pet ownership and meaning in life. Meaning in life consists of 3 facets: the sense that one's life matters (significance), that it is goal-driven (purpose), and that it makes sense (coherence). Although sometimes considered a particularly profound experience, meaning in life is related to common experiences such as being in a good mood or engaging in daily routines (King & Hicks, 2020). The present study examined how pet ownership relates to meaning in life and its facets. We predicted that pet ownership would be linked to higher subjective well-being and meaning in life. We also predicted that pet ownership would have significantly higher reports of significance, compared to purpose and coherence. In addition, we expected dog ownership to be especially related to a higher sense of significance compared to cat ownership. Amazon Mechanical Turk workers (N=799; 634 pet owners, 165 non-pet owners) completed measures of subjective well-being, meaning in life (Costin & Vignoles, 2019), personality traits(Big Five; John, et al., 1991), and whether they were a cat person (n=256) or a dog person (n=542). A series of t-tests showed pet owners reported higher subjective well-being, and higher sense of purpose and coherence. Cat owners and dog owners reported significantly higher subjective well-being and meaning life and significance (all p's <.01). Not surprisingly, self-identified dog people and cat people were more likely to own dogs and cats, respectively, x^2(2) =399, p<.001. These data will be used to design an experiment probing how exposure to pictures of dogs and cats might influence mood and meaning in life. We also plan to further examine the personality traits of dog and cat people in future studies

Della Cox

University City, MO

Examining the portrayals of race and ethnicity within Latinx-centric news sites

Della Cox, Jackson Hale, Rachel Henderson, Andrea Figueroa-Caballero, and Christopher Josey

Latinx individuals make up a minority group that faces some of the harshest and inaccurate stereotypes in the media today, despite being underrepresented in most media, especially primetime television (Mastro, Figueroa-Caballero, & Sink, 2017) and news programming (Santa Ana, 2013). Stereotypes include the notion that they are illegal immigrants and criminals (Dixon & Williams, 2015). As a result of these portrayals, Latinx audiences are left with few empowering news outlets to turn to in the mainstream media. This research project began as a means to identify safe and uplifting alternative channels for minority audiences. Specifically, we argue that news sites created for and focused on Latinx individuals might serve as channels of potential empowerment. However, little research has been done surrounding the portrayal of minorities in social identity focused news (SIFN) outlets such as these. Consequently, we began our research project by looking at the quality of this content. We hypothesize that (a) they will over-represent Latinx individuals in their content and (b) will present Latinx individuals more positively than traditional news outlets. News content was compiled from four Latinx online media outlets *News Taco, Latino Voices, El Día News*, and *Latina* . Our final sample was N=600 unique news stories. Our preliminary results suggest that the portrayals of Latinx individuals in Latinx-oriented SIFN were rated more positively than in traditional news outlets. Furthermore, Latinx individuals were overrepresented in Latinx-oriented SIFN compared to the percentage of the US population they comprise in the Census. This means that Latinx-oriented SIFN offers an alternative and a counter-influence to degrading representations of Latinx individuals in the traditional news media both by representing Latinx individuals more positively and less stereotypically, as well as including more Latinx individuals overall in their news coverage.

Behavioral/Social Sciences

Maddy Creach

Jefferson City, MO

Faculty Mentor: Dr. Walter Gassmann, Plant Sciences

Funding Source: BioInformatics in Plant Sciences (BIPS)

Using High-throughput Phenotyping to Characterize the srfr1 Arabidopsis Mutant

Madison Creach, Landon Swartz, David Mendoza Cozatl, and Walter Gassmann

As temperatures rise due to climate change and the spread of some pathogens becomes easier, the plant immune system will be even more crucial to crop survival. To know how to mitigate yield loss due to pathogen introduction we need to further understand the immune system. Our focus is SRFR1, which is a negative regulator of immunity in plants. Arabidopsis plants with a non-functional *SRFR1* gene displays stunted growth compared to the wildtype genotype Columbia. This is due to the *srfr1* mutant having a constitutive immune response that comes at the cost of growth. When growing Columbia and *srfr1* mutants side by side they are identical before a stunted appearance manifests. To characterize this phenotype, the root phenotype was analyzed in the mutant by using an inhouse automated image collection platform and an image analysis algorithm. Preliminary results suggest no significant difference in the root growth of Columbia and the *srfr1* mutant. To measure the rosette size high-resolution images were captured every two hours. By doing this we can monitor the plants' leaves in more detail than we could by hand, imaging the plants side by side and pinpointing the exact point in development when SRFR1 becomes necessary for wild type development. Then using a computer algorithm we will be looking at rosette size and other aspects of the plant to generate a fine temporal resolution of the *srfr1* mutant phenotype. These two experiments will provide more information on the *srfr1* mutant phenotype and its affect on development of arabidopsis.

Quinn Cunningham

Columbia, MO

Documenting Luyia Together: Noun Tone in Tiriki

Quinn Cunningham, Rebecca Grollemund, and Michael R. Marlo

Tiriki is an understudied member of the Luyia language cluster of western Kenya. The research presented here has been carried out by Quinn Cunningham and Michael Marlo, using data provided by Tiriki speaker Kelvin Alulu and building on prior research by Marlo and Alulu. This presentation updates the results of our research presented at the 2020 Fall Forum.

Over the past several months, we have been working to tonally transcribe and categorize the tonal patterns of approximately 2000 Tiriki nouns with one or two syllables. We have determined that noun stems with one syllable have one of two patterns: LL (*mu-nwa* 'mouth') or HL (*mú-ṛwi* 'head'). (L stands for low tone; H stands for high tone; high tones are marked with an acute accent; the noun class prefix is set off from the noun stem with a hyphen.) Noun stems with two syllables show more patterns. When the stem-initial vowel is short, there are three patterns: LLL (*mu-limi* 'farmer'), HHL (*mú-xáli* 'woman'), or H↓HL (*má↓-ʃéle* 'frogs'). (↓ indicates that the pitch of following high tone is lowered.) When the stem-initial vowel is long, there are two additional patterns that differ in whether the penultimate vowel has a level H tone (HH) or a falling tone (HL): LLLL (*mu-koongo* 'back'), HHLL (*mú-xáana* 'girl'), HHHL (*mú-sáála* 'tree'), H↓HLL (*vú↓-lwáale* 'sickness'), or H↓HHL (*í↓-síímbwa* 'dog').

Recently, we have collected new data involving 500+ nouns with three or more syllables in the stem in an attempt to accurately transcribe, categorize, and analyze the tonal patterns of longer nouns in the Tiriki dictionary. We are using the results of our study to try to determine how the pronunciation of words has changed over time in the Luyia language cluster by comparing cognate vocabulary in Tiriki and related languages like Logoori, Wanga, and Bukusu.

Drew Dahlquist

Kansas City, MO

Faculty Mentor: Dr. David Mendoza-Cozatl, Plant Sciences

Funding Source: BioInformatics in Plant Sciences (BIPS)

Design and Implementation of Internet-enabled High-throughput Phenotyping

Drew Dahlquist, Landon Swartz, and David Mendoza-Cozatl

Genomic data from different plants, including crops, are now publicly available with novel genomes added every week. However, and despite this information, only 40% of the genes within plants have an assigned function. Automation and high-throughput phenotyping (HTP) have recently reduced many of the bottlenecks for conducting biological experiments that connect the genome with the phenome. However, automation and the ability to collect large amounts of data have brought new challenges including how to properly store, share, and manage it all, as well as how to keep researchers connected to their autonomous HTP experiments. To solve these issues, we designed and implemented an internet-enabled, high-throughput phenotyping architecture that solves both of these issues. To do so, we integrated *automatic management* of experiment data via CyVerse along with instant messenger-based communication between the HTP machines and researchers with the Slack API. We found that letting computers automatically manage the data on behalf of researchers as well as communicate various information about their status is extremely useful with respect to administering experiments as well as sharing and analyzing results. Moreover, the overhead to implement a system such as ours is relatively small and adaptable, lending itself to numerous other applications.

Caroline Davey

Oswego, IL

Stress and Adjustment in Adolescents: Analyzing Co-Rumination, Coping, and Physiological Regulation as Moderators

Caroline Davey, Brayden Langendoerfer, Kassandra Ramos, Sarah Borowski, Ashley Groh, and Amanda Rose

Stress in adolescence can cause adverse effects and the more negative life experiences in adolescence, the higher levels of internalizing symptoms, such as depression and anxiety (Kim et al., 2003). Past research indicates stress has negative impli¬cations for adolescent well-being (Nicolai et al., 2013). Consequently, a comprehensive understanding of the factors that exacerbate or relieve stress is crucial. Coping style and physiological regulation are factors that may alleviate stress, whereas co-rumination worsens it (Rose et al., 2016). The current study considers the role of stress as a possible predictor of internalizing symptoms. Further, we investigate how physiological regulation, coping style, and co-rumination affect the relation between stress and internalizing symptoms.

Participants were 180 adolescents (118 girls; 62 boys; M age = 14.09 years). Adolescents completed the Perceived Stress Scale (PSS; Cohen et al., 1983) to report their overall stress levels (e.g., "I worry a lot of the time; 1 = Not at All True, 5 = Really True"). They completed questions from a depression scale (e.g., "In the past week I was sad, lonely, or fearful) (CES-D; Eaton et al., 2004). Participants completed the Co-rumination Questionnaire (Rose, 2002) and Brief COPE scale (Carver, 1997) to assess positive and negative coping.

Respiratory sinus arrhythmia was used as a measure of physiological regulation. To assess physiological regulation, three disposable electrodes are applied to the participants' torsos to monitor heart rate. To monitor respiration, a belt is applied around their diaphragms. Physiological responses are recorded while the participants sit quietly for three minutes at different times during the visit. Analyses will consider stress as a predictor of adjustment. They will also consider coping style, co-rumination, and physiological regulation as effects on the relationship between stress and internalizing symptoms. We will also examine sex differences among stress, indicators of regulation, and internalizing symptoms.

Lauren Day

Morton, IL

Faculty Mentor: Dr. Stacy Wagovich, Speech, Language and Hearing Sciences

The Use of Mental State Verbs by Preschool-Age Children Who Stutter and Their Mothers

Lauren Day, Lauren Tigner, and Stacy Wagovich

Mental state verbs (MSVs) denote internal cognitive states (e.g., think, believe, remember, understand). They are more abstract than other types of verbs, such as action verbs, and are likely to be embedded in utterances that are more conceptually complex. For example, "She *forgot* [MSV] his name" is more abstract than "She *said* [action] his name". Logan's (2015) working model of speech fluency includes the dimension of communicative flexibility – the ability to shift among communicative contexts. In this preliminary study, through analysis of MSVs, we explored one type of communicative flexibility in children who stutter (CWS) and children who do not stutter (CWNS) as they shifted from action-based conversation with their mothers to interaction that emphasized internal mental states. We hypothesized that CWS may be less flexible than peers in shifting from action-focused language to more inward focused language about thoughts and other internal mental states. Through examination of the play-based language samples of 30 CWS and 30 age- and gender-matched CWNS (ages 3;0-5;10) with their mothers, we explored (a) the frequency of MSV use among the groups of children and their mothers, (b) the correspondence between mothers' use of MSVs and their children's use, and (c) the proportion of utterances with MSVs that contain stutter-like and other disfluencies. Results will be discussed in relation to the idea that mental state verbs may reveal information about a child's communicative flexibility in conversation.

Emily Dehner

Lewistown, MO

Junior
Middle School Education (Mathematics)

Faculty Mentor: Dr. Stephen Whitney, Educational, School & Counseling Psychology

Long-term effects of the achievement gap

Emily Dehner, Jeffrey Pollmann, Elisabeth Mealy, and Stephen Whitney

The achievement gap has been a perennial problem in education over the past 70 years when it was first discovered through the work of the Coleman report. However, little is known about the long-term effects of the achievement gap. Using a Nationally representative, longitudinal dataset (Add-Health), we examine the long-term effects of the achievement gap, defined as class and race, in the educational attainment and income in adults. Add Health follows 20,000 individuals beginning in grade 7-8 in the 1994-95 school year. The data includes five waves, with the most recent wave of data collected in 2016-18, the first four waves were utilized in this analysis. Cases who completed all four waves were included in the analysis (N=12,092). Race and SES were used to define the comparison groups, biological sex was included as a control. Cumulative GPA in waves 1-2 was used to predict highest level of education attained and yearly income in wave four. A ANOVA with Bonferroni correction was used to compare the groups. Results indicate a significant overall interaction between groups and highest education attained and income. Selected post-hoc comparisons indicate a significant difference between several subgroups. For example, Asian poor student had significantly higher levels of education when compared to White poor student and Black poor students. White poor students had significantly higher education levels of education when compared to Black poor students. Asian poor student also had significantly higher levels of income when compared to White poor student and Black poor students. White poor students also had significantly higher income levels when compared to Black poor students. This study highlights the long-term influence of educational differences across the lifespan and calls for the continued need for programs to ensure educational equality across race and class groups.

Behavioral/Social Sciences

Spencer Delucia

Kansas City, MO

Junior
Biological Sciences; Ancient Mediterranean Studies

Faculty Mentor: Dr. Aaron Stoker, Orthopaedic Surgery; Dr. James Cook, Orthopaedic Surgery

Relationships among Patient-Specific Variables and Osteoarthritic Chondrocyte Metabolism

Spencer DeLucia, Allyson Caisley, Anna Sullentrup, James Cook, and Aaron Stoker

Introduction

Osteoarthritis (OA) is a leading cause of disability worldwide. One factor that makes OA difficult to effectively treat is the considerable patient-to-patient variability in the development and progression of symptomatic OA. While patient factors (sex, age, BMI, smoking, diabetes) have been associated with increased OA rates, how these factors relate to OA pathophysiology are poorly understood. It was hypothesized that increased patient age, BMI, and pain at the time of total knee arthroplasty (TKA), as well as female sex, smoking, and diabetes, the production of pro-inflammatory and degradative biomarkers by OA chondrocytes will significantly increase.

Methods

With IRB approval and informed patient consent, cartilage tissue normally discarded was recovered from patients undergoing TKA. Chondrocytes were isolated form the cartilage and cultured until they reached ~90% confluency. A media sample was collected and tested for inflammatory and degradation related biomarkers. Data were analyzed using a spearman correlation to relate chondrocyte biomarker production to patient age, BMI, and VAS pain score, and significant differences in OA chondrocyte metabolism were determined using a Mann-Whitney Rank Sum test or Kruskal-Wallis with post hoc test and Bonferroni correction, based on the number of categories in the analysis ($p<0.05$).

Results

It was found that patients in the highest BMI group had the lowest production of biomarkers, female chondrocytes produced significantly higher levels of degradative enzymes MMP-7, 8, and 13, and chondrocytes from current smokers produced significantly higher levels of TNF-a. There were no significant differences when chondrocytes were based on age or diabetes status.

Discussion

The data from this study indicate that BMI, sex, and smoking status may contribute to the patient-to-patient variability in chondrocyte metabolic responses during knee OA. Correlating these changes in chondrocyte metabolism to clinical measures of disease may allow for the development and optimization of patient-specific diagnostic and therapeutic modalities.

Rachel DeMello

Boca Raton, FL

Senior
Human Development and Family Science (Family and Lifespan Development)

Parenting Stress, Family Conflict, and Motherhood during the COVID-19 Pandemic

Rachel DeMello, Matthew Ogan, J. Kale Monk, and Jeremy Kanter

The 2020 COVID-19 pandemic caused a global lockdown. Consequently, individuals are experiencing significant stress (American Psychological Association, 2020). Using data from Singapore, women and mothers in particular report more moderate or poor work-family balance levels than men and fathers, and poor work-family balance was associated with higher levels parenting stress (Chung et al., 2020). Increased stress can result in increased conflict between partners (Monk et al., 2021). Using data collected from 117 U.S. women in May of 2020, 55 of whom were mothers, we examined the association between stress (parenting status and stress, as well as perceived stress) and conflict with partners. Our first hypothesis was that mothers would have higher levels of conflict and perceived stress, in comparison to the women who were not. Our second hypothesis parentsthat parenting stress and percieved stress are positively associated with increased conflict. Preliminary analyses showed positive correlations between parenting stress and interpersonal conflict (r = .32, p < .05), parenting stress and perceived stress (r = .60, p < .001), and perceived stress and interpersonal conflict (r = .31, p < .01). In line with my hypothesis, t-tests revealed there were significant differences between mothers and non-mothers in conflict, $t(115)$ = -1.99, p = .05, but not stress, $t(115)$ = 1.13, p = .26. Given the pandemic is creating significant change for many people, it is likely that non-mothers are also experiencing high levels of stress during the onset of the pandemic. However, stress disparaties may increase over the course of the pandemic as non-parents adjust more quickly to pandemic-related life changes. In future research, scholars should collect longitudinal data from participants in order to understand this variability in experiences over time.

Behavioral/Social Sciences

Megan Dolsky

Liberty, MO

Faculty Mentor: Monica Romero, Educational, School & Counseling Psychology

Effectiveness of Peer-Mediated Interventions for Emergent Bilingual Students' Achievement

Megan Dolsky, Clayton Henning, Caroline Rorah, Hannah Holt, and Monica Romero

Research has shown that peer-mediated interventions produce positive academic outcomes for a wide range of students. This meta-analysis analyzed the effectiveness of peer-mediated interventions for emergent bilingual students in grades K-12. Fourteen studies using cross-age, same-age, class wide peer tutoring, or cooperative learning met the criteria. The meta-analysis' purpose is to explore the effects of peer intervention on emergent bilinguals' academic achievement. The following research questions guided this study: a) what are the effects of peer-mediated interventions intended to improve Emergent Bilingual students' academic achievement? b) what are the characteristics of peer-mediated intervention with Emergent Bilinguals in grades preK-12? c) to what extent does dosage moderate the effectiveness of the intervention? d) to what extent does the quality of the research design moderate the effectiveness of peer-mediated interventions? Findings from these studies indicate peer-mediated interventions were successful for emergent bilingual learners.

De'anne Donnell

Kansas City, KS

Junior

Nutrition and Exercise Physiology (Physical Activity, Nutrition and Human Performance)

The influence of social isolation on alcohol intake in Drosophila melanogaster

De'anne Donnell, Enoch N'goma, and Elizabeth King

Social species, like *Drosophila melanogaster* and *Homo sapiens*, fare poorly when isolated, and research indicates that perceived social isolation can bring about a lot health problems. Perceived social isolation is used when describing loneliness in species because it is an assumption that the species is lonely when they are socially isolated from conspecifics. Flies have the same behavioral traits as humans when it comes to alcohol and exhibit complex addiction-like behaviors that can have long-lasting effects on behavior just like humans (Scholz, 2008). Using the aspect of social isolation and knowing that flies show similar addictive-like behaviors as humans, can help identify if social isolation plays a part in alcohol addictions. Flies outbred from a large recombinant inbred population, 50 female flies and 50 male flies were chosen. The flies were then split up into two different groups, the control group, and the experimental group. The experimental group was put into 2 weeks of isolation while the control group will have social interaction for 2 weeks, before the experiment took place. After the 2 weeks, the Capillary Feeder (CAFE) Assay will be used to track food for each fly for 8 hours one time a week, giving the fly two liquid food options, the control food which consists of sucrose and yeast extract, and the experimental food that adds in the ethanol. Based on the results of other research studies, we expect that isolated fruit flies will consume more alcohol-containing food than fruit flies who were not isolated. This experiment is still in progress, though we expect our results will back up other research studies that have linked isolation and alcohol consumption. We want to see if isolation causes an alcohol addiction or if having an alcohol addiction causes isolation and this experiment can provide an answer to that.

Kaylynn Donnell

Independence, MO

Faculty Mentor: Dr. Shanise Jones, Educational, School & Counseling Psychology

Sexual Consent

Kaylynn Donnell, Enrique Fuentes, Alyssa Hahn, Rachel Berry, and Shannise Jones

Though many different tactics have been used to ascribe a definition to consensual sexual behavior, the definitions that have been used tend to provide a unidimensional, rote systematic concept of what sexual consent is and how it *should* be practiced. This study aims to deconstruct the formalized notion of consensual behavior and attempts to attain an understanding of how nuanced the communication of sexual consent can be in "real-world" settings. Using a grounded theory qualitative methods approach, participants were presented original vignettes that depict sexual activities where the component of consent is ambiguous. Later, participants were interviewed and asked to explain in a fair amount of detail a fairly recent sexual encounter and elaborate on how they interpreted and signaled signs of consent. Participants were given an oral example of how to do the read-aloud session, and then asked to highlight whether or not the scenario depicted consent, and if so, how/where/in what ways. Gender/sexual orientation data will be collected with demographic data and any differences in interpretation of consent for different groups will be analyzed along with thematic elements of interview responses.

Lindsay Durdle

Columbia, MO

Faculty Mentor: Dr. Amanda Rose, Psychological Sciences

Association of Adolescents' Social Cognitive Orientations and Young Adult Well Being and Adjustment

Lindsay M. Durdle, Allie M. Spiekerman, and Amanda J. Rose

Adolescence is a period of development that introduces many cognitive, social, and emotional changes. How well adolescents navigate these changes lays the groundwork of their later development. Research suggests that youth's social-cognitive processes have important implications for their well-being and development (Crick & Ladd, 1994). This study examines the relationships between adolescents' social-cognitive orientations, and how they impact transitioning into adulthood. Relations were examined between adolescent rejection sensitivity, social goals, and problem solving, and adult educational attainment romantic satisfaction, partner problem talk, and emotional adjustment. We predict that participants with adaptive social-cognitive orientations in adolescence will have more successful adjustment into adulthood.

In 2007-2009, data from seventh and tenth graders were collected (Rose et al., 2014). Participants were contacted again as young adults and invited to complete a follow-up questionnaire online. The final sample consisted of 270 participants, 159 girls and 111 boys.

Measures used in the adolescent assessment included the Social Goals Scale (based on Rose & Asher, 2004), Rejection Sensitivity Questionnaire (Downey & Feldman, 1996), and the Problem-Solving Inventory (Perez et al., 1997). In young adulthood, participants educational attainment was assessed. They also reported whether they had a romantic relationship and, if so, responded to one item regarding satisfaction. Participants also responded to items from Center for Epidemiologic Studies–Depression Scale (CES–D; Radloff, 1977).

Angry rejection sensitivity was associated with lower levels of romantic satisfaction, however there were no associations between rejection sensitivity and internalizing symptoms. Positive social goals were associated with romantic satisfaction and high educational attainment. Negative goals are associated with conflict resolution in relationships. The underlying dimension of problem-solving conflict is related to higher educational attainment. This research could give new information regarding the importance of fostering positive social cognitive skills and highlight the importance of intervention in adolescence.

Lauren Eagon

Frontenac, KS

Faculty Mentor: Dr. Michael Byrne, School of Natural Resources

Effectiveness of coverboards to survey reptiles and small mammals in a tallgrass prairie

Lauren Eagon and Michael Byrne

Prairie Fork Conservation Area in Callaway County, Missouri, is a 711-acre restored prairie managed with prescribed burns. This study aimed to identify the effectiveness of cover boards as a method to survey reptile and small mammal species on a managed tallgrass prairie like Prairie Fork. A total of 55 cover boards were placed throughout prairie habitats and each board was checked once a week from 15 September – 15 November 2021. All reptile and small mammal species under the boards were identified and recorded along with the date and temperature. We used an occupancy modeling approach to quantify the effects of date and temperature on the probability of detecting reptiles and small mammals, respectively. Reptiles were found at 16 (29%) cover boards and most observations (67%) were of speckled kingsnakes (*Lampropeltis holbrooki*) with fewer sightings of prairie kingsnakes (*Lampropeltis calligaster*), eastern yellow-bellied racers (*Coluber constrictor flaviventris*), brown midland snakes (*Storia dekayi*), and common garter snakes (*Thamnophis sirtalis*). Small mammals were found at 25 (45%) sites and included consistent sightings of deer mice (*Peromyscus maniculatus*), North American least shrew (*Cryptotis parva*), and prairie voles (*Microtus ochrogaster)*. Results suggest that cover boards were effective for surveying small mammals but less effective for reptiles. Observed small mammals were fairly diverse and representative of the community while reptile observations were mostly dominated by speckled kingsnakes and did not include some common species previously found in the habitat. As the fall progressed the probability of detecting snakes decreased, whereas the probability of detecting small mammals increased. This indicates that reptiles are most active in early fall with strong decreases in activity by mid-October and an opposite trend for small mammals. For future surveys, we would recommend focusing reptile sampling efforts before October and small mammal efforts after October.

Jake Edgar

Marceline, MO

Senior
Digital Storytelling

Faculty Mentor: Christian Rozier, Digital Storytelling

Stuck :(

Jake Edgar and Christian Rozier

People are free to criticize all they want, but until they know what the day-in-day-out cycle is like for the girl at home who won't seem to leave, their words are empty. *Stuck* does its best to highlight the bittersweet lifestyle of a friend with depression who is simply unable to leave her hometown.Told (with a trigger warning) by a girl whose perception of her condition is desensitized and comical at this point, *Stuck* wants to shed a healthy light on just what is so hard about not being able to do anything, and the small blessings that come at the end of each day.

Esirioghene Emeje

St. Louis, MO

Effects of the beta-adrenergic antagonist propranolol on anxiety and social functioning and relationship with heart rate variability in autism spectrum disorder

Esirioghene Emeje, Kathy Hirst, Julie Muckerman, Katie Bellesheim, Nicole Takahashi, David Beversdorf and Bradley Ferguson

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that is characterized by persistent deficits in social communication and social interaction across multiple contexts. One of the main concerns that affects children with ASD is their ability to communicate socially, which affects their ability to interact with others and often results in reduced quality of life. Also, many people with ASD have high anxiety levels, and as a result, their social functioning is reduced which impacts their day to day lives. The present study examined the effects of propranolol, a beta-adrenergic antagonist with anxiolytic properties, over a 12-week open label clinical trial. We hypothesized that after participants take propranolol for 12 weeks, there would be a significant increase in their sociability and decreases in their anxiety.

Participants were youth and adolescents diagnosed with ASD (n = 51, M age = 14.02, SD = 4.7, range = 7-23, 10 females). Participants received propranolol in an open label fashion. Heart rate variability and Clinical Global Impression of Severity (CGI-S) of anxiety and social functioning were assessed at baseline and again after 12 weeks of taking propranolol.

Results indicate that anxiety and social severity decreased significantly after 12 weeks of propranolol. Heart rate variability significantly increased after 12-weeks of taking propranolol. These results suggest that propranolol may be used to treat social severity and anxiety in some individuals with ASD. Furthermore, increases in HRV after taking propranolol for 12 weeks suggests that the autonomic nervous system was in a "rest-and-digest" state, which may explain why social severity and anxiety decreased after taking propranolol. Future analyses will examine the effects of propranolol on social severity and anxiety in ASD from the double-blind portion of the trial.

Brandi Estes

Sedalia, MO

Faculty Mentor: Dr. Shannise Jones, Educational, School & Counseling Psychology

Exploring the Nuances of Sexual Consent Communication & Interpretation

Brandi Estes, Rachel Berry, Enrique Fuentes, Kay Donnell, Alyssa Hahn, and Shannise Jones

Though many different tactics have been used to ascribe a definition to consensual sexual behavior, the definitions that have been used tend to provide a unidimensional, rote systematic concept of what sexual consent is and how it *should* be practiced. This study aims to deconstruct the formalized notion of consensual behavior and attempts to attain an understanding of how nuanced the communication of sexual consent can be in "real-world" settings. Using a grounded theory qualitative methods approach, participants were presented original vignettes that depict sexual activities where the component of consent is ambiguous. Later, participants were interviewed and asked to explain in a fair amount of detail a recent sexual encounter and elaborate on how they interpreted and signaled signs of consent. Participants were given an oral example of how to do the read-aloud session, and then asked to highlight whether the scenario depicted consent, and if so, how/where/in what ways. Gender/sexual orientation data will be collected with demographic data and any differences in interpretation of consent for different groups will be analyzed along with thematic elements of interview responses.

Catherine Everett

Nixa, MO

Adolescent Friendship Quality: Analyzing the Impact of Temperament, Emotional Reactivity and the Role of Gender

Catherine Everett, Gabrielle Scott, Hannah Holladay, Archer Cole, Allie Spiekerman, Sarah Borowski, Ashley Groh, Amanda Rose

Positive friendships relate to better psychological health. (Stotsky et. al, 2018). During adolescence, dyadic friendships become more important than peer acceptance (Demir & Urberg, 2004) and have consistently related to different indices of adjustment. It is important to consider individual differences that might influence the quality of friendships, such as emotional reactivity. Temperament has been shown to be stable throughout development, and influences individuals' emotional reactivity within friendships. Temperamental characteristics (e.g., emotional intensity) are considered to have significant implications for children's peer relationships (Rothbart & Bates, 1998). Better temperamental reactivity has been found to predict positive friendship quality (Gleason et. al, 2005).

Research on the relation between emotional reactivity and friendship quality among adolescents is limited. The purpose of the current study is to examine the association between emotional reactivity and friendship quality. Two measures of emotional reactivity are considered: trait emotional reactivity (i.e., temperament) and state emotional reactivity (i.e., change in negative emotions from before to after an interaction task). Participants in the study include 180 adolescents (62 boys, 118 girls) in the eighth, ninth, and tenth grade. They completed a series of surveys on Qualtrics as well as a negative valence task (problem talk). Measures include the

Early Adolescent Temperament Questionnaire (Capaldi & Rothbart, 1992; Ellis & Rothbart, 2001), which assesses the extent to which adolescents tend to experience negative affect or negative reactivity. The Positive and Negative Affect Scale (Watson et al., 1999) assessed positive and negative effects before and after task. Lastly, the Friendship Quality Questionnaire (Rose, 2002) assessed positive and negative qualities of the adolescents' friendship. Analyses will be conducted to determine whether there are associations among trait emotional reactivity, state emotional reactivity, and friendship quality. Gender differences will be considered in all analyses.

Faith Fleming

Columbia, MO

Comparing Emotional Responses when Viewing Death and Dying Related Video Art

Faith Fleming, Abby Blenk, Shelby Ryan, Peter Helm, and Katina Bitsicas

The ASH Art of Death Digital Storytelling Research Team analyzed viewer perception of death and dying when viewing death related video art, and whether targeted media can alter emotional responses to death-related stimuli. Previous research from the ASH team has indicated that viewing metaphorical footage of death evokes positive responses ("Beauty", "Peace", and "Positive Emotions") in participants and primes them to think about mortality and discuss death comfortably.

To build on these findings, the team created two video art pieces, collectively named *Points of View*. The study of *Points of View* examines how the metaphorical footage affects death anxiety and perception of death.

Points of View is a two-stage video art experience of death as a physiological and emotional process. The first stage features an animation depicting the scientific process of death as a self-contained piece, while the second combines this animation with a video background reflecting emotional responses to death.

Participants (N=TBD) viewed the videos in sequence through an online survey conductor (mTurk). The factual animated depiction of death was shown first, immediately followed by a baseline survey. This measured participants' mental response and perception of death as a physiological process. Participants then viewed the combined animation and video artwork. Afterward, participants answered the same questions again, as well as three additional questions about the viewing sequence. Finally, participants were asked to select whether each element of the artworks elicited specific emotional responses.

Data collection is still in process and results will be finalized by the beginning of April 2021. The expected result of the project is that participants will experience less death anxiety after viewing the combined footage and animation than after viewing only the animation.

Liz Fletcher

St. Louis, MO

Senior
Biological Sciences; Psychology

Faculty Mentor: Dr. Aaron Stoker, Orthopaedic Surgery

Evaluation of Metabolic Response to Injury and IL-10 Stimulation of Intervertebral Disc

Elizabeth Fletcher, Emma LePage, and Aaron Stoker

Introduction: This study was designed to assess the pathologic and metabolic changes that occur after injury and IL-10 stimulation to a rat tail whole organ IVD during long term culture. It was hypothesized that there will be a significant decrease in the production of inflammatory and degradative biomarkers in response to stimulation with IL-10 in injured and uninjured IVDs. Further, the production of inflammatory and degradative biomarkers in response to IL-10 stimulation will be significantly higher in injured IVDs compared to uninjured IVDs.

Methods: Tails were collected from 6 skeletally mature Sprague Dawley rats euthanized for reasons unrelated to this study. IVD Explants (n=24) were created and assigned to either the Injured or Uninjured group with or without IL-10 at 10.0 or 0.0ng/ml. Explants were cultured for 12 days, and media were changed every 3 days and collected for biomarker analysis. On day 12 tissues were processed for cell viability using a resazurin assay.

Results: On day 3 of culture, groups treated with IL-10 produced significantly lower levels of media GAG, PGE2, and MMP Activity. Injured IVDs treated with IL-10 produced significantly higher levels of GROKC, and uninjured samples treated with IL-10 produced significantly lower levels of VEGF.

Discussion: This study uses a whole organ model of disc disease to uncover pathways activated by IL-10 stimulation with and without injury to provide potential diagnostic biomarkers and therapeutic targets for IVD degeneration. The results suggest that IL-10 shows protective and antidegradative effects, and in uninjured samples IL-10 may decrease vascularization.

Brandon Ford

Lebanon, MO

Faculty Mentor: Dr. Christopher Josey, Communication; Dr. Andrea Figueroa-Caballero, Communication

Examining the portrayals of race and ethnicity within Latinx-centric news sites

Brandon Ford, Kobe Gibson, Evelyn Mabie, Caitlin Tate, Andrea Figueroa-Caballero, and Christopher Josey

Previous research shows traditional news media often present African Americans in negative and stereotypic ways. However, representation of African Americans in African American-focused news media has rarely been studied. We argue that an examination of this content is important as previous research indicates that individuals—particularly those from marginalized groups—are particularly attune to representations of their group in media content and seek out group-affirming content (Abrams & Giles, 2010). In our study, we assessed the content of 600 articles from 4 different African American-focused media outlets (150 stories from each, *Black Voices*, *The Root*, *The Grio,* and *Blavity*) at both the story- and character-level to determine how African Americans were portrayed by news media created for and focused on them. We hypothesized, that African American-focused news media would overrepresent African Americans when compared to African Americans as a percentage of the population of the United States and the number of portrayals of African Americans by traditional news media. We also hypothesized that these news media will feature more positive portrayals of African Americans. Using a digital codebook created using the Qualtrics survey software, coders were trained on ~10% of the sample until they were deemed to be consistent across all relevant variables. Our results indicate preliminary support for our hypotheses. First, African American-focused news media overrepresents African Americans compared to traditional news media and US census data. Second, African American-focused news media portrays African Americans more favorably than traditional news media. Based on this research, we will now focus on assessing whether the more positive portrayals found on this site, can lead to positive effects (i.e., increased self and group esteem) on their target audience.

Camara Ford

Aurora, IL

Effect of oral contraceptive pill phase on carotid body chemosensitivity

Camara A. Ford, Dain W. Jacob, Jennifer L. Harper, Clayton L. Ivie, and Jacqueline K. Limberg

Objective: Patients with sleep apnea experience periods of low oxygen (hypoxia) during sleep. The carotid body (CB) chemoreflex stimulates an increase in breathing during hypoxia (hypoxic ventilatory response, HVR). Sleep apnea is more prevalent in men than women, possibly due to sex differences in CB chemosensitivity; however, mechanisms remain unclear. We sought to examine the impact of sex hormones on CB chemosensitivity to hypoxia. We hypothesized the HVR would be greater in the active pill phase of oral contraceptive use compared to the placebo pill phase.

Methods: Women taking oral hormonal contraceptives (n=10) completed 2 visits (placebo, active) in random order. During each study visit, women were instrumented for measures of heart rate, blood pressure, and minute ventilation. Women completed an HVR test on both visits, consisting of a 2-min normoxic baseline, followed by 4-5 acute exposures to hypoxia. The HVR was assessed as the slope of the relationship between arterial oxygen saturation (SpO2, %) and minute ventilation (L/min).

Results: Plasma ethinylestradiol was 57±34 pg/mL during the placebo pill and 110±42 pg/mL during the active pill phase of oral contraceptive use (p=0.21). The hypoxic ventilatory (-0.28 to -0.25 L/min/%, p=0.47), heart rate (-0.96 to -0.79 beats/min/%, p=0.34), and blood pressure response (-0.42 to -0.40 mmHg/%, p=0.84) to hypoxia did not differ between placebo and active pill, respectively.

Conclusions: Contrary to our hypothesis, the HVR did not differ between active and placebo pill phases of oral contraceptive use. These data suggest there is no observable effect of changes in exogenous female sex hormones on CB chemosensitivity in healthy young women.

Max Frank

For Zumwalt West, MO

Senior
Political Science; Philosophy

Faculty Mentor: Dr. Stephen Quackenbush, Political Science

Sticks and Carrots in American Deterrence

Max Frank and Stephen Quackenbush

The United States is currently the world hegemon, or in more simple terms, the world leader in culture, power, and setting the status quo. In the current international arena, we have four nations who have been seen as rapidly growing in power, both economically and culturally, named by Jim O'Neill of Goldman Sachs' (2001, 1) as the BRIC countries, standing for Brazil, Russia, India, and China.

With these BRIC countries rapidly rising in power, the world will now be looking to see how the hegemon will react to the new, more prominent presences, and more importantly, how relations will continue after the United States has made its reaction. This issue is important now more than ever, as the United States must move to secure world peace before serious confrontation arrives.

The goal of my study is to evaluate the history of the United States' reaction to these rising powers, dating back to the end of the Cold War Era, around 1992. I will be using CRS (Congressional Research Service) Reports to establish reliable historical reports. I will be focusing on the Stick and Carrot view of deterrence (H.L.A. Hart, 1972, 2-25). My theory is that using Carrots, or trying to deter an opposing nation from war with benefits such as alliances or economic aid, will result in a less hostile situation where war is less likely to ensue when compared to situations where sticks (or threats) are used. I will then evaluate the standing relationship between the US and each nation, compare this standing to historical record, and conclude whether my theory is correct or incorrect. Results and Conclusion will be presented at the MU's Undergraduate Research & Creative Achievements Forum on April 21st of 2021.

Veronica Fritz

Columbia, MO

Hydrological processes in agricultural lands under changing environments

Veronica Fritz, Thaksha Thaasan, Andrew Williams, Prasad Calyam, Ranjith Udawatta, Sidath Mendis, and Noel Aloysius

Changing weather patterns and anthropogenic land use change significantly alter the terrestrial water cycle. A key variable that modulates the water cycle on the land surface is soil moisture and its variability in time and space. Hydrological models are used to simulate components of the water cycle including infiltration, soil storage and uptake by plants. Uncertainties remain in accurately representing soil moisture dynamics in models. With the aid of several sensors installed at a 30-ha experimental research facility, we attempt to quantify differences in soil water storage across multiple land use types – cropped area, mosaic of turf grass and native plants, and an unkept weeded area as control land use. We will also discuss the accuracy of sensors in measuring soil water storage. We use a variety of instruments to measure weather, evapotranspiration, and soil water. We used boundary layer scintillometers to measure near-surface turbulence, sensors to continuously track soil moisture and temperature, as well as weather stations for precipitation, air temperature, solar radiation and wind speed. Changes in volumetric water content and soil temperature are measured at 5-minute intervals at 10-, 20-, and 40-cm soil depths to compare soil water storage among the three land use types. We also took soil samples to calibrate the sensor readings at three sites. We analyzed several storm events over a period of five months and compared the actual soil moisture and soil temperature dynamics at finer time intervals. With additional measurements of weather and boundary layer turbulence, we hope to reveal the landscape and weather control on soil moisture distribution across multiple land uses, and their impact on plant water uptake. Our preliminary results indicate that continuously disturbed agricultural lands deplete soil moisture at faster rates, which may present challenges in maintaining land productivity in the long term.

Enrique Fuentes

Chicago, IL

Faculty Mentor: Dr. Shannise Jones, Educational, School & Counseling Psychology

Sexual Consent

Enrique Fuentes, Rachel Berry, Kaylynn Donnell, Alyssa Hahn, Brandi Estes, and Shannise Jones

Though many different tactics have been used to ascribe a definition to consensual sexual behavior, the definitions that have been used tend to provide a unidimensional, rote systematic concept of what sexual consent is and how it *should* be practiced. This study aims to deconstruct the formalized notion of consensual behavior and attempts to attain an understanding of how nuanced the communication of sexual consent can be in "real-world" settings. Using a grounded theory qualitative methods approach, participants were presented original vignettes that depict sexual activities where the component of consent is ambiguous. Later, participants were interviewed and asked to explain in a fair amount of detail a fairly recent sexual encounter and elaborate on how they interpreted and signaled signs of consent. Participants were given an oral example of how to do the read-aloud session, and then asked to highlight whether or not the scenario depicted consent, and if so, how/where/in what ways. Gender/sexual orientation data will be collected with demographic data and any differences in interpretation of consent for different groups will be analyzed along with thematic elements of interview responses.

Behavioral/Social Sciences

Nathan Furnas

Springfield, MO

Sophomore
Anthropology; Ancient Mediterranean Studies

Faculty Mentor: Dr. Jamie Arndt, Psychological Sciences; Dr. Benton Kidd, Ancient Mediterranean Studies

The Art of Death: Recognizing Links between Sex and Death in the Visual Record

Nathan Furnas, Luci Cook, Javier Cuenca, Peter Helm, Benton Kidd, and Jamie Arndt

Throughout history and across mediums, the eternal themes of sex and death have long been paired in the literary and visual records. In our research, we used examples of modern and historical art representing sex and death to question how such subjects influence the thoughts and feelings of viewers. Do respondents recognize a link between sex and death, and if so, is the link positive or negative? Are there connections between a participant´s sexual identity, religion, etc., and their perspective on sex and death? To investigate these questions, we surveyed respondents to gauge erotic and violent overtones in the images. We conducted two identical surveys, the first of which utilized Amazon's MTurk, targeting respondents of all ages; the second study targeted students 18-25 on the Mizzou campus. In the first study, individuals (N = 450) completed personality and individual difference measures regarding their perceptions of various forms of death, violence, and eroticism in visual art. In the second study, students (N = 40) took the same survey, but the group was evenly divided between heterosexual and non-heterosexual participants on MU's Campus. The images used in both surveys illustrated the themes in question and neutral control images. Analyses of the data also revealed whether engaging with images led respondents of different sexualities, religion, etc., to reflect further on death-related feelings towards sex and violence, and whether they recognized a link between sex and death.

Owen Gallagher

Weldon Spring, MO

Senior
Environmental Sciences (Water)

Episodic and Chronic Nutrient Loading Effects on Cyanobacteria and Cyanotoxin Concentrations During Harmful Algal Blooms

Owen Gallagher, Sophie Duchesne, Haley Kretzer, Keilan Ledger, Catherine Goltz, Helen Baulch, Nora Casson, Jason Venkiteswaran, Colin Whitfield University, and Rebecca L. North

Eutrophication is the process in which excessive nutrients, primarily nitrogen and phosphorus, enter a body of water resulting in a rapid growth in population and density of phytoplankton. One type of phytoplankton made more concentrated during eutrophication is cyanobacteria. Some cyanobacteria can produce classes of cyanotoxins including microcystin and cylindrospermopsin. These cyanotoxins can have many negative impacts on both aquatic ecosystems and human health. The objective of this research is to determine the effects chronic and episodic nutrient loading have on cyanobacteria and the resultant cyanotoxin concentrations across four water bodies (Crow Pond in Williamsburg Missouri, Stephens Lake in Columbia Missouri, Lake 3 in Winnipeg, Manitoba and Pike Lake in Saskatoon, Saskatchewan). We simulated chronic loading by adding small amounts of nutrients (nitrogen and phosphorus) over a six-day period in a nutrient simulation experiment. Episodic loading was simulated by adding a large spike of nutrients to lake water on the first day only of the nine-day experiment. At the end of the experiment, we analyzed sample water for chlorophyll-a and phycocyanin concentrations as proxies for phytoplankton and cyanobacteria, respectively, as well as microcystin and cylindrospermopsin concentrations. This research is important to better understand how cyanobacteria respond to different types of external nutrient inputs, helping to understand how fresh water bodies might be impacted in the future as episodic events such as seasonal flooding become more severe.

Life Sciences

Amberlee Gandy

Gower, MO

Senior
Agricultural Education (Communications & Leadership)

Faculty Mentor: Lesleighan Cravens, Plant Sciences

Funeral For One

Amberlee Gandy, Grace Anderson, and Lesleighan Cravens

Whether it be losing a loved one, being isolated from family and friends, or witnessing the horrors of COVID-19 firsthand as a frontline worker, it is impossible to come out of this pandemic without being personally affected by the illness. Our floral artwork conveys the lonely scene of a COVID-19 patient nearing death. Blooms of carnations, roses, gerbera daisies, and delphinium in tones of fuschia, marigold, sky blue, and peony pink were placed closer to the window to convey vitality before transitioning into more neutral earthy tones, symbolizing that they are about to be laid to rest. Using manipulated chicken wire, a human body was constructed on a resting surface. The constructed body was covered in severed fresh roses, baby's breath and mums as well as dried artichokes and hydrangeas in tints, tones, and shades of brown, gold, and burnt orange to represent someone passing alone. One last thought of human connection to our patient was the lone arrangement on the bedside table.

We were inspired to create this installation after our own family members were hospitalized due to COVID-19. We wanted to use this platform to showcase the feelings of hopelessness, anxiety, and loneliness that our family members felt in and outside of the hospital. In true COVID-19 fashion, we were the only two people to see the exhibit and had to deconstruct it as quickly as we constructed it.

Jessica Garcia

Columbia, MO

Sexual Dimorphism in Neuron Count and Density in Anolis cristatellus

Jessica Garcia, Levi Storks and Manuel Leal

The West Indian *Anolis* lizards have evolved independently across the Islands of the Greater Antilles, resulting in different ecomorphs within the habitats of each island. Between ecomorphs categories, adaptations to effectively exploit distinct microhabitats has impacted morphological and behavioral traits, resulting in phenotypic diversity across species. Within those different ecomorphs, varying degrees of sexual dimorphism have also evolved. While there are differences in physical attributes between female and male anoles, little is known about the sexual dimorphism in neuroanatomy. We hypothesized that males will have larger total cell numbers compared to females as they have larger territories, are bigger in size and are more likely to disperse. To test this hypothesis, the *Anolis* brain was sectioned off into three parts: the cerebellum, telencephalon, and the rest of brain. From there, isotropic fractionation was be used in order to count and estimate the total non-neuron and neuron composition of the brain. Preliminary results indicated that in *Anolis cristatellus* males on average had more total neurons in the brain when compared to females. For future studies, ecomorphs with varying degrees of sexual dimorphism can be compared in order to gain a better understanding of how sexual dimorphism impacts the neuroanatomy of *Anolis* brains.

Ashwin Garlapaty

Eureka, MO

Faculty Mentor: Dr. Aaron Stoker, Orthopaedic Surgery

Relationships among Pro-Inflammatory and Degradation-Related Biomarkers released by Articular Cartilage from Osteoarthritic Knees

Ashwin Garlapaty, Hayley Ockerhausen, Matthew Gao, Chantelle Bozynski, James Keeney, James Cook, and Aaron Stoker

INTRODUCTION: Osteoarthritis (OA) is a multifactorial disease progressing to whole-joint inflammation and degeneration causing pain and dysfunction. Previous studies found weak to moderate correlations between inflammatory biomarkers and degradation related biomarkers. This study was designed to find non-linear relationships between inflammatory biomarker and degradation related biomarkers to better understand how OA development and progression.

METHODS: With IRB approval (#1208392), cartilage was collected from TKA (n=8). 6mm diameter cartilage explants were created and cultured in supplemented DMEM with a 3-day media sample analyzed for biomarkers. The data was placed into evenly distributed quartiles. A Kruskal Wallace with post-hoc analysis and Bonferroni correction were used to determine significant differences between groups ($p < 0.05$).

RESULTS: This analysis of the data found numerous biomarker production relationships not found using standard linear correlation analysis, and provided insight into the dynamics of biomarker production for biomarkers with a weak moderate linear correlation.

CONCLUSION: The results of this study uncover relationships between inflammatory and degradation related biomarkers. Ongoing studies are aimed at further characterization of these interactions during development and progression of OA towards better defining disease mechanism and targets for effective interventions.

Kobe Gibson

Memphis, TN

Faculty Mentor: Dr. Christopher Josey, Communication; Dr. Andrea Figueroa-Caballero, Communication

Examining Portrayals of Minority Groups in African American focused news media

Kobe Gibson, Andrea Figueroa-Caballero, and Christopher Josey

This abstract has been withheld due to proprietary permissions.

Gregory Glickert

Wildwood, MO

Faculty Mentor: Dr. David Mendoza-Cozatl, Plant Sciences

Development of a yeast colony classification system using computer vision

Greg Glickert, Elizabeth D. Fallon, Christopher Zachary, and David G. Mendoza-Cozatl

Yeast one-hybrid (Y1H) and yeast two-hybrid (Y2H) systems are among the most common techniques to detect protein-DNA (Y1H) and protein-protein interactions (Y2H). These systems utilize a prey-bait system to detect interactions and our lab has implemented high-throughput Y1H and Y2H screenings by combining a transcription factor (TF) library containing 1,956 TFs from the model plant Arabidopsis and a microbial array pinning robot (RoToR). While our high throughput system is fully functional, the number of putative interactions that are able to be tested has outgrown our capabilities to identify positive interactions by hand. For instance, a Y1H screen probes 5,868 possible interactions per kb of DNA. This in turn creates a bottleneck if the results (i.e., colony size or color) are scored individually by researchers conducting the screen. To solve this issue, we have developed a colony classification system using computer vision and data processing libraries available in Python such as Open Computer Vision and NumPy for image analysis and SciPy/xlrd/Pandas and scikit-learn for data processing and formatting. Briefly, our pipeline first identifies colonies on individual yeast plates [96 or 384 formats], then the plate goes through an adaptive threshold so only one yeast colony remained in the image. To find the size of each colony, a connected components algorithm was used to find the area of each yeast colony. Next, color data was extracted by isolating individual colonies and separating the different color channels. Color and size data are then put into a data frame and exported into an Excel file. In the future, these data can then be used to train machine learning models made with Keras and scikit-learn to classify Y1H and Y2H hybrid with a higher degree of precision.

Maddy Gomez

Allen, TX

Faculty Mentor: Dr. Nick Potter, Digital Storytelling

Mariposa

Maddy Gomez and Nick Potter

Mariposa is about the disappearance of my family's wealth and the unspoken impact it had on the generational women of my family, prompting questions of whether or not they'd be able to survive after immigrating to the US. It is narrated by my aunt who experienced this first hand.

To create a sense of immersion, I've incorporated real footage dating from the 2000s all the way back to the 60's, during the period she describes. While searching for the footage, I found it therapeutic to step back in time and watch my family grow up. The narration is recorded from a phone call with my aunt. I wasn't sure it would work out, while editing, but I found it surprisingly cohesive once finished. I also incorporated two classical piano pieces that I grew up listening to while cooking in the kitchen with my abuelita.

My goal for this film is to tell the story of the struggle Mexican women can face when they've been abandoned in a foreign country. I know it can be scary having to start a new life in a country you're unfamiliar with, so I hope this film brings comfort to people in similar situations, knowing the women in my family made a successful life for themselves here in America.

Sophie Gordan

Naperville, IL

Faculty Mentor: Dr. Sherri Ulbrich, Nursing

Evidence-Based Fall Prevention Strategies for MU Healthcare

Sophie Gordan, Katrina Schache, Melanee Castillo, Chloe Cobb, Jessica Tompkins, Kathryn Stieglitz, Savannah Valeria, and Sherri Ulbrich

Patient falls are a significant problem in every hospital unit because they contribute to poor patient outcomes and increase length of stay and cost. The Fall Council at MU Healthcare collects monthly data, and data from the last year revealed an increase in in-patient and out-patient falls. The National Database of Nursing Quality Indicators sets goals for the number of patient falls per 1,000 patient days and ranks hospitals by percentile. Currently, 38% of MU Healthcare's in-patient units are performing above the 50th percentile, and 81% of the out-patient units are performing above the 50th percentile. The goal of this project is to review the literature for evidence-based fall prevention strategies and present the findings with an associated recommendation to MU Healthcare's Fall Council.

The research question examines the impact of conducting post-fall debriefs on preventing further falls in the hospital setting. The research team conducted literature reviews for each of the following areas: general medical-surgical, critical care, emergency, perioperative, psychiatric, pediatric, and perinatal. Decreasing the number of falls that occur in each of these departments in MU Healthcare is a priority for enhancing patient safety and classifying the institution with magnet status. Initial findings support the hypothesis that post-fall debriefs are an effective strategy in reducing the number of repeat falls and establishing improved safety culture and communication among staff. Post-fall debriefs were found to be most effective when strong and positive leadership runs the debrief meeting and when the team has strong group safety norms. The recommendation based on evidence-based research is that MU Healthcare creates a post-fall debrief tool and initiates post-fall debriefs after each fall with all staff present on the unit at the time of the fall.

Madison Green

Warrensburg, MO

Effects of Maternal Oxycodone Exposure on Mouse Placental Development

Madison T. Green, Rachel E. Martin, Jessica A. Kinkade, Robert R. Schmidt, Nathan J. Bivens, Geetu Tuteja, Jiude Mao, and Cheryl S. Rosenfeld

Maternal opioid use disorder (OUD) has become a prominent public health issue. Many studies have explored the effects of oxycodone use in individuals; however, few have examined how maternal use of oxycodone affects conceptus development. Correlations between maternal OUD and detrimental fetal development effects have been observed. The hemochorial form of placentation present in both humans and mice facilitates the exposure of the developing conceptus to oxycodone as the placenta and maternal blood are in close contact. This project serves as a continuation of a study investigating the effects of maternal oxycodone exposure on mouse placental development. We hypothesize that oxycodone exposure may result in functional changes in the placenta. Twelve CF1 mice received daily doses of either 5 mg oxycodone/kg body weight or saline control via intraperitoneal injection beginning two weeks prior to breeding. Placenta samples were collected at embryonic age 12.5. Prior histological analyses have shown a reduction in the size of the trophoblast giant cell area in placental samples collected from mice exposed to oxycodone. Previous RNA-seq testing indicates gender specific changes in gene expression between the oxycodone and control placenta samples. Quantitative PCR trials were conducted to validate changes observed in eight genes that were DE in OXY female vs CTL female placenta. GAPDH served as the internal reference gene for these trials. The trials confirm an upregulation of *Ceacam11*, *Ceacam12*, *Ceacam14*, *Prl2bl*, *Prl7bl*, and Tpbpb in the oxycodone exposed female placental samples. The downregulation of *Tpbpa* in oxycodone exposed male samples was also confirmed. Quantitative PCR trials are in progress to analyze the expression of *Ceacam11*, *Ceacam12*, *Ceacam13*, *Ceacam14*, *Prl2bl*, *Prl7bl*, *Tpbpa*, and *Tpbpb* in mouse trophoblast stem cells. Results to date suggest that maternal oxycodone exposure does impact the structure and genetic expression of the placenta.

Erik Griffen

Ashland, MO

Faculty Mentor: Dr. Michael Byrne, School of Natural Resources

Diet Composition of Juvenile Blue and Channel Catfish During Different Seasons in the Lower Missouri River

Erik Griffen, Thomas Boersig, and Michael Byrne

Blue and channel catfish are important sportfish that inhabit large, turbid rivers like the Missouri River. Both species coexist as adults in similar habitats by consuming different prey species, but little is known about the diet of juvenile catfish (0-200 mm). Our goal was to quantify and compare diet composition of juvenile blue and channel catfish throughout the summer to assess diet partitioning in early life stages. We opportunistically sampled catfish captured during pallid sturgeon sampling June-August on the lower Missouri River from river mile 130-212. Blue and channel catfish were classified into small (0-100 mm) and large (101-200 mm) size classes. To investigate seasonal diet, catfish were classified as early, mid, and late seasons of the summer. Stomachs were dissected and contents were identified as fish, crustaceans, plants, terrestrial insects, unidentified, and order for aquatic insects. We used regression analyses to understand the relationship of discharge and stomach fullness. We found significant differences in diet composition across both size classes and seasons for both species. Stomach fullness and discharge were statistically significant for small channel catfish. Diets between blue and channel catfish differed significantly for each size between seasons. Channel catfish are highly omnivorous compared to blue catfish and consume more plant material. Blue catfish consume more aquatic insects at small sizes than channel catfish. In the future, larger sample sizes of catfish across broad discharges will create higher accuracy for stomach fullness and discharge relationships. Based on the results, diet partitioning likely assists coexistence of juvenile channel and blue catfish in the Missouri River. For management implications, reduced competition for prey between blue and channel catfish increases the recruitment of age-0 catfish to the population through increased survival. Controlled dam releases allow access to the floodplain for increased food and habitat availability.

Life Sciences

Alyssa Hahn

Wildwood, MO

Junior
Secondary Education (Chemistry)

Faculty Mentor: Dr. Stephen Whitney, Educational, School & Counseling Psychology; Dr. Shannise Jones, Educational, School & Counseling Psychology

Sexual Consent

Alyssa Hahn, Enrique Fuentes, Kay Donnell, Brandi Estes, Shannise Jones, and Stephen Whitney

Though many different tactics have been used to ascribe a definition to consensual sexual behavior, the definitions that have been used tend to provide a unidimensional, rote systematic concept of what sexual consent is and how it *should* be practiced. This study aims to deconstruct the formalized notion of consensual behavior and attempts to attain an understanding of how nuanced the communication of sexual consent can be in "real-world" settings. Using a grounded theory qualitative methods approach, participants were presented original vignettes that depict sexual activities where the component of consent is ambiguous. Later, participants were interviewed and asked to explain in a fair amount of detail a fairly recent sexual encounter and elaborate on how they interpreted and signaled signs of consent. Participants were given an oral example of how to do the read-aloud session, and then asked to highlight whether or not the scenario depicted consent, and if so, how/where/in what ways. Gender/sexual orientation data will be collected with demographic data and any differences in interpretation of consent for different groups will be analyzed along with thematic elements of interview responses.

Jackson Hale

Warrensburg, MO

Senior
Romance Languages (Spanish); Communication

Faculty Mentor: Dr. Christopher Josey, Communication; Dr. Andrea Figueroa-Caballero, Communication

Examining the portrayals of race and ethnicity within Latinx-centric news sites

Jack Hale, Della Cox, Rachel Henderson, Andrea Figueroa-Caballero, and Christopher Josey

Latinx individuals make up a minority group that faces some of the harshest and inaccurate stereotypes in the media today, despite being underrepresented in most media, especially primetime television (Mastro, Figueroa-Caballero, & Sink, 2017) and news programming (Santa Ana, 2013). Stereotypes include the notion that they are illegal immigrants and criminals (Dixon & Williams, 2015). As a result of these portrayals, Latinx audiences are left with few empowering news outlets to turn to in the mainstream media. This research project began as a means to identify safe and uplifting alternative channels for minority audiences. Specifically, we argue that news sites created for and focused on Latinx individuals might serve as channels of potential empowerment. However, little research has been done surrounding the portrayal of minorities in social identity focused news (SIFN) outlets such as these. Consequently, we began our research project by looking at the quality of this content. We hypothesize that (a) they will over-represent Latinx individuals in their content and (b) will present Latinx individuals more positively than traditional news outlets. News content was compiled from four Latinx online media outlets *News Taco, Latino Voices, El Día News*, and *Latina* . Our final sample was N=600 unique news stories. Our preliminary results suggest that the portrayals of Latinx individuals in Latinx-oriented SIFN were rated more positively than in traditional news outlets. Furthermore, Latinx individuals were overrepresented in Latinx-oriented SIFN compared to the percentage of the US population they comprise in the Census. This means that Latinx-oriented SIFN offers an alternative and a counter-influence to degrading representations of Latinx individuals in the traditional news media both by representing Latinx individuals more positively and less stereotypically, as well as including more Latinx individuals overall in their news coverage.

Hannah Hart

St. Louis, MO

Senior
Nutrition and Exercise Physiology (Human Physiology and Translational Sciences)

Faculty Mentor: Dr. Jacqueline Limberg, Nutrition and Exercise Physiology

Periodontal Disease Causes Cardiovascular Disease

Hannah Hart and Jacqueline Limberg

A diverse microbiome in the oral cavity is essential for good oral health and prevents harmful bacteria from growing. However, if this bacteria becomes unbalanced, it can result in an overgrowth of a harmful bacteria. These dangerous bacteria ferment the carbohydrates that remain on teeth after eating. Bacteria release acid as a byproduct, which erodes the tooth enamel and leaves teeth vulnerable for decay. Erosion of tooth enamel can result in dental carries and gingivitis, which may eventually develop into periodontal disease.

Periodontal disease is a chronic gum infection that leads to damage of the soft tissues that support the teeth. If left untreated, the gingival tissue will release chemokines and cytokines, which elicit an immune response to repair the damage. Periodontal disease not only causes local inflammation, but systemic chronic inflammation.

Due to periodontal disease's systemic effects, it is thought to contribute to complications throughout the body. Prior studies have shown support that periodontal disease increases a person's risk for cardiovascular disease. Cardiovascular disease is a broad term that includes disorders of the heart valves, blood vessels, and muscles. Both cardiovascular disease and periodontal disease increase chronic systemic inflammation. It is thought that inflammation from periodontal disease compounds with cardiovascular inflammation, and accelerate the process of atherosclerosis, which is a buildup of fatty materials on the inner walls of arteries.

Fortunately, periodontal disease can be prevented with routine tooth brushing and flossing. Patients who have already developed periodontal disease should visit a dentist who can help minimize future damage caused by the disease and decrease local inflammation. However, this important information is not promoted in an accessible way to the public. In this short video presentation, I will introduce periodontal disease, how to prevent it, and how it can have systemic effects, like cardiovascular disease, to a lay audience.

Behavioral/Social Sciences

Emily Hawkins

Jackson, MO

Faculty Mentor: Dr. Bradley Ferguson, Health Psychology

Open-label trial of propranolol in autism spectrum disorder and effects on anxiety and GI symptoms

Emily Hawkins, David Q. Beversdorf, and Bradley Ferguson

Background: Many people with autism spectrum disorder (ASD) display significant gastrointestinal (GI) symptoms and exaggerated stress responses, the latter resulting in anxious and mood-related symptoms. Recent meta-analysis revealed that almost 40% of youth with ASD have at least one anxiety disorder. Many studies suggest that there is an increase in GI symptoms in those with ASD compared to those without ASD. In this study, the effects of the beta-blocker propranolol, which has anxiolytic effects, on these aspects of ASD were examined. Methods: Children and youths, ages 7-24, participated in a 12-week open-label trial of propranolol after completion of a 15-week propranolol clinical trial and 2-week wash out period. Clinical Global Impression (CGI) of severity (including anxiety and GI symptoms) and improvement were taken by an expert clinician at baseline and again after 12 weeks of taking propranolol. Results: Dependent samples t-tests with an alpha of 0.05 were used to determine significance. Propranolol significantly reduced anxiety after 12 weeks. Results for the effects of propranolol on GI symptoms are pending. We hypothesize that propranolol will also alleviate GI symptoms. Conclusions: Preliminary data shows that, in those with ASD, propranolol can lesson anxiety. This may result in a decrease in GI symptoms. Overall, this study may display a method of improving the quality of life for people with ASD.

Justine Hemaya

Kansas City, MO

Faculty Mentor: Dr. Patrick Shiu, Biological Sciences

Cofactor for a cap-binding complex involved in meiotic silencing

Justine N. Hemaya, Michael M. Vierling, Logan M. Decker, Hua Xiao, and Patrick K. T. Shiu

The presence of an extra DNA segment is often an indication of a virus or transposon on the move. In *Neurospora crassa* (orange bread mold), several surveillance mechanisms are maintained to keep these selfish elements at bay. One of these defense mechanisms is called meiotic silencing by unpaired DNA (MSUD), which silences any gene not having a pairing partner during meiosis. MSUD utilizes common RNA interference factors, such as Dicer and Argonaute, to suppress the expression of its targets. In eukaryotes, an mRNA transcript is typically bound at the 5' cap by the cap-binding complex (CBC), which assists in its nuclear export. Recently, we discovered that CBC mediates MSUD, possibly by helping to bring targeted mRNAs to Argonaute for destruction. Here, we explore the functional and mechanistic roles of ARS2, a CBC cofactor. ARS2 interacts with CBC and contributes to both sexual and asexual cycles.

Rachel Henderson

Roswell, GA

Examining the portrayals of race and ethnicity within Latinx-centric news sites

Rachel Henderson, Della Cox, Jackson Hale, Andrea Figueroa-Caballero, and Christopher Josey

Latinx individuals make up a minority group that faces some of the harshest and inaccurate stereotypes in the media today, despite being underrepresented in most media, especially primetime television (Mastro, Figueroa-Caballero, & Sink, 2017) and news programming (Santa Ana, 2013). Stereotypes include the notion that they are illegal immigrants and criminals (Dixon & Williams, 2015). As a result of these portrayals, Latinx audiences are left with few empowering news outlets to turn to in the mainstream media. This research project began as a means to identify safe and uplifting alternative channels for minority audiences. Specifically, we argue that news sites created for and focused on Latinx individuals might serve as channels of potential empowerment. However, little research has been done surrounding the portrayal of minorities in social identity focused news (SIFN) outlets such as these. Consequently, we began our research project by looking at the quality of this content. We hypothesize that (a) they will over-represent Latinx individuals in their content and (b) will present Latinx individuals more positively than traditional news outlets. News content was compiled from four Latinx online media outlets *News Taco*, *Latino Voices*, *El Día News*, and *Latina*. Our final sample was N=600 unique news stories. Our preliminary results suggest that the portrayals of Latinx individuals in Latinx-oriented SIFN were rated more positively than in traditional news outlets. Furthermore, Latinx individuals were overrepresented in Latinx-oriented SIFN compared to the percentage of the US population they comprise in the Census. This means that Latinx-oriented SIFN offers an alternative and a counter-influence to degrading representations of Latinx individuals in the traditional news media both by representing Latinx individuals more positively and less stereotypically, as well as including more Latinx individuals overall in their news coverage.

Clayton Henning

Wildwood, MO

Faculty Mentor: Monica Romero, Educational, School & Counseling Psychology

Effectiveness of Peer-Mediated Interventions for Emergent Bilingual Students' Achievement

Clayton Henning, Megan Dolsky, Hannah Holt, Caroline Rorah, and Monica Romero

Research has shown that peer-mediated interventions produce positive academic outcomes for a wide range of students. This meta-analysis analyzed the effectiveness of peer-mediated interventions for emergent bilingual students in grades K-12. Fourteen studies using cross-age, same-age, class wide peer tutoring, or cooperative learning met the criteria. The meta-analysis' purpose is to explore the effects of peer intervention on emergent bilinguals' academic achievement. The following research questions guided this study: a) what are the effects of peer-mediated interventions intended to improve Emergent Bilingual students' academic achievement? b) what are the characteristics of peer-mediated intervention with Emergent Bilinguals in grades preK-12? c) to what extent does dosage moderate the effectiveness of the intervention? d) to what extent does the quality of the research design moderate the effectiveness of peer-mediated interventions? Findings from these studies indicate peer-mediated interventions were successful for emergent bilingual learners.

Behavioral/Social Sciences

Emily Herzog

Fenton, MO

Faculty Mentor: Olumayowa Odemuyiwa, Nursing

Electronic Health Literacy Amongst Future Nurses

Emily Herzog, Emma Patterson, and Olumayowa Odemuyiwa

As students in the N3900 class (Introduction to Research for Evidence Based Practice Nursing) during the Spring Semester of 2021, we are interested in assessing the electronic health literacy of our peers. In order to study this topic, a 27 question Qualtrics survey was sent out to our class which analyzed the demographics of our population and the current level of electronic health literacy. From the data we have collected, our plan is to analyze the data for trends in our population and to assess the overall level of electronic health literacy amongst the students enrolled in N3900 Spring 2021. In order to complete our goal, we will use the Statistical Package for the Social Sciences (SPSS) to help us perform data analysis and observe frequencies in our data. We will also search multiple databases in order to find the published literature that exists on this topic. The results of this project will inform our peers, community, and selves about the level of electronic health literacy that exists in this chosen population of Sinclair School of Nursing students enrolled in N3900.

Hannah Holladay

Franklin, TN

Senior
Journalism (Strategic Communication); Psychology

Adolescent Friendship Quality: Analyzing the Impact of Temperament, Emotional Reactivity and the Role of Gender

Hannah Holladay, Catherine Everett, Gabrielle Scott, Archer Cole, Allie Spiekerman, Sarah Borowski, Ashley Groh, and Amanda Rose

Positive friendships relate to better psychological health. (Stotsky et. al, 2018). During adolescence, dyadic friendships become more important than peer acceptance (Demir & Urberg, 2004) and have consistently related to different indices of adjustment. It is important to consider individual differences that might influence the quality of friendships, such as emotional reactivity. Temperament has been shown to be stable throughout development, and influences individuals' emotional reactivity within friendships. Temperamental characteristics (e.g., emotional intensity) are considered to have significant implications for children's peer relationships (Rothbart & Bates, 1998). Better temperamental reactivity has been found to predict positive friendship quality (Gleason et. al, 2005).

Research on the relation between emotional reactivity and friendship quality among adolescents is limited. The purpose of the current study is to examine the association between emotional reactivity and friendship quality. Two measures of emotional reactivity are considered: trait emotional reactivity (i.e., temperament) and state emotional reactivity (i.e., change in negative emotions from before to after an interaction task). Participants in the study include 180 adolescents (62 boys, 118 girls) in the eighth, ninth, and tenth grade. They completed a series of surveys on Qualtrics as well as a negative valence task (problem talk). Measures include the

Early Adolescent Temperament Questionnaire (Capaldi & Rothbart, 1992; Ellis & Rothbart, 2001), which assesses the extent to which adolescents tend to experience negative affect or negative reactivity. The Positive and Negative Affect Scale (Watson et al., 1999) assessed positive and negative effects before and after task. Lastly, the Friendship Quality Questionnaire (Rose, 2002) assessed positive and negative qualities of the adolescents' friendship. Analyses will be conducted to determine whether there are associations among trait emotional reactivity, state emotional reactivity, and friendship quality. Gender differences will be considered in all analyses.

Behavioral/Social Sciences

Hannah Holt

Jefferson City, MO

Junior
Elementary Education (Elementary Education)

Faculty Mentor: Monica Romero, Educational, School & Counseling Psychology

Effectiveness of Peer-Meditated Interventions for Emergent Bilingual Students' Achievement

Hannah Holt, Clayton Henning, Megan Dolsky, Caroline Rorah, and Monica Romero

    Research has shown that peer-mediated interventions produce positive academic outcomes for a wide range of students. This meta-analysis analyzed the effectiveness of peer-mediated interventions for emergent bilingual students in grades K-12. Fourteen studies using cross-age, same-age, class wide peer tutoring, or cooperative learning met the criteria. The meta-analysis' purpose is to explore the effects of peer intervention on emergent bilinguals' academic achievement. The following research questions guided this study: a) what are the effects of peer-mediated interventions intended to improve Emergent Bilingual students' academic achievement? b) what are the characteristics of peer-mediated intervention with Emergent Bilinguals in grades preK-12? c) to what extent does dosage moderate the effectiveness of the intervention? d) to what extent does the quality of the research design moderate the effectiveness of peer-mediated interventions? Findings from these studies indicate peer-mediated interventions were successful for emergent bilingual learners.

Andrea Hutchinson

Houston, TX

Faculty Mentor: Dr. Christine Elsik, Animal Sciences

How to Use FAANGMine to Perform Functional Analysis of a Gene List

Andrea Hutchinson and Christine Elsik

FAANGMine (http://faangmine.org), developed by the Elsik lab at the University of Missouri, is a genomic data mining warehouse for domesticated animal species. FAANGMine provides simple and sophisticated search tools to allow researchers to gather and analyze information about genes and genomes. FAANGMine contains genomes and genes of cat, chicken, cow, dog, goat, horse, pig, sheep, and water buffalo. Genes of humans, mice, and rats are also included to facilitate comparison to model organisms.

My role in the FAANGMine project is beta-testing FAANGMine and assisting in the development of usage examples. In this poster, I will show how to use the FAANGMine List Tool to analyze gene functions, using a published dataset of genes that are differentially expressed between two chicken breeds that differ in their tolerance to harsh temperature environments [1]. With the List Tool, users can upload lists of gene identifiers to access information about gene function. The example will demonstrate the application of three data sources that provide information about gene function. The Gene Ontology (GO) [2] is a set of vocabulary terms used to describe biological and molecular functions of genes, as well as locations of gene products (e.g. proteins) within cells. KEGG [3] and Reactome [4] are biological pathway datasets that describe how gene products interact with each other to carry out biological functions. The FAANGMine List Analysis Tools will be used with GO, KEGG and Reactome to perform gene enrichment analyses to determine whether the set of differentially expressed genes has an overabundance of certain gene functions, which will provide insight into mechanisms of tolerance to harsh environments.

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Kylee Isom

West Plains, MO

Faculty Mentor: Joe Johnson, Art

HOME/BODY

Kylee Isom

HOME/BODY is a collection of black and white self-portraits made with a large-format 4x5 film camera. This work navigates the tangled notions of body and femininity, in relation to the domestic sphere. Engaging with the history of photography as a means of representation accessible to women, this project acknowledges the function of the self-portrait throughout art history as a means of reclaiming agency and rewriting the narrative of womanhood. Utilizing textiles, objects of fashion, and iconographic symbols of femininity as a vessel for dialogue within the confines of the home space, this body of work looks critically at historical and present-day perceptions of gender roles, idealized beauty, and womanhood. Incorporating recognizable emblems of femininity, like floral patterns, allows an access point into a more complex dialogue where investigation is imperative. Leaning into the history of shapewear as a means of smoothing, sculpting, and perfecting the body – one that has kept up with the societal standards of beauty as they have evolved over time – these images work against the material to establish a tension and a heightened focus on the body. This project, also, uses fabric and textiles to alter the function of the body in space. The performative act of abstracting, distorting, or stripping away the body by subverting the function of these materials works to undermine oppressive systems of misrepresentation. There are instances where this act narrows the focus to particular pieces of the subject to confront the tendency to sexualize pieces of the female body that exists nearly subconsciously. The photographs often include built environments and conditions that challenge the perceptions of the image as truthful and begin to suggest the constructed nature of photographs. This is a body of work which questions the way in which womanhood is tethered to domesticity and the way in which this tether serves as an obstacle to the fabrication of identity.

HOME/BODY interrogates the dynamic relationship between beauty, body, and femininity and how this relationship has been sculpted and preserved throughout history.

Artistic Expression

Clayton Ivie

O'Fallon, MO

Sex Differences in the Effect of Acute Intermittent Hypoxia on Respiratory-Sympathetic Coupling in Humans

Clayton L. Ivie, Jane S. Edmunds, Elizabeth P. Ott, Dain P. Jacob, Sarah E. Baker, Jennifer L. Harper, Camila Manrique-Acevedo, and Jacqueline K. Limberg

This abstract has been withheld due to proprietary permissions.

Olivia Jeckel

Pekin, IL

Faculty Mentor: Dr. Charles Borduin, Psychological Sciences

Linkages Between Neighborhood Qualities and Behavioral Health for Individuals on Probation and Parole

Olivia K. Jeckel, Jenna Schopen, Kaitlin M. Sheerin, and Charles M. Borduin

BACKGROUND: Individuals in the criminal justice system have high rates of mental health and substance use concerns (Robertson et al., 2020). Furthermore, these justice-involved individuals also face many challenges in their social environments (e.g., neighborhoods). In fact, rates of neighborhood violence and instability are high for justice-involved individuals living in disadvantaged neighborhoods (Leverentz, 2011). Thus, it seems reasonable to suggest that these neighborhood qualities might have an adverse impact on mental health and substance use for individuals in the criminal justice system. To that end, we examined the relation of neighborhood qualities (i.e., safety, cohesion, violence, and shared activities) to mental health, alcohol use, and substance use among individuals on probation and parole.

METHOD: Individuals (N = 101) on probation and parole in four states (two Midwestern, one Eastern, one Southern) completed measures that assessed mental health problems (*Brief Symptom Inventory*; Derogatis, 1993), substance use (*Drug Use Frequency Questionnaire*; O'Farrell et al., 2003), alcohol use (*Alcohol Use Disorders Identification Test*; Babor et al., 1992), and various qualities of their neighborhoods (i.e., safety, cohesion, violence, activities; *Neighborhood Qualities Measure*; Mujahid et al., 2007).

RESULTS: Backward stepwise regressions examined the effects of neighborhood qualities on mental health, alcohol use, and substance use in individuals on probation and parole. In the final models, neighborhood violence was retained as the sole predictor of both mental health and substance use. No significant predictors emerged for alcohol use.

IMPLICATIONS: The results demonstrate that neighborhood violence is linked with mental health problems and substance use in individuals on probation and parole. These findings highlight the importance of neighborhood contexts for justice-involved individuals' psychological and behavioral well-being. Our results have implications for policymakers regarding the allotment of resources to neighborhoods in which individuals on probation and parole reside.

Lydia Jefferson

Raytown, MO

Junior
Environmental Sciences (Water)

Estimation of Stream Metabolism in Urban Study Sites

Lydia Jefferson and Alba Argerich

The estimation of a stream's metabolism has previously been used as an indicator of its aquatic health. Stream metabolism results from two major processes, primary production and ecosystem respiration (Appling et al., 2018). Environmental influences, such as water velocity and diversity of organisms, have been shown to affect stream metabolism. In the Tri-State Mining District in Southwest Missouri, there are many mine adits that continue to discharge heavy-metal contaminated water into nearby streams. One of these mine adits discharges into Lone Elm Creek, in Joplin, Missouri. Heavy metals negatively impact the microbes and other aquatic organisms in streams. The pollutants accumulate in sediments, where microbes and aquatic organisms reside (Song, Müller, and Friedman, 1999). Since heavy metals are unable to biodegrade, they bioaccumulate as they travel through the aquatic food web, including the primary producers and heterotrophic organisms. In this study, we investigate the relationships between land use and stream metabolism by analyzing various parameters from two urban streams, one affected by legacy mining (Lone Elm Creek, Joplin, MO) and the other not affected (Flat Branch Creek, Columbia, MO). We collected temperature, dissolved oxygen, and dissolved oxygen saturation from Flat Branch Creek and Lone Elm Creek by using a MiniDOT, an optical oxygen sensor with a data logger. Dissolved oxygen concentrations in both streams showed a strong diel pattern, from subsaturation to supersaturation following light availability. Flat Branch was colder and had higher levels of dissolved oxygen than Lone Elm, most likely reflecting the differences in streamflow, riparian canopy cover, and general water quality. Further analysis will be conducted to confirm our hypotheses. This study seeks to improve the understanding of how the overall health of these freshwater bodies relates to land use practices (heavy metals and vegetation).

Life Sciences

Tessa Jennings

Ashland, MO

Faculty Mentor: Dr. Antje Heese, Biochemistry

Delineating day length-dependent autoimmune responses in clathrin-coated vesicle mutants

Tessa Jennings, Kelly Mason, Nga Nguyen, Alex Clarke, and Antje Heese

Agriculture is one of the most important industries that exists to clothe and feed the world, as they are used to make a variety of commodities such as food, fiber, biofuels, and medicine. By understanding how model plants respond to different pathogens, we can translate that knowledge to engineer more resistant plants that may help to reduce crop loss for farmers.

Proteins located in the plasma membrane (PM) play important roles in a plant's ability to perceive and transduce signals between a plant cell and its environment. This includes PM proteins that trigger immune responses upon infection by microbial pathogens. Our lab focuses on vesicular trafficking proteins and their roles in modulating the PM protein composition, so that proteins with immune functions are present in the PM at the right time and in the right abundance for effective immune responses.

Our lab has evidence that in the model plant *Arabidopsis thaliana*, clathrin-coated vesicle (CCV) components contribute to effective immunity against bacterial pathogens. In Arabidopsis, EPSIN is a CCV adaptor protein that recruits clathrin coat components to facilitate transport of PM proteins with immune function from the *trans*-Golgi network to the PM [1]. Here, I provide data showing how in the absence of any stimulus, light stress impacted (auto)immune responses using single and higher-order mutants in *EPSIN1* and genes encoding CCV components. In this study, I quantified the accumulation of a) callose, a beta-1,3-glucan that is deposited outside of the cell as a potential barrier against pathogens and b) mRNA of the immune marker gene *Pathogenesis-related 1 (PR1)*. My results indicate that some but not all autoimmune responses in CCV mutants were dependent on the daylength, under which the seedlings were grown.

Serena Joliff

West Plains, MO

Faculty Mentor: Dr. Laura Cole, Architectural Studies

Application of Natural Building Design on Net Zero Energy Buildings

Serena Jolliff and Laura Cole

As concerns for the environment and our planet have been growing exponentially, there have been numerous responses and strategies proposed to face the reality. The field of architecture is no different; statistics have shown that the building sector continues to be a primary energy consumer in the United States. This research-based project will focus on two building designs that are known for sustainability: Net Zero Energy Buildings (NZEBs), and Natural Buildings. My research seeks out the similarities and differences between the two building designs and analyzes natural building design strategies that can be integrated into designs for NZEBs. The findings of this research can potentially widen options in construction of NZEBs, create more availability for people to live in sustainable homes, and achieve increased sustainability as a building. The research will consist of literature reviews of books and articles, and an in-depth analysis of a precedent design project..

Andrew Jones

Hebron, KY

Identifying genetic background effects for cancer susceptibility

Andrew Jones, Chiswili Yves Chabu, and Elizabeth King

The study of cancer susceptibility is incredibly important due to the harmful effects of cancer and the difficulty in predicting and preventing it. Individuals can vary in their degree of cancer susceptibility due to different genetic backgrounds (4). A major goal in biomedicine is to identify genomic regions that influence cancer severity. Here, we used the *Drosophila melanogaster* model system to identify genetic background effects on the severity of a cJUN NH2-terminal kinase (JNK) mutation. Under normal circumstances, JNK serves as a tumor-suppressor and regulator of cell proliferation (1). When mutated, the JNK gene loses control its regulatory capabilities, causing cells to enter premature death cycles. Similarly, the loss of regulation can also lead to increased prevalence of oncogenes. One of the noticeable effects of the JNK mutation is that yields a phenotypic variation of decreased eye pigment due to increased cell death (2). We crossed a set of 7 different inbred lines with a line that mutates the Eiger (EGR) gene, an upstream regulator of JNK, to create a F1 offspring that are heterozygous. To identify the effect of genetic background (founder line) on the severity of this mutation, we photographed the eyes of these offspring with standard parameters and used imageJ to measure total pigment area of the eye to analyze the difference in coloration. Once all images were acquired, I analyzed the differences between the different founder genotypes to identify any significant genetic background effects. This project is significant because it would be an important finding and steppingstone for further research into genetic relaying of cancer genes. It would also give us insight into cancer susceptibility and metastatic factors. Much of the biological organization of *D. melanogaster* is conserved in humans so results found in this species could possibly be similar in our own.

Benjamin Jones

Hebron, KY

Faculty Mentor: Dr. Erika Boerman, Medical Pharmacology & Physiology

Decreased endothelin converting enzyme-1 and neprilysin expression contributes to vascular dysfunction with Inflammatory Bowel Disease

Benjamin Jones, Elizabeth Grunz-Borgmann, and Erika Boerman

Inflammatory Bowel Diseases (IBD) are associated with poor intestinal perfusion and cardiovascular disease risk. Mesenteric arteries (MAs) increase blood flow via activation of perivascular sensory nerves and release of Calcitonin Gene-Related Peptide (CGRP) and Substance P (SP). Previous work highlights that CGRP and SP fail to dilate MAs during IBD. The metalloproteases endothelin-converting enzyme-1 (ECE) and neprilysin (NEP) control degradation and recycling of CGRP and SP receptors in many tissues, but their role in vasculature and IBD is unclear. Thus, we tested the hypothesis that IBD alters the expression and/or localization of ECE and NEP in MAs. IBD developed over 90 days in IL10-/- mice following *H.hepaticus* gavage, and C57BL6/J mice served as controls. To measure vascular expression/localization of ECE and NEP relative to CGRP and SP receptors, MAs were cannulated, pressurized labeled for ECE, NEP, CGRP (receptor activity modifying protein 1, RAMP1) and SP (Neurokinin 1, NK1) receptors before and after incubation in CGRP and SP to simulate sensory nerve activation. Ongoing work focuses on quantitative analysis of these 3D images. To verify clinical relevance, immunolabeling studies were repeated on vascular sections of human control and IBD colon samples. Resulting images were analyzed for area fraction fluorescent for ECE, NEP, RAMP1 and NK1 using ImageJ, with statistical analysis by nested t-tests. IBD was associated with decreased vascular expression ($P<0.05$) of NEP (Control 70±3%; IBD 41±5%), ECE (Control 74±2; IBD 51±3) and RAMP1 (Control 69±2%; IBD 57±3%), while NK1 was unchanged (Control 33±3%; IBD 28±2%). Decreased vascular expression of ECE, NEP and RAMP1 suggests decreased receptor recycling, which may contribute to inflammation and impaired sensory vasodilation with IBD. Further analysis of confocal images from mouse MAs will provide more information about how IBD affects CGRP and SP receptor trafficking and degradation as they relate to blood flow through mesenteric arteries.

Dominique Joseph

Waynesville, MO

Faculty Mentor: Dr. Charlotte Phillips, Biochemistry

Characterizing Bone Microarchitecture and Histology in the G610C Osteogenesis Imperfecta Murine Model

Dominique Joseph, Catherine Omosule, Victoria Gremminger, Youngjae Jeong, Ferris Pfeiffer, and Charlotte Phillips

Osteogenesis imperfecta (OI), known as brittle bone disease, is an incurable connective tissue disorder varying in severity. OI is primarily due to mutations in type I collagen genes and is clinically manifested in type I collagen-containing tissues, primarily bone. Anti-resorptive drugs, bisphosphonates, are currently the standard care for OI. Although bisphosphonates have been shown to increase bone mass, they inhibit osteoclast activity particularly in children. Thus, suitable therapeutic options for managing OI are still needed.

Previous studies in the moderately severe osteogenesis imperfecta murine model (*oim*), demonstrated sex differences in bone microarchitecture, biomechanical properties, and biochemical composition. In this study we sought to further characterize and compare growth rates, body tissue composition, and bone histological, microarchitectural and biomechanical properties of male and female heterozygous *G610C* OI mice. In this study, male and female Wt and *+/G610C* mice were weighed twice weekly. At 16 weeks (the age of peak bone mass) mice were sacrificed and their hindlimb muscles and bones harvested for analyses.

We found that although *+/G610C* male and female mice have similar muscle and body weights as Wt counterparts, femoral bone microarchitecture is compromised as evidenced by decreased bone mineral density, volume, trabecular number, and increased trabecular spacing. Bone biomechanical strength is also decreased in both *+/G610C* sexes. While only female *+/G610C* mice displayed decreases in femoral maximal load, yield load, and stiffness relative to their Wt counterparts, both *+/G610C* sexes present with greater than 34% reductions in femoral ductility and work to fracture. Overall data suggests that though there are genotypic bone microarchitecture differences, sex differences may be less prevalent in the *G610C* mouse model than in the *oim* model. Histological analyses of osteoblasts and osteoclasts number and function are currently underway to define their cellular contribution to compromised G610C bone.

Cristian Keegan-Caro

Columbia, MO

Yersinia pestis secretion regulation requires LcrQ-SycH binding

Cristian Keegan-Caro, Rachel M Olson, and Deborah Anderson

Yersinia pestis, the etiological agent of bubonic and pneumonic plague, is responsible for multiple devastating epidemics throughout history. In the mammalian model of disease, *Y. pestis* uses a needle-like protein complex, the type III secretion system (T3SS), to inject effector proteins into host cells. These proteins, called Yops, hijack cell death pathways, suppress inflammatory cytokines, and prevent phagocytosis, allowing *Y. pestis* to evade the host innate immune response. Under non-secreting conditions, expression of type III secretion is negatively regulated by protein LcrQ, whose method of regulation is not fully characterized as LcrQ binds only to T3SS gate proteins and its chaperone, SycH, which has been previously shown to have an important role in T3SS regulation. To explore the interactions between LcrQ and SycH, we created four mutant strains of *Yersinia pestis* with alterations made to the LcrQ proteins at sites where it is thought to bind with SycH. We hypothesized that SycH-LcrQ binding was necessary for T3SS control. To test this, we grew *Yersinia pestis* LcrQ mutants along with a wild type and ΔLcrQ mutant under non secretion permissive conditions. Two of our mutants showed comparable growth defects to the ΔLcrQ strain, which we attribute to a loss of secretion control due to the mutant LcrQ's inability to bind to SycH. This suggests that SycH-LcrQ binding is critical for T3SS regulation. To confirm this, we are currently running western blot analysis to confirm the stability of our mutant LcrQ proteins. We will then run a western blot analysis to confirm the presence of excess Yops in the supernatant of our LcrQ mutant yersinia strains, which would confirm that the growth defect observed was due to loss of secretion control. We will use this to propose a LcrQ-SycH dependent model of T3SS regulation.

Javier Kelly Cuenca

Columbia, MO

Sophomore
Biochemistry

Faculty Mentor: Dr.Benton Kidd, Ancient Mediterranean Studies

The Art of Death: Recognizing Links between Sex and Death in the Visual Record

Javier Cuenca, Luci Cook, Nathan Furnas, Peter Helm, and Benton Kidd

Throughout history and across mediums, the eternal themes of sex and death have long been paired in the literary and visual records. In our research, we used examples of modern and historical art representing sex and death to question how such subjects influence the thoughts and feelings of viewers. Do respondents recognize a link between sex and death, and if so, is the link positive or negative? Are there connections between a participant´s sexual identity, religion, etc., and their perspective on sex and death? To investigate these questions, we surveyed respondents to gauge erotic and violent overtones in the images. We conducted two identical surveys, the first of which utilized Amazon's MTurk, targeting respondents of all ages; the second study targeted students 18-25 on the Mizzou campus. In the first study, individuals (N = 450) completed personality and individual difference measures regarding their perceptions of various forms of death, violence, and eroticism in visual art. In the second study, students (N = 40) took the same survey, but the group was evenly divided between heterosexual and non-heterosexual participants on MU's Campus. The images used in both surveys illustrated the themes in question and neutral control images. Analyses of the data also revealed whether engaging with images led respondents of different sexualities, religion, etc., to reflect further on death-related feelings towards sex and violence, and whether they recognized a link between sex and death.

Lauren Kirtley

Smithville, MO

Sophomore
Biomedical Engineering

Cabbages, Kale, and Cameras; Analyzing Leaf Shape Data Among Brassica Ferals

Lauren Kirtley, Tasha Ogoti, Michael Pisias, and J.Chris Pires

Brassica oleracea is a diverse species that includes important domesticate varieties including cabbage, cauliflower, and kale. In some cases, populations of *B. oleracea* have escaped domesticated crop fields and undergone feralization, a process by which domesticated plants revert to or adapt to fit a new environment including things like extreme temperatures, poor soil quality, diseases, and pests that are not pressures on crop fields. These adaptations are of interest to us due to the possibility of future application in breeding or genetic engineering approaches to produce more hardy crops. Utilizing the traits that increase the fitness of ferals in their domestic crop ancestors could help to deal with mounting pressures on crops like global warming. We believe Brassica oleracea originated from wild species like *Brassica cretica*, *B. hilarionis*, *B. montana*, or *B. incana*; however, these relationships are unclear. Feral relatives offer unique leaf morphotypes; our data will consist of leaf scans from the fourth leaf of every feral *Brassica* species in our collection of germplasm. Scanned leaves will be analyzed using Plant CV to determine their leaf shape phenotype. We will use this data to evaluate the similarities of leaf shape across our ferals compared to wild relatives of *Brassica oleracea* and domesticated varieties within *Brassica oleracea*. Our sample will include 12 different feral accessions from the *Brassica cretica*, *B. hilarionis*, and *B. montana* species; we will grow 8 plants for each accession. Then, we will compare with leaf data from commonly grown crop species like cabbage, cauliflower, and kale. With this data we will construct a dendrogram to compare with existing morphological data for applicable information from our system. In the future, we hope to evaluate potential phenotypes of interest with multiple-omics approaches to obtain even more data that could be analyzed and used to refine our conclusions.

Morgan Kluge

Cape Girardeau, MO

Junior
Biochemistry

Faculty Mentor: Dr. Aaron Stoker, Orthopaedic Surgery

Effects of Glucose and Insulin on Intervertebral Disc Metabolic Responses in an In Vitro Rat Tail Model

Morgan C. Kluge, Emma C. LePage, Elizabeth A. Fletcher, Ally Sivapiromrat, Mark J. Lambrechts, Theodore J. Choma, James L. Cook, and Aaron Stoker

INTRODUCTION: Intervertebral disc degeneration (IVDD) is associated with debilitating low back pain and is a major cause of disability in the U.S. Diabetes is a comorbidity for IVDD and is associated with chronic systemic inflammation. However, the effect of diabetes on IVDD is not fully understood. This *in vitro* study was designed to test the effects of high or low glucose with low or normal insulin levels on the metabolic responses of the IVD using a whole organ culture rat tail model. It was hypothesized that IVDs cultured in high glucose would produce significantly increased inflammatory biomarkers compared to low glucose, and IVDs cultured in low insulin would produce significantly increased inflammatory biomarkers compared to normal insulin.

METHODS: With IACUC (ACUC#9435) approval, tails were harvested from skeletally mature Sprague Dawley rats (n=6) euthanized for reasons unrelated to this study. IVD explants (n=24) were created and assigned to 4500 µg/ml high glucose or 1000 µg/ml low glucose and 1 µg/ml low insulin or 10 µg/ml normal insulin (n=6/group). Explants were cultured for 12 days with media changed and collected every 3 days for biomarker analyses.

RESULTS: Data analyses are ongoing but will be presented on the poster.

CONCLUSION: This study uses a whole organ model to measure the IVD metabolic response when exposed to varying glucose and insulin levels to better understand the relationship between diabetic inflammation in the realm of IVDD. Data analysis is still ongoing, and conclusions will be made on the poster following complete analysis.

Life Sciences

Madison Knight

Hazelwood, MO

How does the structure of the phloem cell wall contribute to whole-plant carbohydrate partitioning?

Madison Knight, Tyler McCubbin, Ben Julius, and David M. Braun

Carbohydrate partitioning is fundamental to plant growth, but poorly understood at the genetic level. Carbohydrate partitioning is the process by which sugars move from source tissues, e.g., mature leaves, to sink tissues, such as the roots. These sugars are transported in the form of sucrose and later turned into glucose polymers to form cellulose or other cellular building blocks and metabolites. In plant cells, cellulose is the largest form of carbon storage and is deposited in plant cell walls. The *COBRA* gene, has been identified to affect the deposition of cellulose in *Arabidopsis thaliana*. COBRA proteins help assemble the cellulose microfiber structure of the cell walls during plant development, and *cobra* mutants have been characterized to have root defects. A gene that functions in carbohydrate partitioning in maize encodes a *COBRA* gene: *Brittle stalk2-Like3* (*Bk2L3*). To examine if there are cell wall changes between the wild type and mutants in the maize *Bk2L3* gene (first identified as the *carbohydrate partitioning defective28* mutant), I am conducting immunolocalization experiments using antibodies raised against cellulose and other cell wall epitopes. The immunostaining results are visualized using fluorescence microscopy to compare mutants to the wild type. Early promising results include possible alterations in the cell wall structure of the phloem tissue in the mutants. These and other data will help illuminate how BK2L3 contributes to phloem cell wall architecture and ultimately contributes to whole-plant carbohydrate partitioning.

Leo Koenigsfeld

Westphalia, MO

Faculty Mentor: Dr. Paula McSteen, Biological Sciences

Interactions between Auxin and the tassel-less4 Mutant in Maize

Leo Koenigsfeld, Janlo Robil, Mika Nevo, Dennis Zhu, and Paula McSteen

tassel-less4 (tls4) is a mutant in *Zea mays* (maize) which is characterized by its deficiencies in inflorescence development resulting in a smaller tassel, the male reproductive structure in maize. The *tls4* mutant is also characterized by reduced plant height and narrow leaves. This phenotype is characteristic of mutants with defects related to the plant growth hormone, auxin. One of the primary functions of auxin is the control of organ formation in meristems, such as the tassel meristem. To explore the relationship between the *tls4* mutant and auxin, several double mutant analyses were performed between *tls4* and mutants with known functions related to auxin. The auxin biosynthesis mutants *vanishing tassel2 (vt2)* and *sparse inflorescence1 (spi1)* were crossed with *tls4* to determine how the gene responsible for the tls4 mutant interacts with auxin. Both *vt2* and *spi1* had significant interactions with *tls4* indicating that *tls4* function is related to auxin. Additional, double mutant analyses were performed between *tls4* and the auxin transport mutant *barren inflorescence2 (bif2)* and the auxin signaling mutants *Barren inflorescence1 (Bif1)* and Barren inflorescence4 (Bif4). These also had significant interactions with *tls4* strengthening the hypothesis that *tls4* functions in the auxin pathway. Further characterization and cloning of *tls4* will provide a more complete picture of how auxin functions in plants.

Taylor Kroupa

Troy, MO

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Elementary Education

Faculty Mentor: Dr. Stephen Whitney, Educational, School & Counseling Psychology

Critical Time Periods in Reading Development

Taylor Kroupa, Anna Al-Sayed, Elise Buchert, Danielle Schneider, and Stephen Whitney

Reading is a fundamental aspect that supports all future education and understanding how to allocate scarce resources to support reading comprehension is of paramount importance. Previous research has shown the large impact that socio-economic status and race have on process of reading achievement. Our research examines if there are critical timepoints during reading education based on socio-economic status and race. Data for the study was taken from the nationally representative longitudinal study ECLS K-8 which follows 17,911 Kindergarten students through 7 waves of data starting in 1998 and ends after their 8th-grade year. For the current analysis the sample was grouped based upon race and SES. To simplify the analysis we examined two races, Black and White students, and three levels of SES, Poor, Middle class, and Rich samples. In the model Reading IRT (Item Response Theory) reading scores is used as the outcome during kindergarten, first, and third grade. Biological Sex is included within the groups as a control variable and group means differences were tested using an independent sample t-test. Our main findings show that the growth rate for reading is higher for students in 1st-3rd grade than with students in K-1st grade. Our findings also show that in K-1st male, Black students have a growth rate that is significantly less than white male students, but there was no difference amongst the female populations. However, across all genders and classes in 1st-3rd grades, black students, including black female students, grew significantly less in their reading achievements than white students. This research and finding points to important allocations in schools and future research.

Behavioral/Social Sciences

Elizabeth Kujath

Raytown, MO

Senior
Linguistics; Religious Studies

Faculty Mentor: Dr. Michael Marlo, Linguistics; Dr. Rebecca Grollemund, Linguistics

Documenting Luyia Together: Bukusu Verb Tone

Elizabeth Kujath, Rebecca Grollemund, and Michael R. Marlo

Bukusu is an understudied language of the Luyia language cluster of western Kenya, spoken by approximately 1.4 million speakers (2009 Kenya Census). The current project builds on work done by Elizabeth Kujath in Winter-Spring 2001, and by Dr. Marlo and other members of the *Documenting Luyia Together* team in previous years.

Bukusu is a tonal language, which has high (H) tones, low (L) tones, and falling tones, which are analyzed as the combination of a H and a L. (We analyze L tones as the absence of H tones.) All verbs fall into one of two categories which are categorized by an abstract H tone in one category and a lack of H tone in the other category (toneless). All tense-aspect-mood constructions can be split into 7 distinct tonal patterns, which have high tones on different positions of the verb. Two of the 7 tone patterns are illustrated by the Near Future vs. the Distant Future tenses. In the Near Future, the H verb *a-lá[βotooxana]* 'he will go around' has a H tone on the tense prefix *la-*, while the toneless verb *a-la[loleelela]* 'he will watch' is pronounced without any H tones. (In these examples, the verb stem is indicated inside brackets [].) In the Distant Future, the H verb *a-li[βotóoxana]* 'he will go around' has a H tone on the second syllable of the verb stem, and the toneless verb *a-li[lóleelela]* 'he will watch' has a H tone on the first syllable of the verb stem.

This project analyses the seven patterns as identified by our team and compares our results to those of other researchers. Our results are generally the same as those of Hyman & Khisa (1997), but Mutonyi (2000) describes a different dialect with different tonal properties.

Brayden Langendoerfer

Jefferson City, MO

Sophomore
Middle School Education (Language Arts)

Stress and Adjustment in Adolescents: Analyzing Co-Rumination, Coping, and Physiological Regulation as Moderators

Brayden Langendoerfer, Caroline Davey, Kassandra Ramos, Sarah Borowski, Ashley Groh, and Amanda Rose

Stress in adolescence can cause adverse effects and the more negative life experiences in adolescence, the higher levels of internalizing symptoms, such as depression and anxiety (Kim et al., 2003). Past research indicates stress has negative impli¬cations for adolescent well-being (Nicolai et al., 2013). Consequently, a comprehensive understanding of the factors that exacerbate or relieve stress is crucial. Coping style and physiological regulation are factors that may alleviate stress, whereas co-rumination worsens it (Rose et al., 2016). The current study considers the role of stress as a possible predictor of internalizing symptoms. Further, we investigate how physiological regulation, coping style, and co-rumination affect the relation between stress and internalizing symptoms.

Participants were 180 adolescents (118 girls; 62 boys; M age = 14.09 years). Adolescents completed the Perceived Stress Scale (PSS; Cohen et al., 1983) to report their overall stress levels (e.g., "I worry a lot of the time; 1 = Not at All True, 5 = Really True"). They completed questions from a depression scale (e.g., "In the past week I was sad, lonely, or fearful) (CES-D; Eaton et al., 2004). Participants completed the Co-rumination Questionnaire (Rose, 2002) and Brief COPE scale (Carver, 1997) to assess positive and negative coping.

Respiratory sinus arrhythmia was used as a measure of physiological regulation. To assess physiological regulation, three disposable electrodes are applied to the participants' torsos to monitor heart rate. To monitor respiration, a belt is applied around their diaphragms. Physiological responses are recorded while the participants sit quietly for three minutes at different times during the visit. Analyses will consider stress as a predictor of adjustment. They will also consider coping style, co-rumination, and physiological regulation as effects on the relationship between stress and internalizing symptoms. We will also examine sex differences among stress, indicators of regulation, and internalizing symptoms.
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Behavioral/Social Sciences

Quinn Lasley

Carthage, MO

Senior
Biomedical Engineering

Faculty Mentor: Dr. Bongkosh Vardhanabhuti, Food Systems and Bioengineering; Dr. Kiruba Krishnaswamy, Biomedical, Biological & Chemical Engineering

Developing a Method for Determining the Shelf Life of High-Protein Beverages

Quinn Lasley, Bongkosh Vardhanabhuti, and Kiruba Krishnaswamy

This abstract has been withheld due to proprietary permissions.

Anna Laughlin

O'Fallon, MO

Senior
Political Science; Economics

Faculty Mentor: Dr. William Horner, Political Science

Missouri Versus Illinois: A Comparison of Judicial Merit Selections to Judicial Partisan Elections

Anna Laughlin and William T. Horner

State supreme courts are entrusted with guarding our most valuable constitutional rights and also have great power in interpreting our state's laws. State supreme courts have a large impact on their constituents' lives. In order for the public to follow the courts' decisions, they must trust them. Trust can be facilitated through a competent, impartial, and independent judiciary. Independence of thought from political influence is essential to our judiciary. So how do we select justices to ensure that they are of the upmost ability and will deliver fair decisions, so that the public can trust them? What qualities do we look for in our judicial bench? How do we make justices accountable to the people, while they remain out of political entrapment? My research aims to determine if either merit selections or partisan elections are better at facilitating factors that increase trust in the judiciary. I focused my study on Missouri and Illinois. My research collected primary biographic and demographic data on all past Missouri and Illinois State Supreme Court Justices. I analyzed this data for any anomalies or trends. I then compared this to secondary data collected from trends of thought or consensuses of opinions in the literature. I also looked at public opinion data, as well as interviewed a past Missouri Supreme Court Judge. I compared these two data sets to determine whether the overarching beliefs in the literature came to fruition in the real world of the Missouri and Illinois Supreme Courts. As my project is still in progress, my results and conclusion will be presented at the forum. Due to my time limitations, my data set was a two-state case study, so I recommend that future studies expand this type of analysis to other states or selection methods.

Behavioral/Social Sciences

Meghan Lawlor

St. Louis, MO

Faculty Mentor: Dr. Peter Sutovsky, Animal Sciences

Spermatozoan Metabolism as a Non-traditional model for the study of Huntington's Disease

Meghan Lawlor, Michal Zigo, and Peter Sutovsky

Huntington's Disease (HD) is a fatal autosomal dominant neurogenerative disease manifested through motor dysfunction and cognitive deficits. Decreased fertility is also observed in male patients, likely due to altered spermatozoan function, thus resulting in reduced fertilization potential. Although some pharmaceuticals are currently utilized to mitigate these symptoms, an effective treatment which halts pathogenesis of the disease is yet to be approved by the FDA. This review addresses the HD pathway in neuronal and spermatozoan metabolism, including gene and protein expression in both neurons and spermatozoa indicated in the pathogenesis of HD. More specifically, zinc-containing and zinc-ion interacting proteins are thought to regulate or be regulated by zinc ion homeostasis. Identification of genes and relevant diagnostic biomarkers including elements of pyruvate and mitochondrial complex-I-dependent respiration may be advantageous for early diagnosis, management, and treatment of the disease. This review aims to provide analysis of HD pathogenesis and explore the comparative role of zinc in both neuronal function and spermatozoan capacitation, a physiological process that grants spermatozoa the ability to fertilize. Ongoing studies aim to characterize the products of genes implicated in HD pathogenesis that are expressed in both neurons and spermatozoa to facilitate study of future treatment avenues in HD and HD related male infertility. The emerging link between zinc homeostasis and HD pathway could lead to new treatments and diagnostic methods linking genetic spermatozoan defects with somatic comorbidities.

Alex Lee

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Senior
Health Science (Pre-Professional)

Defining Osteoarthritic Patient Phenotype Clusters based on Infrapatellar Fat Pad Metabolic Profiles

Alex Lee, Shelby Salisbury, James Keeney, James Cook, and Aaron Stoker

INTRODUCTION: Osteoarthritis (OA) is a painful and irreversible musculoskeletal disease common in overweight and middle-aged to elderly populations. Recent studies have suggested the infrapatellar fat pad (IPFP) plays a significant role in the development and progression of OA. However, patient-to-patient variability has been identified in biomarkers produced by the IPFP. Therefore, this study was designed to utilize the *in vitro* metabolic profiles of IPFP obtained from patients undergoing total knee arthroplasty (TKA) to develop potential cohorts using cluster analysis. It was hypothesized that using a cluster analysis could separate patients into cohorts based on the variability in IPFP metabolism representative of unique metabolic profiles.

METHODS: With IRB approval, IPFP tissues were collected from osteoarthritic TKA patients (n=47). Three explants from each IPFP were created and cultured in media with a three-day media collection. Media were then evaluated for various inflammatory and degradative biomarkers that were standardized to IPFP tissue weight. Patients were clustered into five cohorts using a K-Means cluster analysis.

RESULTS: Four of the five clusters contained enough patients for statistical analysis. Results showed potential linkages between IPFP inflammation and pain perception, age and IPFP inflammation, and sex and biomarker production.

CONCLUSION: The data from this study indicate that differences in metabolic profiles based on relevant biomarker panels for IPFP in culture can be used to characterize patients into phenotypic cohorts. Further investigation is required to determine how the trends identified in this study relate to the pathobiology of OA and how it presents clinically.

Life Sciences

Mary LePique

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Faculty Mentor: Dr. Marc Johnson, Molecular Microbiology and Immunology

SARS-CoV-2 ORF7a and Spike do not antagonize Tetherin

Mary LePique, Braxton Salcedo, and Marc Johnson

BST-2 or Tetherin is a component of the innate immune system that has antiviral properties and is stimulated by interferons. Tetherin has been shown to provide non-specific inhibition of the release of enveloped virions from the surface of infected cells by targeting and tethering them to the plasma membrane. Several viruses have evolved Tetherin antagonists that allow them to be released from the cell surface including HIV, Influenza, Ebola virus, and SARS-CoV-1. In the case of SARS-CoV-1, it has been suggested that the ORF7a accessory protein is responsible for Tetherin antagonism. Because of its similarity to SARS-CoV-1 and its enveloped nature, it has been speculated that SARS-CoV-2 also contains an antagonist to Tetherin. The two main proponents for SARS-Cov-2 Tetherin antagonism are ORF7a and the Spike glycoprotein (S) found on the surface of the virus. Our goal was to determine if Tetherin has an inhibitory effect on viral release of viral like particles containing the SARS-CoV-2 S protein, and if ORF7a or SARS-CoV-2 S have an effect on the inhibitory function of Tetherin. Our data suggests that while Tetherin is capable of inhibiting VLPs containing the S protein, neither ORF7a nor S appear to antagonize Tetherin.

Rhianna Lightle

Bentonville, AR

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Faculty Mentor: Dr. Jonathan Krieckhaus, Political Science

The Paradox of Plenty Revisited: Venezuela's Plight from Petroleum

Rhianna Lightle and Jonathan Krieckhaus

The country of Venezuela is in political, economic, and social chaos. Despite having one of the largest oil reserves in the world, a lucrative resource, Venezuela has experienced extreme hyperinflation and has the lowest world freedom rating in South America. This phenomenon was studied by Professor Terry Karl *The Paradox of Plenty*: *Oil Booms and Petro-States* 1997 Venezuela, and other countries like it, have suffered from *Dutch Disease* they have become dependent on a singular natural resource, and the effects of that economic decision are so astronomical that is trickles into the rest of the state's functions. This study aims to reexamine Karl's explanation for Venezuela's plight to determine if the same logic applies today.

The results showed that the rates of inflation and lack of freedom in Venezuela have remained poor and exponentially higher than other countries in South America that have remained constant or improved.

These results suggest that Karl's theory has merit and that Venezuela's oil-dependent economy has continued to lead to its poor economic, political and social chaos.

Kesha Liles

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Faculty Mentor: Dr. John Kerns, Psychological Sciences

Cognitive Self-Control, Openness to Experience, and Positive Schizotypy

Kesha Liles and John G. Kerns

Schizotypy is defined as a latent personality organization reflecting liability for schizophrenia (Lenzenweger, 2018). Positive schizotypy, specifically, involves magical beliefs and unusual perceptual experiences (Kwapil & Barrantes-Vidal, 2015). Research findings suggest an association between positive schizotypy and the five factor model (FFM) dimension, openness to experience (Cicero & Kerns, 2010; Crego & Widiger, 2017). Our study further examines this association, with the inclusion of cognitive self-control as a possible facilitator for the relationship. Decreased cognitive inhibitory control and increased impulsivity have been found in patients with psychotic disorders, when compared to healthy controls (Nolan, D'Angelo, & Hoptman, 2011; Enticott, Ogloff, & Bradshaw, 2008). Additional research suggests that employment of self-control practices may relieve psychotic symptoms in psychiatric patients (Breier & Strauss, 1983). Our study examines whether there is an interaction between openness and self-control predicting positive schizotypy. Hypothesized findings suggest that high positive schizotypy results from an interaction between high openness to experience and low cognitive self-control, while high openness does *not* predict positive schizotypy in individuals with high self-control.

Positive schizotypy is assessed using the Multidimensional Schizotypy Scale-Brief Edition (Gross, Kwapil, Raulin, Silvia, & Barrantes-Vidal, 2018). Openness to Experience is assessed using the Aesthetic Sensitivity and Creative Imagination subsets of the Open-Mindedness Domain Scale of the BFI-2 (Soto, C. J., & John, O. P., 2017). Cognitive self-control is assessed using the English short version of UPPS-P Impulsive Behavior Scale (Lynam, Smith, Whiteside, & Cyders, 2006). Participants also completed the Infrequency Scale (Chapman & Chapman, 1983), measuring careless responding; Following previous research, participants who endorsed more than two of these items were omitted from data analysis (Chapman et al., 1994). Data analysis for our study is ongoing—a linear multiple regression analysis used to assess hypothesized interactions. Findings supportive of our hypothesis could demonstrate the efficiency of self-control as a predictor, and possible intervention construct, of psychosis and general psychopathology.

Eric Lis

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Biological Sciences; Psychology

Role for the carotid body chemoreceptors in glucose homeostasis in healthy humans

Eric C. Lis, Elizabeth P. Ott, Jennifer L. Harper, Camila M. Manrique-Acevedo, and Jacqueline K. Limberg

Objective: The carotid body (CB) chemoreceptors are important in sensing and responding to changes in arterial oxygen levels. Recent data from pre-clinical rodent models suggests the CBs also play an important role in glucose homeostasis. Our objective was to examine the contribution of the CB chemoreceptors to glucose regulation in humans. We hypothesized attenuation of CB chemoreceptor activity would improve glucose tolerance in healthy humans. We further hypothesized the magnitude of the effect of CB desensitization on glucose tolerance would be related to the level of CB chemosensitivity.

Methods: Participants (n=4, 53±6 yrs, 24±1 kg/m^2) completed a screen visit to assess CB chemosensitivity (hypoxic ventilatory response, HVR), as well as two study visits randomized to normoxia (control) and hyperoxia (CB desensitization). During the study visit, blood glucose, plasma insulin and C-peptide were measured every 15-min for 2-hours following consumption of a 75g glucose drink. Data for glucose, insulin, and C-peptide are reported as area under the curve (AUC). Pearson correlations between chemosensitivity (HVR) and the difference in AUC measures between visits were conducted.

Results: Individuals were healthy (HbA1c 5.0±0.2%) with an HVR of -0.26±0.04 L/min/%. There was no effect of hyperoxia on $AUC_{glucose}$ (p=0.65), $AUC_{insulin}$ (p=0.15), or $ACU_{C-peptide}$ (p=0.63). When the difference in AUC measures between visits (normoxia, hyperoxia) were compared to HVR, no significant correlations were observed.

Conclusions: Following consumption of a glucose drink, there is an increase in blood glucose which does not differ between control and CB desensitization in healthy humans. Furthermore, there is no effect of hyperoxia on main outcome variables and measures of peripheral chemosensitivity in the healthy adults studied. These data do not support a role for the CB chemoreceptors in glucose homeostasis in healthy

Life Sciences

Iman Lloyd

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Faculty Mentor: Dr. Jacqueline Limberg, Nutrition and Exericise Physiology

Effect of hyperinsulinemia on cerebral autoregulation

Iman N. Lloyd, Brian Shariffi, Jennifer L. Harper, James A. Smith, Camila M. Manrique-Acevedo, Jaume Padilla, and Jacqueline K. Limberg

This abstract has been withheld due to proprietary permissions.

Camryn Long

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Effects of Oxycodone on Trophoblast Stem Cells

Camryn Long, Yuchen Tian, and Michael Roberts

Many drugs are abused during pregnancy, including opioids. Due to the on-going opioid crisis, it is important to test how such drugs, specifically oxycodone, might affect offspring development in utero and contribute to offspring's long-term behavioral pathologies. Earlier work shows significant reduction in the area of the mouse placenta occupied by trophoblast giant cells and subsequent profound changes in offspring behavior in response to developmental exposure during pregnancy. We hypothesized that maternal treatment of human placental trophoblast cells with oxycodone (OXY) would deleteriously affect the development and gene expression patterns of the placenta in humans and mice. We have used a well-established model for human placental trophoblast development in vitro, in which pluripotent human stem cells are exposed to BMP4 (bone morphogenetic protein 4) and inhibitors of FGF2 and ACIVIN signaling. I tested two concentrations of oxycodone (250 nM and 50 nM) on H1 human embryonic stem cells (hESC) which were driven along the trophoblast lineage described above. All cell colonies were imaged daily to determine whether there were visible differences in morphology. Medium from each well was collected daily to allow measurements of the concentrations of the human pregnancy hormone (human gonadotropin, hCG) by ELISA. These assays were used to assess whether the cells were developing normally over time. At d7, the cells were lysed to measure DNA content, which allowed normalization of data. Each experimental condition was in duplicate and repeated X3 to provide a robust statistical assessment. My experiments indicate that neither concentration of oxycodone influenced the production of hCG or changes in colony size or morphology. These negative effects so far with these in vitro approaches suggest potential differences between the mouse and human trophoblast in response to oxycodone, although the human equivalent of mouse trophoblast giant cells may not be represented in our cultures.

Connie Luk

Chesterfield, MO

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Relationships among Articular Cartilage Biomechanical Properties and Biomarkers Produced by Subchondral Bone from Osteoarthritic Knees

Connie Luk, Matthew Gao, Ashwin Garlapaty, James A. Keeney, James L. Cook, and Aaron M. Stoker

INTRODUCTION: Osteoarthritis (OA) is a multifactorial disease progressing from an initial injury to whole-joint inflammation and degeneration causing pain and dysfunction. While OA is a disease of the cartilage, the subchondral bone has been shown to play a role of OA. This study was designed to determine the relationship between biomechanical properties of the articular cartilage and production of biomarkers by the underlying bone. It was hypothesized that there would be significant changes in subchondral bone biomarker production associated with changes in the biomechanical properties of the overlying articular cartilage from osteoarthritic knees.

METHODS: With IRB approval (#1208392), cartilage and bone were collected from patients undergoing total knee arthroplasty, TKA (n=8). 6mm diameter tissue explants were created and cultured in for 3 days. On day 3 media were tested for biomarkers and the biomechanical properties of the cartilage were assessed. The samples were group into evenly distributed quartiles based on cartilage biomechanical properties, and a Kruskal Wallace test with post-hoc analysis and Bonferroni correction were used to determine significant differences in bone biomarker production between groups ($p<0.05$).

RESULTS: The data indicates that as cartilage modulus increases and KSI decreases, the production of degradative and pro-inflammatory biomarkers by the bone increases significantly.

CONCLUSION: The outcome of this study helps to reveal some of the complex relationships between cartilage and bone in OA. Ongoing studies in our laboratory are steered toward further characterizing the complex interactions during development and progression of OA to better delineate disease mechanism and the development of effective interventions.

Maria Lusardi

Fargo, ND

Development of automated sensors to track pH changes elicited by iron deficiency in hydroponic cultures

Maria Clare Lusardi, Emily Walter, Dario Alavez, and David Mendoza Cozatl

Iron (Fe) is an essential nutrient for plant growth, and plants are the main source of Fe for humans and livestock. The World Health Organization estimates that Fe deficiency affects 30% of the world's population and is considered the most prevalent nutritional deficiency around the globe. Thus, understanding the molecular mechanisms that plants use to accumulate Fe will allow the development of biofortified crops for better human nutrition. Despite recent and significant advances in our understanding of how plants respond to Fe deficiency, the molecular and physiological mechanisms behind Fe deficiency are still poorly understood. This is due in part to the static nature of how our field currently assesses Fe deficiency responses. For instance, plants are known to acidify the root environment to make Fe more available but currently, data describing the timing and progression of this acidification is lacking. To solve this issue, we developed an automated pH tracking system to monitor pH changes in hydroponic systems. As a proof of concept, we tracked the acidification of media on maize plants grown over a week with and without Fe. We also compared the accuracy and consistency of two different sensors, PASCO's ready-to-use Wireless pH Sensor and DFRobot's DIY open-source Gravity pH Meter Pro. Overall, the PASCO sensors showed more consistent readings and required minimal software and hardware setup. DFRobot sensors on the other hand showed much more variance in their readings and required a microcontroller, a Raspberry Pi, and self-written software to read and analyze the values. However, the open-source capacity allows more possibilities for future development, such as real-time data uploads. Further experiments will focus on optimizing the sensitivity of both systems to provide an informed data-driven comparison of each sensor brand.

Evelyn Mabie

O'Fallon, MO

Examining Portrayals of Minority Groups in African American focused news media

Evelyn Mabie, Brandon Ford, Kobe Gibson, Caitlin Tate, Andrea Figueroa-Cabellero, and Christopher Josey

Previous research shows traditional news media often present African Americans in negative and stereotypic ways. However, representation of African Americans in African American-focused news media has rarely been studied. We argue that an examination of this content is important as previous research indicates that individuals—particularly those from marginalized groups—are particularly attune to representations of their group in media content and seek out group-affirming content (Abrams & Giles, 2010). In our study, we assessed the content of 600 articles from 4 different African American-focused media outlets (150 stories from each, *Black Voices, The Root, The Grio,* and *Blavity*) at both the story- and character-level to determine how African Americans were portrayed by news media created for and focused on them. We hypothesized, that African American-focused news media would overrepresent African Americans when compared to African Americans as a percentage of the population of the United States and the number of portrayals of African Americans by traditional news media. We also hypothesized that these news media will feature more positive portrayals of African Americans. Using a digital codebook created using the Qualtrics survey software, coders were trained on ~10% of the sample until they were deemed to be consistent across all relevant variables. Our results indicate preliminary support for our hypotheses. First, African American-focused news media overrepresents African Americans compared to traditional news media and US census data. Second, African American-focused news media portrays African Americans more favorably than traditional news media. Based on this research, we will now focus on assessing whether the more positive portrayals found on this site, can lead to positive effects (i.e., increased self and group esteem) on their target audience.

Aubrielle Maginness

Columbia, MO

Foraging strategies and personality - does fear/shyness lead to more reward?

Aubrielle Maginness and Kristy vanMarle

Purpose: Herrnstein's (1961) Matching Law establishes that in an individual foraging task (one forager, n locations), participants divide time in proportion to the income available in each location. This "probability matching" is observed in animals (Gallistel et al., 2007) and humans (e.g., Bliss, Gilson, & Deaton, 1995; Koehler & James, 2010). Probability matching does not maximize individual reward, leading researchers to ask what factors affect strategy choice. West and Stanovich (2003) showed that adults using a "maximizing" strategy (i.e., spending most of their time in the most productive zone) had higher cognitive abilities than individuals employing matching. Likewise, Koehler and James (2010) suggest that matching is a heuristic that comes to mind easily, but when asked to deliberate over alternatives individuals are more likely to choose a better strategy, i.e., maximizing. Furthermore, Derks and Paclisanu (1967) found that probability matching emerges around age 6, while younger children use a maximizing strategy. The present study investigates strategy choice in preschoolers and adults and whether the temperment trait of shyness/fear is related to strategy in a foraging task.

Methods: Five adults (mean age=20) and three children ages (mean age=3.5) participated on Zoom, completing the Rothbart Temperament Questionnaires for Fear and Shyness (Rothbart et al., 2001, Evans & Rothbart, 2007), and playing a 15-minute computer game where they must hover the cursor over the location they think will be "rewarded" next in an attempt to garner the most rewards. Rewards are delivered in an unpredictable concurrent VI schedule and reward ratios vary (1:1, 2:1, 5:1, twice each).

Results: Preliminary results show that children reaped more rewards than adults but neither group picked a single strategy. Shyness was associated with lower rewards in both children and adults (R=-0.87,-0.81), whereas fear was associated with higher rewards (R=0.99,0.27).

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Aleea Magras

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Impact of Rising Temperatures on Oil Content and Pest Resistance of Plants Engineered for Biofuel

Aleea J. Magras, Aidan Ireton, and Abraham J. Koo

As mean global temperature continues to rise, largely attributable to fossil fuel combustion, the need for renewable energy is evident. Efforts are underway to improve oil content in plants to use plants as an economically viable source of bioenergy, but little is known about the impact of increased oil on plant adaptations to stress. The purpose of this study was to examine the triple-faceted relationship among temperature, insect herbivory, and oil metabolism. Oil content in plant leaves was increased through ectopic overexpression of *LIPID DROPLET ASSOCIATED PROTEIN 1 (LDAP1)* under constitutive promoter in model plant *Arabidopsis thaliana (LDAP1-OE)*. Insect feeding trials showed that cabbage looper larvae raised on *LDAP1- OE* gained similar weight as those on wildtype (WT) control both under normal (22 °C) and moderately raised (30 °C) temperatures; however, the insect consumption rate was remarkably accelerated at 30 °C. This was mostly attributable to faster growth of insects under higher temperatures as was shown by insect growth assays conducted on artificial diet under different temperatures. Interestingly, when plants were pre-acclimated to 30 °C for five days before conducting the insect feeding trial at 22 °C, *LDAP1-OE* plants were found to be more susceptible to insect herbivory than similarly treated WT, indicating that increased temperature caused differential effects on the food quality of the two genotypes. Lipid profiling analysis using thin layer chromatography of leaf extracts revealed time-dependent increase of triacylglycerol, the major form of lipids in vegetable oil, by high temperature treatments in both genotypes with more significant changes in *LDAP1-OE*. Such differential oil accumulation may have contributed to the differential insect performance on each genotype, but more research is needed to establish the causal relationships. Future studies will adopt the use of other varieties of oil-engineered lines and genome scale analysis of gene expression and metabolites.

Jillian Marino

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Secondary Education (Language Arts); English

Faculty Mentor: Dr. Chad Rose, Special Education

Developing Evidence-Based Bullying Prevention Tip Sheets for Parents, Students, and Educators

Jillian Marino, Nikki Bowman, and Chad Rose

Bullying is a pervasive issue throughout the world and can cause immense challenges within the school environment. Thus, it is critical to continue developing support structures for parents, educators, and students to combat this problem. In recent years, the general populace has increasingly interacted with social media applications and this platform may be an effective tool to use for informing people about the issue of bullying and preventative strategies. This study was a collaboration by the University of Missouri Bully Prevention Lab, the International Bully Prevention Association, and Facebook. The purpose of this study was to develop succinct and empirical guidelines for parents, students, and educators to help them prevent and respond effectively to bullying by disseminating evidence-based advice through Facebook. The authors developed three separate tip sheets targeted at each group of primary stakeholders related to the issue of bullying: parents, students, and educators. A literature review was conducted to identify suggestions for each of the three common roles involved in preventing bullying mentioned previously. For each of the three categories, the top tips were chosen based on how frequently each recommendation was found throughout the literature search. At the time of this publication, the final products have been distributed by Facebook through a soft launch limited to certain regions and will remain part of Facebook's anti-bullying campaign. The prevalence of bullying in schools can have a severe impact on students' learning as well as physical, mental, and emotional health. Therefore, it is vital to continue connecting the general population with accessible tips and strategies that will enable them to more effectively prevent bullying.

Behavioral/Social Sciences

Cassandra Marks

Warrensburg, MO

Junior
Political Science; Economics

Faculty Mentor: Dr. Peverill Squire, Political Science

Is the Missouri Oversight Division Biased? Analyzing Missouri Fiscal Note Data 2000-2020

Cassandra Marks and Peverill Squire

Bureaucratic institutions have a significant role in policymaking, despite their unelected status. While there is literature surrounding federal bureaucratic institutions like the Congressional Budget Office and the Federal Reserve, there is a gap in the literature regarding state legislatures and their bureaucratic institutions. Applying current, general theory about bureaucratic behavior and bias, and combining quantitative data from Missouri, this study analyzes potential bias in the Missouri State Oversight Division as a model for future analyses in other states. This study uses a combination of regression and classification methods to research any potential relationships between the governor's administration, legislator party, or leadership position. The results of this study will be presented at the forum.

Amara Mason

Alsip, IL

Succinoglycan Production and Œ≤-lactamases Confers Resistance to External Stresses in Agrobacterium tumefaciens

Amara Mason, Jacob Bouchier, and Pam Brown

   Peptidoglycan (PG) is a conserved feature that initiates an immune response in almost all plants and animals. Slowing PG synthesis during host invasion may be an effective strategy for bacteria to avoid detection by the host immune system. Remarkably, loss of an essential PG synthase, PBP1a, not only results in the loss of PG synthesis but also activates a transcriptional program that transitions *Agrobacterium tumefaciens* from a free-living motile bacterium, into a host-invading state. During this transition, production and secretion of the exopolysaccharide, succinoglycan is upregulated. To explore the link between PG synthesis and succinoglycan production, I dissected known components of the succinoglycan regulatory and biosynthesis pathways and tested the hypothesis that succinoglycan may be protective against environmental stressors. Here, we find that cells without succinoglycan are sensitive to acid stress, membrane disruptors, and cell-wall targeting antibiotics. These findings suggest a direct role for succinoglycan in providing protection to external stressors. Additionally, I show evidence that *A. tumefaciens* utilizes beta-lactamases as an additional layer of protection from beta-lactam antibiotics. Through the use of both genetic and chemical inhibition, I propose here a comprehensive characterization of the two β-lactamases encoded in the genome of *A. tumefaciens*. Together, these findings will lead to a greater understanding of bacterial antibiotic resistance, informing on a major global health crisis.

Maya McClain

Bettendorf, IA

Faculty Mentor: Dr. Kaleea Lewis, Public Health

Black Pregnancy in America: Injustice in the Healthcare System

Maya McClain and Kaleea Lewis

Black mothers in America experience higher maternal and infant mortality rates in comparison to white mothers. Through my research I have found different factors such as discrimination, implicit and explicit biases, stress, and many others that contribute to this disproportionate death rate. I will be addressing how these areas affect mortality rates, what legislation is doing about this issue, different studies that have followed this trend, and solutions to address this growing problem. This issue is gaining recognition in the medical world, but still needs others to advocate for the unjust treatment that black mothers are receiving in the United States. Through my research and through this forum I hope to be an advocate for this disproportionate death and provide evidence to support the adverse health effects that Black mothers experience. I will do this by bringing attention to the injustice in the medical world and identify the steps that can be taken to begin bringing justice to Black mothers in America.

Maya McClain

Bettendorf, IA

Junior
Biological Sciences

Faculty Mentor: Dr. Lynn Itagaki, English

Trans Health in America: Discrimination and Exclusion in Healthcare

Maya McClain and Lynn Itagaki

The topic of transsexuality has often been an issue of discussion in the healthcare field. With discrimination and exclusion exhibited in the medical field, trans patients often find themselves struggling to gain acceptance and adequate health care from doctors that respect their identities. The purpose of my research was to discover the adverse health effects that trans patients receive in medical care *and* in situations surrounding the topic of medical care (such as trans people in the military). Trans patients face a variety of adverse health effects because of their identity and are often discriminated against and feel excluded in medical care facilities. Through my research of peer reviewed and scholarly articles along with firsthand interviews I have gathered information about trans health and how medical facilities treat trans individuals. I will also address steps needed to create a more inclusive healthcare field for trans patients. Results and conclusions will be presented at the Forum.

Behavioral/Social Sciences

Kathryn McCulloch

Houston, TX

Faculty Mentor: Dr. Nicole Campion-Barr, Psychological Sciences

Role of marital relationship quality on different domains of sibling conflict

Kathryn McCulloch, Yue Guo, and Nicole Campione-Barr

Marital relationship quality influences sibling relationship quality (Cox & Paley, 2003; Yu & Gamble, 2008). However, there is little research exploring the impact of marital relationship quality on the different types of sibling conflict. Sibling conflict during adolescence has been previously found to engage two distinct content domains: Invasion of the Personal (IP) and Equality and Fairness (EF; Campione-Barr & Smetana, 2010). The present study examines the association between marital relationship quality and these two domains of sibling conflict. We predicted that positive marital relationships would be protective against sibling conflicts, particularly for IP conflicts as they are more impactful to the quality of the sibling relationship and adolescent adjustment (Campione-Barr & Smetana, 2010). The primarily White and middle-class sample consists of 123 families with multiple children (first-borns:13-19 years; second-borns10-18 years). The Network of Relationships Inventory (NRI; Furman & Buhrmester, 1985) was completed by mothers and fathers to assess marital positivity ($\alpha_{mothers}$ = .97, $\alpha_{fathers}$ = .95). The Sibling Issues Checklist (Campione-Barr & Smetana, 2010) was completed by adolescents to assess sibling conflict (IP, α = .77-.89; and EF, α = .59-.83). Sibling gender composition, age, and conflict at Time 1 were controlled for in hierarchical regression analyses. Higher mother-reported NRI positivity marginally predicted higher IP conflict frequency (β =.31, p < .10), and significantly predicted more intense IP conflict (β = .37, p < .05). In contrast, higher father-reported NRI positivity marginally predicted less intense IP sibling conflicts (β = -.34, p < .10). The results suggest that marital positivity has a greater impact on IP sibling conflict intensity than all other types of sibling conflict, but that this differs by parent and direction. This information could aid parents and family practitioners to understand how the family sub-systems impact one another, for better or for worse.

Taylor McDonald

Columbia, MO

Senior
Human Development and Family Science (Family and Lifespan Development)

Faculty Mentor: Dr. Fiorella Carlos Chavez, Human Development & Family Science

Understanding the Motivations and Cultural Work Values of Male Mexican H-2A Migrant Farmworker Youth

Taylor N. McDonald, Grace J. Patton, and Fiorella L. Carlos Chavez

Background. Latinx migrant farmworker adolescents (LMFAs) are foreign-born, unacompanioned, and one of the most vulnerable and underrepresented subgroups of migrant farmworkers (Arcury et al., 2014). Despite their young age, LMFAs work under poor weather conditions (i.e., rain and heat) in exchange for income. Although previous research has shown that remittances to family is a key factor for migration (Carlos Chavez et al., 2021, in press), little is known about their intrinsic and cultural motivations. We argue [im]migrant Latinx adolescents come to the United States with *ganas*, a culturally inherited motivation to hard work and sacrifice for one's family (Easley et al., 2012).

Purpose. The present qualitative exploration focused on Mexican H-2A migrant farmworker adolescents' work motivation, work advice for other migrant adolescents, and cultural values toward work. Our research questions included:
1) What leisure activities do migrant adolescents focus on when they are not at work?
2) What is the direct advice migrant farmworker adolescents give to other youth to stay motivated?
3) How do cultural values manifest or influence work motivation for Male Mexican H-2A migrant farmworker adolescents?

Method. Data came from Mexican H-2A migrant workers in Georgia (*n* = 10; 100% male, aged 18 to 20, 70% financially supporting their parents). Participants received a $10 incentive for their participation. An NIH Certificate of Confidentiality was obtain to further secure participants' information.

R**esults.** Thematic analysis highlighted four core themes were found: (1) "getting distracted" (2) "this work is temporary" (3) "respect and responsibility of oneself" (4) "put *ganas* forward".

Conclusions. Mexican H-2A migrant farmworker adolescents confront environmental and emotional stressors. However, to distract themselves they turn to leisure activities (i.e., playing soccer, talking/playing on their phone) and motivate themselves and others through *ganas*

Behavioral/Social Sciences

Elizabeth McGuire

St. Louis, MO

Faculty Mentor: Olumayow Odemuyiwa, Nursing

Assessment of Readability of Cardiovascular Patient Education Materials

Elizabeth McGuire, and Olumayowa A. Odemuyiwa

This project is being performed in order to assess the average readability of patient education materials that are provided to patients as a part of their discharge packet or during teaching projects on the floor. This project is being conducted for an undergraduate nursing class at the University of Missouri-Columbia Sinclair School of Nursing called Honors Nursing 3900H: Introduction to Research for Evidence Based Nursing Practice. The materials that are being used for this research project were obtained from the Cardiovascular Unit on the 4th floor at University Hospital in Columbia, MO. The materials cover 3 different topics related to cardiovascular health which are heart failure, atrial fibrillation and the cardiovascular rehabilitation program known as fit for life. The materials include normal text, bullet points, visual diagrams and tables. Each of these education materials will be assessed for their readability levels using the Kincaid grade, SMOG readability formula and Gunning Fog Index. If a patient education material has the readability level of a 7th or 8th grader (ages 12-14), then the average patient will be able to read and understand the information.

Elisabeth Mealy

Jefferson City, MO

Faculty Mentor: Dr. Stephen Whitney, Educational, School & Counseling Psychology

Long-term effects of the achievement gap

Elisabeth Mealy, Jeffrey Pollmann, Emily Dehner, and Stephen Whitney

The achievement gap has been a perennial problem in education over the past 70 years when it was first discovered through the work of the Coleman report. However, little is known about the long-term effects of the achievement gap. Using a Nationally representative, longitudinal dataset (Add-Health), we examine the long-term effects of the achievement gap, defined as class and race, in the educational attainment and income in adults. Add Health follows 20,000 individuals beginning in grade 7-8 in the 1994-95 school year. The data includes five waves, with the most recent wave of data collected in 2016-18, the first four waves were utilized in this analysis. Cases who completed all four waves were included in the analysis (N=12,092). Race and SES were used to define the comparison groups, biological sex was included as a control. Cumulative GPA in waves 1-2 was used to predict highest level of education attained and yearly income in wave four. A ANOVA with Bonferroni correction was used to compare the groups. Results indicate a significant overall interaction between groups and highest education attained and income. Selected post-hoc comparisons indicate a significant difference between several subgroups. For example, Asian poor student had significantly higher levels of education when compared to White poor student and Black poor students. White poor students had significantly higher education levels of education when compared to Black poor students. Asian poor student also had significantly higher levels of income when compared to White poor student and Black poor students. White poor students also had significantly higher income levels when compared to Black poor students. This study highlights the long-term influence of educational differences across the lifespan and calls for the continued need for programs to ensure educational equality across race and class groups.

Behavioral/Social Sciences

Senay Mengesteab

Columbia, MO

Junior
Biological Sciences; Psychology

Faculty Mentor: Dr. Jill Kanaley, Nutrition and Exercise Physiology

Sleep Restriction and Altered Sleep Timing on Energy Expenditure

Senay Mengesteab and Jill Kanaley

Sleep restriction studies have shown insulin insensitivity, obesity, and weight gain are a few physiological changes associated with sleep restriction, but few studies have examined the effect on physical activity. No studies have examined if the timing of the sleep restricting impacts physical activity levels. Thus, the purpose of this study was to examine the effect of 4 days of shortened sleep on changes in physical activity when the sleep loss is due to delaying sleep or awaking early. Two men and two women (age: 27.5 yr) participated in three randomized conditions sessions. The subjects wore an Actigraph and Actiwatch for five days. The conditions were: normal sleep (7-9 hours), delayed sleep (delayed bedtime by 2hr late, same wake time) or early awake (waking 2 h early, same bedtime). Result: Total number of steps taken while awake was not different by condition ($P>0.05$), but there was a trend ($P<0.059$) to be a difference in step taken across days, with the lowest number of step taken on the 4th day of sleep restriction. Examining just the 2 hr of awake time under the delayed vs early condition, resulted in on differences in the number of steps taken. In conclusion, staying awake 2 h longer did not alter the total step count and there was no difference in the number of steps taken in the 2hr of being awake in either delayed sleep or early waking.

Regan Mertz

Ft. Leonard Wood, MO

Senior
Journalism (Convergence Journalism)

Faculty Mentor: Kathy Kiely, Journalism

Meeting public information needs in a crisis: How MU Journalism students responded to COVID-19

Regan Mertz and Kathy Kiely

From May to August 2020, Missouri Information Corps, a MU School of Journalism pop-up newsroom, reported on the coronavirus pandemic. I am presenting on behalf of Mo Info Corps and am citing my teammates' work, as well as my own. We did traditional public service journalism and experimented with delivering crucial public health information in social media groups. We did this because many of us had lost jobs and internships because of the pandemic. We also wanted to put our training to use by informing the public in our region and reinforcing newsrooms that were under severe economic stress due to COVID-19 shutting down many advertisers. We worked as an autonomous newsroom with two graduate student editors and two faculty advisors. Our stories ranged from the disturbing – the impact of COVID-19 in prisons, Missouri's failure, as of early July, to support contact tracing at the local level and Missouri counties' slow disbursement of federal coronavirus relief funding – to the uplifting, including pieces on how some Missouri farms pivoted to selling food locally and a class that encouraged Latino gardening which drew Spanish-speakers around the world. To make our news and information widely accessible at a time of great public need, we offered it to news organizations for free. Mo Info Corps also established a presence in local Facebook groups, engaging with people through comments and occasionally doing additional reporting to answer questions. Our work has been published in more than 30 outlets, including USA TODAY, and we received many messages of gratitude from readers and editors. By the end of the summer, we learned to (1) engage with communities on social media, (2) explain why information is changing and (3) keep it quick, clear and useful.

David Meyerhoff

St.Louis, MO

Senior
Biological Sciences; Political Science

Faculty Mentor: Dr. Jeff Whyte, Biomedical Sciences; Dr. Jeff Adamovicz, Biomedial Sciences

Repurposing chloroquine for the clinical treatment of COVID-19

David Meyerhoff, Jeff Adamovicz, and Jeff Whyte

SARS-CoV-2, the causative virus of COVID-19, and the pandemic it has resulted in has severely impacted daily life both socially and economically. While physicians struggled in the early days of the outbreak to discern appropriate and efficient medical treatment options, the novel nature of the virus proved a significant obstacle. This created an unprecedented need for rapid research efforts to generate data regarding the structure and mechanisms of pathogenesis of SARS-CoV-2 and, in turn, possible clinical treatments of COVID-19.

Dr. Jeff Adamovicz, Dr. Jeff Whyte, and I embarked on research with the purpose of contributing to the development of the latter need. Specifically, through a kinetic time-course Vero E6 cell culture assay performed on a Lionheart FX Automated Microscope, we investigated the effects of the anti-malarial drug chloroquine on SARS-CoV-2 proliferation in real time over a 48 hour period. The Vero E6 cell line, originally isolated from African green monkey cells, has unique properties that make it an ideal system for the propagation and study of pathogenic viruses. Chloroquine has been widely reported on by journalists in mass news media as potentially useful in the clinical treatment of COVID-19, and our results – expected in just over a week – will either corroborate or contradict many of these claims.

Ultimately, more investigation into the mechanism of action of chloroquine is required to truly make an informed, definitive statement about its efficacy as a clinical treatment for COVID-19. Both research utilizing human cell lines and representative animal models in vivo will better allow the scientific community to ascertain the potential of chloroquine in the treatment of COVID-19. However, both the scientific and medical communities' knowledge of the virus is increasing exponentially, a signal of immense promise in reaching the end of the COVID-19 pandemic.

Heather Miller

Lemont, IL

Sp21-012

Senior
Psychology; English

Sex Differences in Solving Algebra Word Problems

Heather Miller, Mary Hoard, Lara Nugent, and Dave Geary

Problem or Purpose:
It is currently debated whether there is a sex difference, favoring males, in solving mathematical word problems. This study tested the hypothesis that boys have an advantage for solving algebra word problems and that this advantage will be related to one or several aspects of spatial ability and to mathematics attitudes or anxiety (Geary, Saults, Liu, & Hoard, 2000; Geary et al., 2019).

Procedure:
The sample is from a larger, ongoing longitudinal study and included 171 (87 boys, 84 girls) ninth-graders (M =14 years, 8 months old, *SD*= 4.81 months). The students were administered a measure that included 13 multi-step algebra word problems and a general measure of algebra ability, along with measures of spatial ability and working memory. The students also completed surveys that measured self-reported anxiety and attitudes related to math and English.

Results:
The results confirmed boys' advantage for the word problems (*d* = .47), with no difference in overall algebra competence (*d* = .03). Sex differences were also found for visuospatial attention (i.e., Judgement of Line and Angle Position task, (*d* = .55) and mathematics anxiety (*d* = .50), both of which were significantly correlated with performance on the word problems test. Mediation analyses revealed that the sex difference in word problems was fully mediated by the sex differences on these measures.

Conclusions and Implications:
The results show that boys' advantage in algebra is restricted to multi-step word problems, and this advantage appears to be due to boys' advantages in visuospatial attention and lower levels of math anxiety. These results show that sex differences in math are related to only some types of problems and have implications for interventions to improve girls' performance on word problems.

Behavioral/Social Sciences

Alicia Mitchell

McKinney, TX

Faculty Mentor: Dr. Jordan Booker, Psychological Sciences

Child Backgrounds, Positive Parenting, and Internalizing Risks in a Nationwide Sample of 6-to-17-Year-Olds

Alicia Mitchell and Jordan A. Booker

Children from different backgrounds may have different experiences that impact their emotional health (e.g., support for more vulnerable emotions of sadness and fear for girls than boys; e.g., Caplin et al., 2005). Further, parental involvement and the ways parents interact with and support their children can inform children's emotional adjustment (e.g., Wang et al., 2014). We were interested in the ways child demographics and parental involvement were associated with children's risks for emotion problems of withdrawal and depression. We addressed whether: 1) demographics informed reports of internalizing risks; 2) parental involvement informed repots of internalizing risks; and 3) whether interactions were supported between demographics and parental involvement. We hypothesized that demographics would be informative for internalizing risks and that parental involvement would be negatively associated with internalizing risks.

Using a re-analysis of a large, nationwide survey from 2003 (n = 56,386; M child age = 11.8 years, SD = 3.43; 48.5% girls), we considered the ways child demographics (i.e., age, gender, racial background, family income) and caregiver reports of involvement (i.e., shared family meals, relationship quality with the child, talks with the child) were associated with reported risks of depression and withdrawal.

We found small differences in children's reported emotion problems given demographics. Older children were at higher risk for depressive and withdrawal problems, whereas children from wealthier families were at lower risk. Girls and Multiracial children had higher reports of depression risks, whereas boys and African American children had higher reports of withdrawal risks. Each measure of parental involvement showed small to medium negative associations with depression and withdrawal risks. Select demographics-by-involvement interactions were also supported. Overall, the findings from the large, nationally representative sample display support for our hypothesis. Parental involvement had a negative association with internalizing risks. The demographics showed to be somewhat informative for internalized risks.

Pamela Montano

Santa Cruz de la Sierra, Bolivia

Faculty Mentor: Lynn Kim, Digital Storytelling

English as My Second languages

Pamela Montano and Lynn Kim

During these two years living in the United States, I never had the opportunity to express my emotions about how difficult it was for me to adjust to my new home. As an international student, adapting my customs, ideas and my language was not easy.

English as My Second Language is a short stop motion video of almost three minutes inspired by the emotions and difficulties that I had to go through to improve my English.

The video is an animation where the images and texts reflect my moments of sadness and happiness. They convey every moment I had to show myself and my family that I could achieve my goal and defy obstacles in this path.

The design of the video is simple but very meaningful to me because it is the proof of my effort, time and creativity. The animation use paper cut out puppets, letters, and personal objects like my books to represent myself and my experiences in learning English.

For me, showing a challenge in my life through video is something that I never imagined doing, especially when it comes to certain emotions that are difficult to express in a single drawing or in words alone.

This process of learning a language led me to understand that there are many things left to discover and to know about English. I appreciate the opportunity to share my journey and experience with the public and to bring forth the results of my hard work.

Bethany Moore

Springfield, MO

Freshman
International Studies (Peace Studies)

Challenging Maslow's Hierarchy of Needs: Perspectives of Latino Migrant Adolescents in U.S. Agriculture

Bethany A. Moore, Chase J. O'Neal, and Fiorella L. Carlos Chavez

Introduction. Maslow's Hierarchy of Needs (1943) has been popularized in the psychology of business as the predominate theory to explain human motivation; however, its applicability to populations beyond those of Western, individualistic cultures remains ambiguous. As the hierarchy progresses toward higher motivations, a greater emphasis is placed on independence and realizing one's own potential; however, there is limited information on the appropriateness of this theory regarding individuals from cultures that alternatively emphasize interdependence.

Purpose. The qualitative study had two core aims. First, we explored the extent to which Maslow's original theory applies to Latino migrant adolescents in U.S. agriculture. Second, we proposed a more culturally-appropriate model based on cultural influences that may take place for Latino migrant adolescents.

Methods. To accomplish these aims, we analyzed N = 20 semi-structured voice-recorded interviews transcribed in Spanish with migrant farmworker youth from Guatemala and Mexico (aged 15 to 20 years old). Deductive analysis was utilized to determine the applicability of Maslow's Hierarchy before subsequently identifying themes not formerly addressed in the theory through inductive methods.

Results. The foundational motivations of physiological and safety needs remain pertinent to the Latino farmworker youth population. However, higher motivations, proceeding toward the top of Maslow's Hierarchy, were less universally applicable. Instead, findings highlighted that collectivistic upbringings (i.e., benefit of community) and a focus on family-oriented values (i.e. familism, or *familismo*), informed a hierarchy prioritizing familial love, communal sacrifice, co-actualization, and meaning of life through family and work.

Discussion. This revised hierarchy accounts for cultural differences and family upbringings of the focal population. Future research should seek to determine the applicability of the revised hierarchy to other groups of adolescents to identify any variability on the basis of ethnic group membership, age, socio-economic status, and U.S. region.

Behavioral/Social Sciences

Aaron Mott

Centralia, MO

Eye Place this Class: Testing an instructional intervention on eye movement of novice livestock evaluators

Aaron Mott, Tawnie DeJong, and John Tummons

Novices often miss details easily visible by experts. Sight is personal; coaches cannot see where and how students focus. This project compared eye movement of livestock evaluators before and after a short workshop on how to evaluate livestock. Researchers placed eye-tracking glasses on high school students without livestock evaluation experience. Students wore the glasses and analyzed a heifer picture, received a 30 minute workshop on evaluation, then reevaluated the same heifer. Researchers analyzed paired data from 7 students using Tobii Pro Lab, then used SPSS to calculate descriptive data and paired t-tests for the first 10 seconds of data on interval, fixation, and saccade video data.

Researchers rejected null hypotheses on three comparisons. Average participant duration of fixations was significantly longer during the post-test. Students had significantly less fixations during the posttest; posttest minimum peak velocity of saccades were significantly higher than pretest. All significant differences had a *large* effect size. Researchers failed to reject the null for duration of interval, total duration of fixations, duration of first fixation, maximum peak velocity of saccades, time to first saccade, and peak velocity of first saccade.

Researchers analyzed aggregated heat map and gaze plot data. Preworkshop student attention focused on the head, neck, and lower belly. Post workshop, students shifted attention to structural concerns in rear quarter. Post gaze data also indicated intentional focus on the shoulder and no attention to the head.

Researchers conclude the workshop positively impacted the location of attention, duration of fixation, reduced number of fixations and faster movement between fixation locations. Eye tracking technology has great potential in helping coaches to understand how students view tasks and provides an opportunity for coaching and assessing attention.

Elise Mulligan

Naperville, IL

Faculty Mentor: Kathy Kiely, Journalism

How American companies benefit from countries that suppress journalism and free speech

Elise Mulligan and Kathy Kiely

In October 2018, U.S.-based journalist Jamal Khashoggi was murdered under the orders of Saudi Arabian Crown Prince Mohammed bin Salman, a CIA report concluded. In the Philippines, President Rodrigo Duterte's administration has repeatedly arrested journalist Maria Ressa on charges of cyber libel, threatening her with as much as 100 years in prison.

Meanwhile, lobbyists in the U.S. continue to represent Saudi Arabia and the Philippines, collecting millions of dollars in payments as journalists continue to suffer.

I am doing this work because I think it is important for the public to know that corporate citizens who benefit from the rights of free speech are profiting from work for those who oppress it.

For more than a year, I've monitored the activity of lobbying firms and compiled research into comprehensive records of certain lobbying firms' payments, contracts and other clients.

I scrutinize the lobbying firms' mandatory filing statements on the Foreign Agents Registration Act database, and aggregate news articles and company information on the firms' leadership and other prominent clients.

Using the research I've gathered, my faculty mentor Kathy Kiely will reach out to the lobbying firms, and, depending on their response, may launch a public campaign making an issue of their relations to countries that oppress freedom of speech. We hope this pressure of a negative public spotlight will urge the firms to enact positive changes in those countries, or cut ties with their foreign agents.

Andrew Murphy

Grayslake, IL

Senior
Information Technology

RestroomMap: A Mobile App for Finding Accessible Restrooms

Andrew Murphy, Hao Dong, Youngbin Ha, and Fang Wang

As communities and public facilities promote inclusion, many are overlooking a crucial need that must be met for a place to be truly inclusive of everyone--accessible restrooms. Many people, children with disabilities who are too large for infant-size changing tables as well as adults who need assistance and privacy when using the restroom, would benefit from the existence of more private family restrooms that include adult-size changing tables Collaborating with Missouri Disability Empowerment (MoDE), we are making information about accessible restrooms more available to the public. This project is to provide mobile applications to view and submit restrooms information, and a website for the management of this data.

The mobile applications provide a map to locate accessible restrooms and display the necessary information for their access. They also provide a form to submit data about additional restrooms that may not already be in the database. These mobile applications have to be fully accessible and aim to be easy to use to properly serve the intended users of the apps. A database management web portal is created to manage the restroom information in the database. The website features a side-by-side layout containing a map that displays restroom locations, and a filterable list of all the restroom entries. The filtering allows easy access to locate specific entries. When used in combination with the map, the restroom's location details are easily verifiable and manageable. For example, the user can locate unapproved submissions, verify basic data (addresses, phone numbers, and building information), and approve the submission to be displayed on the map. The website needs to streamline the process as efficiently as possible to ensure the data is as accurate, and up-to-date as possible. This is especially important because the administrators from MoDE manually verify the crowdsourced submissions. The app will undergo user testing with the disability community facilitated by MoDE.

Morgan Murphy

Port Hope, MI

Senior
Art,

Faculty Mentor: Chris Daniggelis, Art

Two Lovers

Morgan Murphy and Chris Daniggelis

Morgan Murphy's work is parallel to Ingmar Bergman's film noir stage set quality that caricatures psychological settings. Through the utilization of the romance of printmaking, and the paper and plate only touching once before that connection is ripped away, "Two Lovers" achieves social commentary of the current state of the Coronavirus Pandemic. Rene Magritte's painting, "The Lovers" is reproduced backwards in mezzotint to show the reflection on time in the past. This painting represents a barrier preventing an embrace between two lovers and the frustration and isolation that comes along with that. These, of course, are very similar struggles that seem to be ubiquitous, given our crisis. While Murphy's reproduction of "The Lovers" encourages us to reflect on the past, Murphy's second mezzotint engraving implores us to analyze the times we currently live in. The masks worn by two lovers in the second mezzotint signify that interruption of human connection and the distance and alienation many of us suffer due to the current pandemic. The connections that Murphy draws between the surrealist painting "The Lovers" and the masked, socially distanced setting we endure today remind us to cherish the opportunities we have with our loved ones, and more importantly, that we are all in this together.

Claire Neighbors

Lee's Summit, MO

Faculty Mentor: Dr. Paula McSteen, Biological Sciences

GrasVIQ: An Image Analysis Framework for Automatic Quantification of Veins in Grass Leaves

Claire M. Neighbors, Janlo M. Robil, Ke Gao, Michael Boeding, Francine M. Carland, Filiz Bunyak, and Paula McSteen

    Leaf veins facilitate transport and provide mechanical support to the leaf and have critical implications for the performance and productivity of the plant and the ecosystem. Computational image analysis programs have been developed to extract and quantify vein traits from the reticulate venation of dicots, but a dedicated program for the parallel venation of monocots, particularly grasses, has yet to be developed. To address the need for high throughput vein phenotyping in grass species, like Oryza sativa (rice) and Zea mays (maize), we developed the Grass Vein Image Quantification (GrasVIQ) framework which automatically segments and quantifies vein from images of cleared leaf pieces using classical computer vision techniques. Using image datasets from inbred lines and auxin mutants in maize, we demonstrate that GrasVIQ can perform high throughput quantification of vein traits, including vein density, vein width, and interveinal distance, with a precision on par with manual quantification. Further, we show that the framework can be used to recognize quantitative traits, identify previously undetected phenotypes, and measure vein patterning defects, which is advantageous for both basic and translational research. We envision GrasVIQ to be adapted for vein phenomics in maize and other grass species.

Adriana Northrop

Elgin, IL

Senior
Political Science; Business Administration

Faculty Mentor: Dr. James Endersby, Political Science

United States Political Realignment in the Present Day

Adrianna Northrop and James Endersby

This research analysis explores the question of whether the United States is currently is experiencing or has recently experienced a political realignment. Understanding political realignments helps us understand voting behavior and predict voting trends. My initial hypothesis is that Donald Trump's 2016 election marked a political realignment. Through analyzing various political speeches including State of the Union addresses, inaugural addresses, nomination acceptance speeches, and opposition responses to the State of the Union. Textual data extends from 1968 (Nixon presidency) to 2021 (Biden presidency). Using *Diction 7.2* text analysis software, it seems likely that the Republican Party is experiencing and/or has experienced an internal realignment. An internal realignment is a restructuring of issues within a political party, while a critical realignment occurs between political parties. *Diction 7.2* tracks important words within different categories of political speech in order to determine whether significant changes in priority and emphasis have occurred between political parties and over time. Changes in political rhetoric for Republicans on topics such as immigration, welfare and labor, and terrorism support the idea of an internal realignment. It remains unclear whether this internal realignment is connected to a critical realignment. The trend of Democrats almost exclusively winning the popular vote in presidential elections since Bill Clinton's election in 1992 might be evidence of a connected critical realignment. Further, there is some evidence to suggest that a critical realignment has occurred as well. Most convincingly, emphasis on foreign policy has drastically shifted from Democrats to Republicans. Emphasis on military-related issues has also shifted from Republicans to Democrats. Full conclusions and results will be presented at the Undergraduate Research Forum. Ultimately, this research provides insight into the indicators of partisan realignment based upon political rhetoric and language.

Tasha Ogoti

Nairobi, Kenya

Sophomore
Computer Science

Faculty Mentor: Dr. J. Chris Pires, Biological Sciences

Cabbages, Kale, and Cameras; Analyzing Leaf Shape Data Among Brassica Ferals

Tasha Ogoti, Lauren Kirtley, Michael Pisias, and J.Chris Pires

Brassica oleracea is a diverse species that includes important domesticate varieties including cabbage, cauliflower, and kale. In some cases, populations of *B. oleracea* have escaped domesticated crop fields and undergone feralization, a process by which domesticated plants revert to or adapt to fit a new environment including things like extreme temperatures, poor soil quality, diseases, and pests that are not pressures on crop fields. These adaptations are of interest to us due to the possibility of future application in breeding or genetic engineering approaches to produce more hardy crops. Utilizing the traits that increase the fitness of ferals in their domestic crop ancestors could help to deal with mounting pressures on crops like global warming. We believe *Brassica oleracea* originated from wild species like *Brassica cretica*, *B. hilarionis*, *B. montana*, or *B. incana*; however, these relationships are unclear. Feral relatives offer unique leaf morphotypes; our data will consist of leaf scans from the fourth leaf of every feral *Brassica* species in our collection of germplasm. Scanned leaves will be analyzed using Plant CV to determine their leaf shape phenotype. We will use this data to evaluate the similarities of leaf shape across our ferals compared to wild relatives of *Brassica oleracea* and domesticated varieties within *Brassica oleracea*. Our sample will include 12 different feral accessions from the *Brassica cretica*, *B. hilarionis*, and *B. montana* species; we will grow 8 plants for each accession. Then, we will compare with leaf data from commonly grown crop species like cabbage, cauliflower, and kale. With this data we will construct a dendrogram to compare with existing morphological data for applicable information from our system. In the future, we hope to evaluate potential phenotypes of interest with multiple-omics approaches to obtain even more data that could be analyzed and used to refine our conclusions.

Life Sciences

Jee Eun Park

Bloomington, IN

Faculty Mentor: Dr. Jamie Arndt, Psychological Sciences

Art of Death: Can Religious Artwork Manage Existential Concerns of COVID-19?

Jee Eun "Jenny" Park, Kate Bushnell, Erin Zimmerman, Megan E. Edwards, Madhwa Galgali, Peter J. Helm, and Jamie Arndt

The human awareness of mortality perpetuates the potential for death-related anxiety. Terror Management Theory proposes that people use cultural worldviews to cope with this existential crisis, finding that people increase their reliance on cultural beliefs (and decrease openness towards other beliefs) when mortality is salient. Historically, many forms of art have displayed cultural beliefs, thus viewing worldview affirming artwork after reminders of death may return an individual to equilibrium. This study asked: can religious themed artwork help people manage existential concerns elicited by COVID-19? If threatening aspects of COVID-19 increase thoughts of death, and if worldview consistent art offers psychological protection, then Christians will rate Christian paintings more positively than Hindu paintings after reading threatening COVID-19 headlines (vs. benign headlines). Atheists were selected as a control group who should not be comforted by any religious art. An online survey recruited and randomly assigned participants (N = 390) to read threatening or nonthreatening COVID-19 headlines. Afterwards, participants rated previously piloted Christian and Hindu paintings, and reported their openness to experience.

Results indicated that threatening COVID-19 headlines increased thoughts of death. However, there was no interaction between participant religion and COVID-19 condition on painting ratings. Christians rated Christian paintings highly and Atheists rated paintings poorly regardless of condition. Interestingly, further analysis revealed a participant religion by COVID-19 condition interaction predicting openness to experience. Christians' openness remained constant regardless of condition, while Atheists' openness decreased in the threatening COVID-19 condition. Results suggest that existential threats may lower openness to experience, and worldview consistent artwork may offer psychological protection enabling people to maintain openness to experience. Specifically, Atheists' decreased openness after threatening COVID-19 headlines may be attributed to a lack of exposure to worldview affirming art. Additional studies will seek to better understand this possibility.

Sophia Parmacek

Lincolnshire, IL

Faculty Mentor: Dr. Bradley Ferguson, Health Psychology

Preliminary report on the effects of propranolol on gastrointestinal symptoms, anxiety, and heart rate variability in autism spectrum disorder

Sophia Parmacek, Samantha Hunter, Kathy Hirst, David Beversdorf, and Bradley Ferguson

Many individuals with autism spectrum disorder (ASD) have co-occurring gastrointestinal (GI) symptoms, but the etiology is poorly understood. Some individuals with ASD have a lowered stress response, while others may have a heightened stress response, also known as the "fight-or-flight" response. The stress response has been shown to be associated with GI problems, especially constipation, in ASD. Some children with ASD can't verbally express their discomfort communicating their discomfort. As such, we are exploring pharmacological treatments that reduce the stress response to look at the effects on GI symptoms because currently there are no effective treatments. The present study explored the effects of propranolol, a beta-adrenergic antagonist with anxiolytic properties, on GI symptoms in children with ASD. We hypothesized that after 12-weeks of propranolol administration, heart-rate variability (HRV), a measure of fluctuation in the time intervals between heartbeats which is linked to the balance between parasympathetic and sympathetic branches of the autonomic nervous system, will be negatively correlated with GI symptoms. Participants were those with an ASD diagnosis between the ages of 7-24. Participants took propranolol for 12 weeks in an open label extension trial. The GI Severity Index (GSI) was completed at baseline and again after 12 weeks of taking propranolol. Clinician-rated anxiety severity was also examined after 12 weeks of propranolol. Time-domain HRV measurements were calculated using a 5-minute resting state electrocardiogram (ECG) at baseline and after 12 weeks of taking propranolol. Propranolol significantly reduced anxiety and increased HRV after 12 weeks. However, there were no statistically significant differences between baseline GI symptoms and GI symptoms after 12 weeks of propranolol. There was no statistically significant relationship between HRV and constipation. Further research is needed to suggest pharmacological treatments that may help with ASD and GI symptoms.

Betsy Pascoe

Mexico, MO

Faculty Mentor: Dr. Peter Sutovsky, Animal Sciences

The Role of BAG5 In Post-Fertilization Sperm Mitophagy

Beatrice Pascoe, Dalen Zuidema, and Peter Sutovsky

Mitochondria and mitochondrial genes are exclusively inherited from mother in mammals. It is not fully understood why this occurs, or what happens to the father's mitochondria during fertilization. It is known that the mitochondria from spermatozoa are degraded after oocyte fertilization, but many of the contributors to that degradation process remain unclear. BAG5 is a pro-autophagic protein which regulates the PINK1-Parkin mitophagy pathway. This pathway is known to control mitophagy in many cell types; however, it has yet to be implicated in mitochondrial inheritance. In order to assess this protein's role in post-fertilization sperm mitophagy, we used our established porcine mitophagy model from which spermatozoa and oocytes are easily obtained. To analyze the BAG5 protein, we used immunocytochemistry, quantitative proteomics, SDS-PAGE Western blotting, and a mammalian cell-free system (primed boar spermatozoa coincubated with sow oocyte extracts) which our laboratory has established. In ejaculated spermatozoa, BAG5 localizes on the acrosome of the sperm head. Sperm priming for cell-free system coincubation, which mimics sperm demembranation during early stages of fertilization, appears to unmask the BAG5 protein, now also found throughout the sperm tail, including the mitochondrial sheath. However, after exposure to the cell-free system BAG5 is no longer detected in spermatozoa. This is interpreted as oocyte-extract mitophagy elements degrading BAG5 in the sperm mitochondria and other tail accessory structures. We hypothesize that this disappearance of BAG5 allows the PINK1-Parkin mitophagic pathway to degrade the sperm mitochondria shortly after fertilization. This study can be used as a starting point for future studies on post-fertilization sperm mitophagy. Through studying BAG5, we begin to better understand the proteomic changes that happen during post-fertilization sperm mitophagy. Understanding post-fertilization sperm mitophagy and mitochondrial inheritance can shape the way reproduction is approached in animal agriculture and human assisted reproductive therapy.

Emma Patterson

San Clemente, CA

Faculty Mentor: Dr. Valerie Bader, Nursing; Odemuyiwa Olumayowa, Nursing

Electronic health literacy amongst future nurses

Emma Patterson, Emily Herzog, Odemuyiwa Olumayowa, and Valerie Bader

As students in the N3900 class (Introduction to Research for Evidence Based Practice Nursing) during the Spring Semester of 2021, we are interested in assessing the electronic health literacy of our peers. In order to study this topic, a 27 question Qualtrics survey was sent out to our class which analyzed the demographics of our population and the current level of electronic health literacy. From the data we have collected, our plan is to analyze the data for trends in our population and to assess the overall level of electronic health literacy amongst the students enrolled in N3900 Spring 2021. In order to complete our goal, we will use the Statistical Package for the Social Sciences (SPSS) to help us perform data analysis and observe frequencies in our data. We will also search multiple databases in order to find the published literature that exists on this topic. The results of this project will inform our peers, community, and selves about the level of electronic health literacy that exists in this chosen population of Sinclair School of Nursing students enrolled in N3900.

Grace Patton

O'Fallon, MO

Junior
Secondary Education (Language Arts)

Faculty Mentor: Dr. Fiorella Carlos Chavez, Human Development & Family Science

Understanding the Motivations and Cultural Work Values of Male Mexican H-2A Migrant Farmworker Youth

Grace J. Patton, Taylor N. McDonald, and Fiorella L. Carlos Chavez

Background. Latinx migrant farmworker adolescents (LMFAs) are foreign-born, unacompanioned, and one of the most vulnerable and underrepresented subgroups of migrant farmworkers (Arcury et al., 2014). Despite their young age, LMFAs work under poor weather conditions (i.e., rain and heat) in exchange for income. Although previous research has shown that remittances to family is a key factor for migration (Carlos Chavez et al., 2021, in press), little is known about their intrinsic and cultural motivations. We argue [im]migrant Latinx adolescents come to the United States with *ganas*, a culturally inherited motivation to hard work and sacrifice for one's family (Easley et al., 2012).

Purpose. The present qualitative exploration focused on Mexican H-2A migrant farmworker adolescents' work motivation, work advice for other migrant adolescents, and cultural values toward work. Our research questions included:
1)   What leisure activities do migrant adolescents focus on when they are not at work?
2)   What is the direct advice migrant farmworker adolescents give to other youth to stay motivated?
3)   How do cultural values manifest or influence work motivation for Male Mexican H-2A migrant farmworker adolescents?

Method. Data came from Mexican H-2A migrant workers in Georgia (*n* = 10; 100% male, aged 18 to 20, 70% financially supporting their parents). Participants received a $10 incentive for their participation. An NIH Certificate of Confidentiality was obtain to further secure participants' information.

Results. Thematic analysis highlighted four core themes were found: (1) "getting distracted" (2) "this work is temporary" (3) "respect and responsibility of oneself" (4) "put g*anas* forward".

Conclusions. Mexican H-2A migrant farmworker adolescents confront environmental and emotional stressors. However, to distract themselves they turn to leisure activities (i.e., playing soccer, talking/playing on their phone) and motivate themselves and others through *ganas*.

Alisha Perry

South Bend, IN

Fatty acid oxidation in nonalcoholic steatohepatitis (NASH)

AM Perry, JM Mucinski, A Diaz-Arias, JA Ibdah, RS Rector, and EJ Parks

A major component in the pathogenesis of NASH is reduced hepatic mitochondrial activity, specifically decreased β-oxidation β-ox). The diagnosis of NASH requires a liver biopsy for histologic grading of liver tissue. In the present study, 18 subjects (6 men, 12 women, 47±8 years, 119±23kg (mean±SD)) underwent a diagnostic liver biopsy to confirm NASH; liver tissues were scored by a pathologist to determine liver disease status, denoted by the NAFLD activity score (NAS). This project's goal was to quantify hepatic β-ox using a noninvasive breath test to predict NASH severity. We utilized the stably-labeled fatty acid 1,2,3,4-^{13}C-octanoate. In theory, when fed orally, subsequent breath $^{13}CO_2$ levels reflect hepatic β-ox, because octanoate is directly transferred to the liver via the portal vein and enters the mitochondria without a carrier protein. A single dose of ^{13}C-octanoate (23.4mg) was fed in orange juice and eight breath samples were collected once before and intermittently for 135-minutes. Total CO_2 production rates were measured by respiratory gas analysis and breath $^{13}CO_2$ enrichment measured by isotope ratio-mass spectrometry. During the test, subjects oxidized an average of 24±4% (range: 17-31%) of the octanoate dose. Baseline octanoate oxidation did not correlate with body weight, liver enzymes, NAS, or fibrosis. After nine months, 11 of the subjects underwent a second biopsy to reassess their liver disease and repeated the breath test. The change in steatosis (a NAS sub-score) was associated with changes in octanoate oxidation – both in units of absolute $^{13}CO_2$ produced (r=-0.523, *P*=0.012) and total oxidized relative to body weight (r=-0.707, *P*=0.001). These results suggest that a ^{13}C-octanoate breath test alone is not a sufficient indicator of liver disease. However, the results support ^{13}C-octanoate breath tests as a strong predictor of changes in steatosis in NASH and repeated breath tests as an indicator of change in liver disease status..

Matthew Pinner

St. Louis, MO

Faculty Mentor: Dr. Maria Fidalgo, Civil and Environmental Engineering

Hybrid filtration-reaction process for the removal of sulfamethazine from water

Matthew Pinner and Maria Fidalgo

Manufactured and organic compounds such as flame retardants, antibiotics, and other persisting pollutants have been detected in wastewater discharges. The current biological and physical processes in treatment plants failure to remove these non-biodegradables lead to accumulation and potentially adverse effects for humans and the environment. Advanced oxidative processes (AOPs) are being explored to remove these persisting contaminants. The hydroxyl radicals produced by AOPs are extremely reactive and useful for the degradation of organic pollutants. The objective of this work was to use an iron oxide coated ceramic membrane in a continuous flow system to catalyze a photo-Fenton reaction for degradation of sulfamethazine (SMZ), a common antibiotic in veterinary medicine. The membrane was fabricated in the lab, and X-ray diffraction (XRD) analysis confirmed the formation of hematite. A feed solution with a concentration of 5 ppm SMZ and dosed with 50 mM hydrogen peroxide (H2O2) was circulated through a custom-made membrane-module, at pH values of 2, 5, and 8. The SMZ concentration in the feed and permeate solutions was quantified at various times in each trial using UV-Vis as a preliminary measure and later high-pressure liquid chromatography (HPLC) to check. Control experiments in dark without addition of H_2O_2 did not show significant removal of SMZ with the membrane. Separation by size, adsorption, and photolysis, are not major mechanisms compared to the Fenton reaction in agreement with previous results obtained in batch reactors. The filtration experiments with the addition of hydrogen peroxide and light and suggest a promising reaction but the work is an ongoing process with data still being collected and analyzed. More research will be needed to optimize the process parameters and assess its effectiveness on other persisting contaminants. The observed Fenton reaction could be a cost-effective solution for the treatment of drinking water sources contaminated with recalcitrant contaminants.

Jeffrey Pollmann

St. Louis, MO

Junior
Secondary Education; English

Faculty Mentor: Dr. Stephen Whitney, Educational, School & Counseling Psychology

Long-term effects of the achievement gap

Jeffrey Pollmann, Elisabeth Mealy, Emily Dehner, and Stephen Whitney

The achievement gap has been a perennial problem in education over the past 70 years when it was first discovered through the work of the Coleman report. However, little is known about the long-term effects of the achievement gap. Using a Nationally representative, longitudinal dataset (Add-Health), we examine the long-term effects of the achievement gap, defined as class and race, in the educational attainment and income in adults. Add Health follows 20,000 individuals beginning in grade 7-8 in the 1994-95 school year. The data includes five waves, with the most recent wave of data collected in 2016-18, the first four waves were utilized in this analysis. Cases who completed all four waves were included in the analysis (N=12,092). Race and SES were used to define the comparison groups, biological sex was included as a control. Cumulative GPA in waves 1-2 was used to predict highest level of education attained and yearly income in wave four. A ANOVA with Bonferroni correction was used to compare the groups. Results indicate a significant overall interaction between groups and highest education attained and income. Selected post-hoc comparisons indicate a significant difference between several subgroups. For example, Asian poor student had significantly higher levels of education when compared to White poor student and Black poor students. White poor students had significantly higher education levels of education when compared to Black poor students. Asian poor student also had significantly higher levels of income when compared to White poor student and Black poor students. White poor students also had significantly higher income levels when compared to Black poor students. This study highlights the long-term influence of educational differences across the lifespan and calls for the continued need for programs to ensure educational equality across race and class groups.

Behavioral/Social Sciences

Eric Queathem

Montgomery City, MO

Senior
Nutrition and Exercise Physiology (Human Physiology); Biochemistry

Faculty Mentor: Dr. Victoria Vieira-Potter, Nutrition and Exercise Physiology

Beta-3 adrenergic receptor activation induces adipose tissue browning in a sex and depot-dependent manner

Eric D. Queathem, Rebecca Welly, Laura Clart, Candace Rowles, Scott Rector, Peggy A. Eichen, Kevin Fritsche, Jaume Padilla, Dennis Lubahn, and Victoria Vieira-Potter

Female cardiometabolic health (e.g., glucose tolerance, body composition) is protected compared to males when fed high-fat-diet (HFD). Activation of the beta-3 adrenergic receptor (β3AR) via the chemical ligand CL316,243 (CL) induces browning in white adipose tissue (WAT), a process sufficient to improve glucose tolerance and reduce visceral adiposity. Our aim was to determine (a) if sex differences exist in CL-induced WAT browning; and (b) if two WAT depots, perigonadal (PGAT) and subcutaneous (SQAT), differ in CL responsiveness, in a sex-specific manner. To this end, 8-week-old male and female mice, bred on a C57BL/6J background were fed HFD for a total of 16 weeks, and given daily CL injections (1ug/g body weight) for the final 2 weeks. We compared those groups using 2x2 ANOVA to determine main and interaction effects (S=sex; T=treatment; SxT=interaction) for browning and adipocyte health markers in PGAT and SQAT (gene expression via qrtPCR; protein expression via Western blot). We report here that the effects of CL are both depot-dependent and sex-specific. As expected, females had greater uncoupling protein 1 (UCP1); however, this was only observed in PGAT (S, $p<0.001$), not SQAT. UCP1 was more responsive in female PGAT (SxT, $p=0.011$); however, sexes were equally responsive in SQAT. Interestingly, in male SQAT, PGC1a (i.e., mitochondrial biogenesis marker) responded significantly better to CL (SxT, $p=0.046$); whereas in PGAT, females were more responsive (SxT, $p=0.026$). We also show for the first time that CL increases glucose-related protein 75 (GRP75), a recently discovered browning marker, in both depots, in both sexes (T, $p<0.05$, both). Lastly, while female PGAT had greater adiponectin, males had higher adiponectin in SQAT (S, $p<0.05$, both). In conclusion, it appears SQAT is more responsive to CL in males, whereas PGAT is more responsive in females, which we hypothesize is partially explained by differences in local estrogen exposure.

Kaitlyn Raith

Birch Tree, MO

Faculty Mentor: Dr. Jeffrey Johnson, Psychological Sciences

The effects of emotional valence and arousal on episodic retrieval of word stimuli

Kaitlyn M. Raith, Brittney M. Bishop, and Jeffrey D. Johnson

A variety of psychological disorders – including major depression, generalized anxiety, and post-traumatic stress disorder – are accompanied by abnormal processing and memory of emotional stimuli. Individuals with these diagnoses can demonstrate a reliance on retrieving overgeneralized memories, show poor encoding for positive experiences, and exhibit enhanced processing of negative experiences. The current study was directed at investigating the latter of these effects to understand how emotional processing at the time of encoding might have lasting consequences on memory retrieval. Young adult subjects (N = 46) were asked to complete an experiment requiring the encoding and retrieval of negatively emotional and neutral words. At encoding, words from the following categories were shown: negative valence, low arousal; negative valence, high arousal; neutral valence, low arousal; and neutral valence, high arousal. Subjects then completed a memory test consisting of the words from encoding (old words) intermixed with an equal number of non-presented (new) words. The memory task required judging the confidence associated with retrieval on a four-point scale: sure old, maybe old, sure new, or maybe new. Preliminary analyses showed that, contrary to our original hypothesis that negative words would be better remembered than neutral words, there was no significant effect of valence or arousal. Our ongoing work on this topic focuses on attempting to reconcile these null findings for emotional words with the effects typically shown for emotional pictures, with the longer-term goal of using neural measures such as EEG and fMRI to understand how persistent reactivation during memory encoding might help explain the valence and arousal enhancements.

Kassandra Ramos

Farmington, MO

Stress and Adjustment in Adolescents: Analyzing Co-Rumination, Coping, and Physiological Regulation as Moderators

Kassandra Ramos, Caroline Davey, Brayden Langendoerfer, Sarah Borowski, Amanda Rose, and Ashley Groh

Stress in adolescence can cause adverse effects and the more negative life experiences in adolescence, the higher levels of internalizing symptoms, such as depression and anxiety (Kim et al., 2003). Past research indicates stress has negative impli¬cations for adolescent well-being (Nicolai et al., 2013). Consequently, a comprehensive understanding of the factors that exacerbate or relieve stress is crucial. Coping style and physiological regulation are factors that may alleviate stress, whereas co-rumination worsens it (Rose et al., 2016). The current study considers the role of stress as a possible predictor of internalizing symptoms. Further, we investigate how physiological regulation, coping style, and co-rumination affect the relation between stress and internalizing symptoms.

Participants were 180 adolescents (118 girls; 62 boys; M age = 14.09 years). Adolescents completed the Perceived Stress Scale (PSS; Cohen et al., 1983) to report their overall stress levels (e.g., "I worry a lot of the time; 1 = Not at All True, 5 = Really True"). They completed questions from a depression scale (e.g., "In the past week I was sad, lonely, or fearful) (CES-D; Eaton et al., 2004). Participants completed the Co-rumination Questionnaire (Rose, 2002) and Brief COPE scale (Carver, 1997) to assess positive and negative coping.

Respiratory sinus arrhythmia was used as a measure of physiological regulation. To assess physiological regulation, three disposable electrodes are applied to the participants' torsos to monitor heart rate. To monitor respiration, a belt is applied around their diaphragms. Physiological responses are recorded while the participants sit quietly for three minutes at different times during the visit. Analyses will consider stress as a predictor of adjustment. They will also consider coping style, co-rumination, and physiological regulation as effects on the relationship between stress and internalizing symptoms. We will also examine sex differences among stress, indicators of regulation, and internalizing symptoms.

Tyler Reeder

Seattle, WA

Faculty Mentor: Hope Martin, Marketing

NEUTROIS

Tyler Reeder and Hope Horn

   This collection titled "Neutrois" was inspired by Generation Z and their growing interest in clothing that does not adhere to binary lines. The collection's style holds origin from Thierry Mugler's overall aesthetic in the 1990s. Mugler continually celebrates and understands hyper-femininity and androgyny to the core, and I intend to carry this sentiment of a celebration of both gender and unconventionality into this collection. In addition, elements of inspiration came from the 1990's club kid scene, which was a subculture that celebrated a multitude of sexual identities, gender identities, and the expression of both types identity.

      This collection intends to bring back elements of unconventional gender expression, celebrate differences, and provoke collective societal thought on the subject of gender expression.

      Lastly, this collection was a case study submission to the Fashion Scholarship Fund in 2020, and an Honors project for the University of Missouri. In terms of method of design, it focused on experimenting with the advanced computer-aided design program CLO3D, learning to drape, make patterns, render, and animate designs in a 3D digital space.

Katie Reich

Mt. Vernon, IL

Senior
Political Science; Communication

Faculty Mentor: Dr. William Horner, Political Science

The insecurity of surety: How states have moved from cash bail to risk assessment

Katie Reich and William Horner

In recent years, large portions of the country have moved to either eliminate or drastically reduce the use of cash bail. The centuries-old practice has been scaled back in Washington D.C., New York, New Jersey, California, and Illinois. Instead, these areas have moved toward a pretrial risk assessment program. This research looks at each state in turn and examines how the legislation passed in each case. Understanding the chronology of how bail reform efforts have changed over the last decade allows for examination of failures and successes throughout the movement. Some states, such as Illinois, passed reform solely through legislation. In other cases, such as California and New Jersey, the reform was put to a vote. In every state, pretrial risk assessments drew significant backlash, which was sometimes enough to repeal the reform. The results and conclusion of the research will be presented at the undergraduate research conference in April 2021. Risk assessment programs, though they vary slightly from state to state, examine the details of a person's life to determine if they are a flight risk or not. Pretrial risk assessment programs are highly controversial and have been denounced by both the American Bail Coalition and Human Rights Watch. Further quantitative analysis is needed to understand the full scope of the issue, though this research provides the foundation and timeline necessary to understand the reform.

Daniella Reyes

Chicago, IL

Respiratory Sinus Arrhythmia Reactivity in Adolescents: Gender Differences and Implications for Friendship Quality

Daniella Reyes, Christine Schulze, Emma Burton, Ashley Groh, and Amanda Rose

Friendships are important relationships during adolescence but little research considers interrelations between physiological functioning and friendship functioning (Murray-Close et al., 2013). Respiratory sinus arrhythmia (RSA) reactivity indexes changes in parasympatheticnervous system activity and has important implications for functioning in close relationships (Porges 2001; 2009). Decreases in RSA in response to stressors is thought to reflect adaptive regulation (Beauchaine, 2001). Although research has not examined RSA reactivity in relation to adolescent friendships, one study found that adults who were primed to think about friendships demonstrated greater RSA reactivity to stress when they had high quality friendships (Carlisle et. al, 2012). The current study considers the effects of positive and negative friendship quality on adolescents' RSA reactivity during friendship interactions. Data collection is ongoing. Participants are same-gender friend dyads in 8th, 9th, and 10th grades. The adolescents completed the 18-item Friendship Quality Questionnaire (Rose 2002 revision of Parker and Asher 1993) which assesses positive friendship qualities (e.g., trust) and negative friendship qualities (e.g., conflict). The adolescents also engaged in a 3-minute resting baseline task and a problem talk interaction task with their friends while linked to physiological sensors monitoring heart rate, respiration. RSA reactivity will be computed by taking the difference between the average RSA during the resting task and the interaction task. We expect to find that greater levels of friendship quality will be related to greater RSA reactivity (i.e., decreases in RSA relative to resting conditions). Gender differences will also be tested. Given that previous research has found stronger links between friendships and adjustment for girls (Demir and Urberg, 2004), we hypothesize that there will be stronger links between friendship quality and RSA reactivity for girls than boys.

Previous studies have examined RSA and its relationship to adolescent friendships and found that priming new relationships with positivity was associated with significant RSA decreases during stress This implies that existing relationships with positive friendship quality could have similar effects on RSA reactivity and provide an indicator of how adolescent friendships impact physical and emotional health.

Dayan Reynolds

Carl Junction, MO

Senior
Political Science; Russian

Faculty Mentor: Dr. Mary Stegmaier, Truman School of Public Affairs

The Populist Bloc(k): A Study of Croatians, Slovenians, and Institutional Roadblocks to Populism

Dayan Reynolds and Mary Stegmaier

The party systems of Croatia and Slovenia have never been on more divergent paths. Having at one point in the early 2000s appeared seemingly on the same trajectory toward stable, multi-party, liberal democracy, the two today are moving in opposite directions - as Croatia solidifies its two-party model, Slovenia's party system has collapsed entirely.

With this paper, I strive to provide context and an understanding of how this occurred through the lens of populism and how it relates to institutional structures in each state. More specifically, whereas much of our modern literature on populism attributes its prevalence to evolving trends such as corruption or economic crises, I explore the constraints placed upon populism by institutional and electoral laws and reforms, factors which can then determine whether populist parties manifest or even take power. I do so by breaking my paper into two main parts, establishing first through prior scholarly work and survey data the degree to which populism prevails in both Croatia and Slovenia, then using election data, surveys, articles, and records for a comprehensive analysis on the role of institutional and electoral law reform.

Thus, by the end of this paper I am able to make a definitive argument as to the merits of a clear connection between the two. At present, there is limited readily available data on populism's relationship with institutional structures. What's presented here, however, is a compelling case for the topic to be revisited with more resources in the future, both in these two states in particular and in a broader sense as we work to better understand populism and its challenge to the established party system.

Tessi Rickabaugh

Fulton, MO

Junior
Interdisciplinary (Women's & GenderStudies); Religious Studies

A Preliminary Report on The Impact of Evangelical Christian Purity Culture on Sexual Minorities

Tessi Muskrat Rickabaugh, Alexandra Porcaro, Madison Worley, Alexandra Franco, and Francisco J. Sanchez

Purity culture is a term used to describe the evangelical Christian abstinence-based approach to teaching children and adolescents about sex. Key components of purity culture includes modest dress for females, emphasis on virginity as a fragile gift, strict performance of the gender binary, heteronormativity, and the idea that sexual exploration causes one to be "damaged goods." Research on the long-term effects of being a member of purity culture during adolescence is extremely limited—especially for those who identify as sexual and gender minorities as adults. This qualitative study explores how purity culture impacted the sexuality, gender expression, religiosity, and outness of adults who identify as sexual or gender minorities.

For this study, we analyzed fourteen in-depth interviews with persons who had been part of purity culture and are sexual or gender minorities. Using CQR (Consensual Qualitative Research) methodology, preliminary analyses has yielded several themes related to the long-term effects of having been a part of purity culture, including persistent fear of sexual activity and of religious or social censure, social isolation, shame regarding sexual desire, and a lack of knowledge related to reproductive anatomy, reproductive health, and healthy sexual behaviors. Participants also experienced a variety of barriers to accessing sex education; to recognizing and understanding their developing sexual orientation or gender identity; and to accepting and disclosing their non-heterosexual orientation or gender dysphoria. Consequently, many participants reported high levels of sexual shame and revulsion toward who they were. Finally, many experienced deconversion from their faith of origin and the loss of significant relationships (e.g., parents, siblings, spouses, and other congregants).

Caroline Rorah

St.Louis, MO

Faculty Mentor: Monica Romero, Educational, School and Counseling Psychology

Effectiveness of Peer-Meditated Interventions for Emergent Bilingual Students' Achievement

Caroline Rorah, Megan Dolsky, Clayton Henning, Hannah Holt, and Monica Romero

Research has shown that peer-mediated interventions produce positive academic outcomes for a wide range of students. This meta-analysis analyzed the effectiveness of peer-mediated interventions for emergent bilingual students in grades K-12. Fourteen studies using cross-age, same-age, class wide peer tutoring, or cooperative learning met the criteria. The meta-analysis' purpose is to explore the effects of peer intervention on emergent bilinguals' academic achievement. The following research questions guided this study: a) what are the effects of peer-mediated interventions intended to improve Emergent Bilingual students' academic achievement? b) what are the characteristics of peer-mediated intervention with Emergent Bilinguals in grades preK-12? c) to what extent does dosage moderate the effectiveness of the intervention? d) to what extent does the quality of the research design moderate the effectiveness of peer-mediated interventions? Findings from these studies indicate peer-mediated interventions were successful for emergent bilingual learners.

Behavioral/Social Sciences

Miya Russell

O'Fallon, MO

Junior
Linguistics; Anthropology

Faculty Mentor: Dr. Michael Marlo, Linguistics; Dr. Rebecca Grollemund, Linguistics

Documenting Luyia Together: Noun Tone in Kabarasi

Miya Russell, Rebecca Grollemund, and Michael R. Marlo

Kabarasi is an understudied member of the Luyia language cluster of western Kenya, spoken by approximately 250,000 people (2009 Kenya census). This presentation will describe research on the Kabarasi language by Miya Russell from Summer 2020 through Spring 2021. Prior to the onset of our study of Kabarasi, very little research had been done on the language.

The present project focuses on a 700-item wordlist collected in December 2019, which has served as the main database for our ongoing research on the language. Our initial research focused on segmental transcriptions of the words in the database--that is, identifying the correct consonant and vowel sounds. On the basis of these transcriptions, Russell developed a preliminary description of the Kabarasi sound system. Ongoing research has focused on tonal transcriptions of the words in the database. For instance, the nouns *omu-nwa* 'mouth' and *omú-rwé* 'head' illustrate the two possible tonal patterns we have identified on noun stems with one syllable: all low-toned, as in 'mouth', vs. high-toned on the last two vowels, as in 'head'. We have verified the tonal transcriptions of approximately 400 words in the database and have begun to identify the tonal patterns found in the Kabarasi dictionary. In this presentation, we will update prior results reported at the 2020 Fall Forum.

Aleasia Ryan

Farmington, MO

Faculty Mentor: Dr. Erin Dannecker, Physical Therapy

Funding Source: Discovery Fellowship - Honors College

The Relationships Between Emotion, Pain, and Perspective Taking

Aleasia Ryan and Erin Dannecker

This abstract has been withheld due to proprietary permissions.

Shelby Ryan

Holcomb, MO

Comparing Emotional Responses when Viewing Death and Dying Related Video Art

Shelby Ryan, Abby Blenk, Faith Fleming, Peter Helm, and Katina Bitsicas

The ASH Art of Death Digital Storytelling Research Team analyzed viewer perception of death and dying when viewing death related video art, and whether targeted media can alter emotional responses to death-related stimuli. Previous research from the ASH team has indicated that viewing metaphorical footage of death evokes positive responses ("Beauty", "Peace", and "Positive Emotions") in participants and primes them to think about mortality and discuss death comfortably.

To build on these findings, the team created two video art pieces, collectively named *Points of View*. The study of *Points of View* examines how the metaphorical footage affects death anxiety and perception of death.

Points of View is a two-stage video art experience of death as a physiological and emotional process. The first stage features an animation depicting the scientific process of death as a self-contained piece, while the second combines this animation with a video background reflecting emotional responses to death.

Participants (N=TBD) viewed the videos in sequence through an online survey conductor (mTurk). The factual animated depiction of death was shown first, immediately followed by a baseline survey. This measured participants' mental response and perception of death as a physiological process. Participants then viewed the combined animation and video artwork. Afterward, participants answered the same questions again, as well as three additional questions about the viewing sequence. Finally, participants were asked to select whether each element of the artworks elicited specific emotional responses.

Data collection is still in process and results will be finalized by the beginning of April 2021. The expected result of the project is that participants will experience less death anxiety after viewing the combined footage and animation than after viewing only the animation.

Stephanie Sage

St.Peters, MO

Faculty Mentor: Dr. Paula McSteen, Biological Sciences; Dr. Norman Best, Plant Sciences

Auxin and brassinosteroid interdependent regulation of stomatal development in maize

Stephanie Sage, Norman B. Best, and Paula McSteen

Zea mays (maize) contains pores in the epidermis known as stomates that are important for regulating gas exchange for photosynthesis. Maize, a C4 photosynthetic plant, thrives in warm temperatures by continuing photosynthesis via a spatial separated carbon mechanism within the bundle sheath cells with reduced stomatal aperture. Auxin (IAA) and brassinosteroids (BR) are hormones for growth and development, shown to inhibit the development of stomates in Arabidopsis. The *brassinosteriod deficant1 (brd1)* mutant is a serve dwarf with low concentrations of BR. The *brd1* mutant is a BR C-6 oxidase, which functions in the final step of BR synthesis. BR regulates stomatal development through the Mitogen Activated Protein Kinase (MAPK) pathway. The *vanishing tassel2 (vt2)* mutant contains low levels of IAA, exhibiting reduced height, reduced number of leaves, and altered inflorescence development. The *vt2* mutant is a co-ortholog of tryptophan aminotransferase (TAA1) in Arabidopsis. The *vt2* mutant exhibits a decreased stomatal index and density on the abaxial side of the leaf compared to the wild-type plants. The stomatal index also was decreased on the adaxial side of the leaf, although the density was higher compared to the wild-type siblings. The *brd1* mutant displayed a decreased stomatal index and an increased stomatal density on both sides of the leaf compared to the wild type. The double mutant displayed a slightly higher index and significantly higher density on the abaxial epidermis of the leaf. Stomatal index and density were higher on the adaxial side of the leaf in *brd1* mutants than in the wild type. A study to determine the cellular effects of BR reduction on IAA polar transport, and the effects of lowered IAA on BR signaling in developing stomata is in progress to further understand the initiation and development of stomata in maize.

Victoria Salathe

Springfield, MO

Faculty Mentor: Dr. Dawn Cornelison, Biological Sciences

What the Eph(/ephrin) is going on in regenerating muscle vasculature.

Victoria Salathe, Courtney Colench, and Alexandra Diller Costello

Blood vessels are like a tiny highway, acting to deliver oxygen and nutrients throughout the body. The branching of blood vessels is vital to embryonic muscle development; but how vital are they for adult muscle repair? Muscles are made up of myofibers that communicate with each other and their environment through signaling molecules. One set of signaling molecules is a family of receptor tyrosine kinases called Ephs and their ligands, ephrins. We study a specific Ephrin, EphrinB2, due to its established role in vasculogenesis during embryo development. In the absence of ephrinB2 embryos fail to develop functioning capillaries, resulting in embryo death. By removing ephrin-B2 expression only in vascular cells in adult animals, we are investigating the role of ephrinB2 in vascular regeneration, following a local injury. By scoring molecular landmarks such as embryonic myosin heavy chain (eMyHC, a marker of newly made muscle fibers) from at various time points after injury, we have compared muscle regeneration in ephrin-B2 knockout mice to what occurs in wild type mice. We found that in these mice, not only is vascular regeneration impaired but muscle regeneration was slowed significantly. We are now asking the opposite question: whether vasculature will regenerate in the absence of muscle. To accomplish this, we are using genetic methods to kill muscle stem cells (satellite cells) in adult mice. Without satellite cells muscle will not regenerate following injury. We hypothesize that the vasculature will be able to regenerate in the absence of musculature. We believe the vasculature will have a "memory" of where it was localized prior to injury, possibly due to interactions with the extracellular matrix, and thus will regrow in the same pattern/location even without muscle fibers. These experiments address basic questions in cell biology and may someday be useful in designing treatments for human injury.

Shelby Salisbury

Centralia, MO

Faculty Mentor: Dr. Aaron Stoker, Orthopaedic Surgery

Effect of Osteoarthritic Infrapatellar Fat Pad Metabolism on Chondrocytes

Shelby Salisbury, Alex Lee, and Aaron Stoker

INTRODUCTION:

Osteoarthritis (OA) is characterized by the degradation of articular cartilage, is a common cause of disability in the U.S. Studies have suggested that the infrapatellar fat pad (IPFP) of the knee contributes to the development and progression of OA. However, the effect of IPFP on chondrocyte metabolism is not well understood. This study was designed to determine the metabolic responses of chondrocytes to stimulation with OA IPFP conditioned media.

METHODS:

IPFP Tissue culture: With IRB approval (#1208392) and informed patient consent, IPFP tissues were collected from patients (n=10) undergoing total knee arthroplasty for OA, and explants from each IPFP were cultured for 3 days to create OA IPFP stimulated media. The media were collected and stored at -20°C for biomarker analysis and stimulation of OA chondrocytes.

Stimulation of chondrocytes: Passage 1 OA chondrocytes were isolated from 10 patients were stimulated with 2 mL DMEM containing 10% OA IPFP conditioned for 3 days. On day 3 the media was collected and used for inflammatory and degradative biomarker analysis. A Mann-Whitney test was used to determine significant ($p<0.05$)differences in media biomarker concentrations between OA IPFP stimulated and control chondrocytes groups.

RESULTS:

Production of MIP-1α, IL-6, IL-8, MMP-1, MMP-2, MMP-3, TIMP-1, TIMP-2, and MMP activity all increased after IPFP media stimulation

CONCLUSION:

These data indicate that IPFP may increase the inflammatory and degradative responses of chondrocytes during OA.

Katrina Schache

Dunlap, IL

Faculty Mentor: Dr. Sherri Ulbrich, Nursing

Evidence-Based Fall Prevention Strategies for MU Healthcare

Katrina Schache, Melanee Castillo, Chloe Cobb, Sophie Gordan, Kate Stieglitz, Jessica Tompkins, Savannah Valeria, and Sherri Ulbrich

Patient falls are a significant problem in every hospital unit because they contribute to poor patient outcomes and increase length of stay and cost. The Fall Council at MU Healthcare collects monthly data, and data from the last year revealed an increase in in-patient and out-patient falls. The National Database of Nursing Quality Indicators sets goals for the number of patient falls per 1,000 patient days and ranks hospitals by percentile. Currently, 38% of MU Healthcare's in-patient units are performing above the 50th percentile, and 81% of the out-patient units are performing above the 50th percentile. The goal of this project is to review the literature for evidence-based fall prevention strategies and present the findings with an associated recommendation to MU Healthcare's Fall Council.

The research question examines the impact of conducting post-fall debriefs on preventing further falls in the hospital setting. The research team conducted literature reviews for each of the following areas: general medical-surgical, critical care, emergency, perioperative, psychiatric, pediatric, and perinatal. Decreasing the number of falls that occur in each of these departments in MU Healthcare is a priority for enhancing patient safety and classifying the institution with magnet status. Initial findings support the hypothesis that post-fall debriefs are an effective strategy in reducing the number of repeat falls and establishing improved safety culture and communication among staff. Post-fall debriefs were found to be most effective when strong and positive leadership runs the debrief meeting and when the team has strong group safety norms. The recommendation based on evidence-based research is that MU Healthcare creates a post-fall debrief tool and initiates post-fall debriefs after each fall with all staff present on the unit at the time of the fall.

Danielle Schneider

Columbia, MO

Junior
Early Childhood Education

Faculty Mentor: Dr. Stephen Whitney, Educational, School and Counseling Psychology

Critical Time Periods in Reading Development

Danielle Schneider, Anna Al-Sayed, Elise Buchert, Taylor Kroupa, and Stephen Whitney

Reading is a fundamental aspect that supports all future education and understanding how to allocate scarce resources to support reading comprehension is of paramount importance. Previous research has shown the large impact that socio-economic status and race have on process of reading achievement. Our research examines if there are critical timepoints during reading education based on socio-economic status and race. Data for the study was taken from the nationally representative longitudinal study ECLS K-8 which follows 17,911 Kindergarten students through 7 waves of data starting in 1998 and ends after their 8th-grade year. For the current analysis the sample was grouped based upon race and SES. To simplify the analysis we examined two races, Black and White students, and three levels of SES, Poor, Middle class, and Rich samples. In the model Reading IRT (Item Response Theory) reading scores is used as the outcome during kindergarten, first, and third grade. Biological Sex is included within the groups as a control variable and group means differences were tested using an independent sample t-test. Our main findings show that the growth rate for reading is higher for students in 1st-3rd grade than with students in K-1st grade. Our findings also show that in K-1st male, Black students have a growth rate that is significantly less than white male students, but there was no difference amongst the female populations. However, across all genders and classes in 1st-3rd grades, black students, including black female students, grew significantly less in their reading achievements than white students. This research and finding points to important allocations in schools and future research.

Faculty Mentor: Dr. David Borduin, Psychological Sciences

The Relation of Psychopathic Traits to Social Relationships for Individuals on Probation and Parole

Jenna A. Schopen, Olivia K. Jeckel, Kaitlin M. Sheerin, and Charles M. Borduin

BACKGROUND: Psychopathic traits (i.e., disregard for the rights of others) are common among individuals involved in the justice system (Campbell, 2004). Individuals with psychopathic traits generally have less stable family, romantic, and peer relationships than do individuals without such traits (Barry, 2008). However, the more precise qualities of these social relationships (e.g., emotional support, involvement with deviant individuals) that might be linked with psychopathy have yet to be determined. The present study examined whether (a) family member, peer, and romantic partner support; (b) involvement with deviant family members, romantic partners, and peers; and (c) psychopathic traits were linked among these individuals.

METHOD: Individuals (*N* = 101) on probation and parole in four states completed measures that assessed social support from family members, romantic partners, and peers (*Multidimensional Perceived Support Scale*; Zimet et al., 2008); involvement with deviant family members, romantic partners, and peers (*Pittsburgh Study Peer Delinquency Scale*; Loeber et al., 1998); and psychopathic traits (*Brief Dark Triad*; Jones & Paulhus, 2004).

RESULTS: Bivariate correlations initially demonstrated that involvement with deviant peers and family support were significantly correlated with psychopathy. Next, a linear regression that incorporated both involvement with deviant peers and family support as predictors was conducted to determine the variance explained in psychopathy. Involvement with deviant peers explained a statistically significant amount of variance (R^2 = .11) in psychopathy.

IMPLICATIONS: The results indicate that deviant peer relations are linked with psychopathy among individuals on probation and parole. In future research, it seems important to determine whether involvement with deviant peers occurs before or after the development of psychopathic traits. It seems reasonable to suggest that interventions for justice-involved individuals with high levels of psychopathic traits should focus on development of prosocial peer relationships.

Christine Schulze

Kansas City, MO

Faculty Mentor: Dr. Amanda Rose, Psychological Sciences; Dr. Ashley Groh, Psychological Sciences

Respiratory Sinus Arrhythmia Reactivity in Adolescents: Gender Differences and Implications for Friendship Quality

Christine Schulze, Emma Burton, Daniella Reyes, Sarah Borowski, Amanda Rose, and Ashley Groh

Friendships are important relationships during adolescence but little research considers interrelations between physiological functioning and friendship functioning (Murray-Close et al., 2013). Respiratory sinus arrhythmia (RSA) reactivity indexes changes in parasympatheticnervous system activity and has important implications for functioning in close relationships (Porges 2001; 2009). Decreases in RSA in response to stressors is thought to reflect adaptive regulation (Beauchaine, 2001). Although research has not examined RSA reactivity in relation to adolescent friendships, one study found that adults who were primed to think about friendships demonstrated greater RSA reactivity to stress when they had high quality friendships (Carlisle et. al, 2012). The current study considers the effects of positive and negative friendship quality on adolescents' RSA reactivity during friendship interactions. Data collection is ongoing. Participants are same-gender friend dyads in 8th, 9th, and 10th grades. The adolescents completed the 18-item Friendship Quality Questionnaire (Rose 2002 revision of Parker and Asher 1993) which assesses positive friendship qualities (e.g., trust) and negative friendship qualities (e.g., conflict). The adolescents also engaged in a 3-minute resting baseline task and a problem talk interaction task with their friends while linked to physiological sensors monitoring heart rate, respiration. RSA reactivity will be computed by taking the difference between the average RSA during the resting task and the interaction task. We expect to find that greater levels of friendship quality will be related to greater RSA reactivity (i.e., decreases in RSA relative to resting conditions). Gender differences will also be tested. Given that previous research has found stronger links between friendships and adjustment for girls (Demir and Urberg, 2004), we hypothesize that there will be stronger links between friendship quality and RSA reactivity for girls than boys.

Previous studies have examined RSA and its relationship to adolescent friendships and found that priming new relationships with positivity was associated with significant RSA decreases during stress This implies that existing relationships with positive friendship quality could have similar effects on RSA reactivity and provide an indicator of how adolescent friendships impact physical and emotional health.

Gabrielle Scott

Belle, MO

Adolescent Friendship Quality: Analyzing the Impact of Temperament, Emotional Reactivity and the Role of Gender

Gabrielle Scott, Catherine Everett, Hannah Holladay, Archer Cole, Allie Spiekerman, Sarah Borowski, Ashley Groh, and Amanda Rose

Positive friendships relate to better psychological health. (Stotsky et. al, 2018). During adolescence, dyadic friendships become more important than peer acceptance (Demir & Urberg, 2004) and have consistently related to different indices of adjustment. It is important to consider individual differences that might influence the quality of friendships, such as emotional reactivity. Temperament has been shown to be stable throughout development, and influences individuals' emotional reactivity within friendships. Temperamental characteristics (e.g., emotional intensity) are considered to have significant implications for children's peer relationships (Rothbart & Bates, 1998). Better temperamental reactivity has been found to predict positive friendship quality (Gleason et. al, 2005).

Research on the relation between emotional reactivity and friendship quality among adolescents is limited. The purpose of the current study is to examine the association between emotional reactivity and friendship quality. Two measures of emotional reactivity are considered: trait emotional reactivity (i.e., temperament) and state emotional reactivity (i.e., change in negative emotions from before to after an interaction task). Participants in the study include 180 adolescents (62 boys, 118 girls) in the eighth, ninth, and tenth grade. They completed a series of surveys on Qualtrics as well as a negative valence task (problem talk). Measures include the

Early Adolescent Temperament Questionnaire (Capaldi & Rothbart, 1992; Ellis & Rothbart, 2001), which assesses the extent to which adolescents tend to experience negative affect or negative reactivity. The Positive and Negative Affect Scale (Watson et al., 1999) assessed positive and negative effects before and after task. Lastly, the Friendship Quality Questionnaire (Rose, 2002) assessed positive and negative qualities of the adolescents' friendship. Analyses will be conducted to determine whether there are associations among trait emotional reactivity, state emotional reactivity, and friendship quality. Gender differences will be considered in all analyses.

Donia Shawn

St.Louis, MO

Senior
Biological Sciences; Political Science

Expanded Review of EHR and Research Database Data Quality to Identify Common Errors

Donia Shawn, Iris Zachary, Uzma Khan, and Magda Esebua

SARS-CoV-2, the causative virus of COVID-19, and the pandemic it has resulted in has severely impacted daily life both socially and economically. While physicians struggled in the early days of the outbreak to discern appropriate and efficient medical treatment options, the novel nature of the virus proved a significant obstacle. This created an unprecedented need for rapid research efforts to generate data regarding the structure and mechanisms of pathogenesis of SARS-CoV-2 and, in turn, possible clinical treatments of COVID-19.

Dr. Jeff Adamovicz, Dr. Jeff Whyte, and I embarked on research with the purpose of contributing to the development of the latter need. Specifically, through a kinetic time-course Vero E6 cell culture assay performed on a Lionheart FX Automated Microscope, we investigated the effects of the anti-malarial drug chloroquine on SARS-CoV-2 proliferation in real time over a 48 hour period. The Vero E6 cell line, originally isolated from African green monkey cells, has unique properties that make it an ideal system for the propagation and study of pathogenic viruses. Chloroquine has been widely reported on by journalists in mass news media as potentially useful in the clinical treatment of COVID-19, and our results – expected in just over a week – will either corroborate or contradict many of these claims.

Ultimately, more investigation into the mechanism of action of chloroquine is required to truly make an informed, definitive statement about its efficacy as a clinical treatment for COVID-19. Both research utilizing human cell lines and representative animal models *in vivo* will better allow the scientific community to ascertain the potential of chloroquine in the treatment of COVID-19. However, both the scientific and medical communities' knowledge of the virus is increasing exponentially, a signal of immense promise in reaching the end of the COVID-19 pandemic.

Rose Shirkey

Jacksonville, IL

Freshman
Biological Sciences

Faculty Mentor: Marc W. Vital II, Theatre

Birthday Toast[ed]

Rose Shirkey and Marc W. Vital

Birthday Toast(ed) is a special effects (SFX) makeup design, inspired by the song "Pity Party" by Melanie Martinez. Special effects makeup is a form of makeup in which non-beauty makeup products, such as latex, fake blood, prosthetics, and scar wax, are used to create an illusion. This may be of an injury, a mutant transformation, a supernatural creature, or just an animal. Many movies, shows, and other productions use some form of special effects makeup. When designing an SFX look, the artist gathers information on a character that has, in most cases, been provided to them. They use personality traits, original and altered appearances, as well as the background story to design the makeup. In the case of *Birthday Toast(ed)*, the character threw a birthday party that ended in flames. She was all dolled up in a floral dress and makeup, when disaster struck! While lighting the birthday candles, gas from a previously unknown gas leak caused a small explosion. Half of her face was devastatingly burnt, a candle got stuck in her forehead, and as if that wasn't enough, sprinkles stuck to the freshly burnt skin. Completely distraught by the event, she cried until she pushed her sorrows aside, developing a more "whatever" attitude, allowing her anger and dismissiveness to fully affect her, as seen in the images. *Birthday Toast(ed)* is an SFX look, captured in 3 photographs, displaying the end result of this character's story.

Artistic Expression

Rebecca Shyu

Columbia, MO

Junior
Computer Science

Faculty Mentor: Dr. Wei Jiang, Electrical Engineering & Computer Science

Privacy-Preserving Techniques in Genomic Applications

Rebecca Shyu and Wei Jiang

Genomics data is highly useful for a multitude of applications, but often the question of patient privacy is raised. It is important to advance our knowledge in medicine while understanding the limitations and boundaries of the existing privacy-enhancing technology in the healthcare domain. In this project, our goal is to design more efficient privacy-preserving protocols in data outsourcing environments that allow multiple healthcare organizations to securely, accurately, and safely share and query genomic data for biomedical research and evidence-based precision medicine. We are adjusting and developing novel approximation strategies commonly used in the field for generating edit distance, which produces a similarity score between two genetic sequences, in order to improve the efficiency of various biological applications. Our methods include using secure multi-party computation techniques to develop secure and verifiable sequence matching protocols. We experimentally test our methods for accuracy and speed to find the optimal approximation algorithm. This study is still in progress and is currently assessing different multi-party computational techniques.

Spencer Silvey

Liberty, MO

Faculty Mentor: Dr. Charlotte Phillips, Biochemistry

Utilizing Dynamic Histomorphometry to Evaluate Bone Formation in Mouse Femurs Following Myostatin Inhibition

Spencer Silvey, Catherine Omosule, and Charlotte Phillips

Osteogenesis Imperfecta (OI) is a hereditary connective tissue disorder due primarily to type I collagen mutations. Characterized by frequent fractures and bone fragility, OI, is colloquially known as "brittle bone disease." Currently, OI is incurable, and the most common treatment is bisphosphonates, an antiresorptive agent, which inhibits osteoclasts, cells vital to bone remodeling. Bone remodeling is necessary for maintaining healthy bone by removing and replacing damaged bone. Without osteoclast pruning, normal bone remodeling and growth does not occur, leading to decreased bone quality and compromised bone structure. Myostatin inhibition provides a potential solution to this problem. Bone is in a biomechanical/biochemical equilibrium with muscle, responding to changes in muscle size and force. Myostatin negatively regulates muscle mass. A decrease in circulating myostatin results in increased muscle mass and strength, increasing the force exerted on the bone, culminating in increased bone mass. This study hypothesizes that Myostatin inhibition will stimulate osteoblast activity and bone growth without compromising osteoclast function, resulting in increased bone quality and bone quantity. Previous studies show that myostatin inhibition significantly improves bone microarchitecture and strength. To investigate myostatin inhibition on osteoblast function in wildtype (Wt) mice, we evaluated femoral cortical bone formation rates (BFR) and mineral apposition rates (MAR) to elucidate the mechanism for this increased bone mass. Beginning at five weeks of age, Wt mice were weighed and injected twice weekly with humanized monoclonal control or anti-myostatin antibody (10 mg/kg of body weight) for 11 weeks. To evaluate the change in MAR and BFR, a calcein label and an alizarin red label were administered 10 and 3 days before euthanization. Through histological evaluation of the amount of fluorescent labeling and distance between the fluorescent labels (ImageJ software), we can determine whether the increased bone mass found with myostatin inhibition is due to increased bone formation.

Life Sciences

Alisa Sivapiromrat

O'Fallon, MO

Sophomore
Biological Sciences; Economics

Investigation of the Effect of IL-1B, RANTES, and MMP-1 Injection into Nucleus Pulposus (NP) of Intervertebral Disc (IVD)

Alisa Sivapiromrat and Aaron Stoker

INTRODUCTION : Back pain can originate from Intervertebral Disc (IVD) degeneration (IVDD). Inflammatory stimulation and degradative enzyme activity contribute to this disease. IVDD often develops through changes in nucleus pulposus (NP) structure, compromising the function of the IVD. However, the metabolic effects of injury and localized inflammation, and degradative enzyme activity on the NP is poorly understood. This study was designed to determine the effects of NP stimulation with IL-1β, RANTES, and MMP-1. It was hypothesized that localized IVD stimulation would result in significant increases in the proinflammatory and degradative metabolism, and decreases in physical properties.

METHODS : With ACUC approval, rat tail IVD explants were created, and assigned to MMP-1 (Injury+injection), IL-1β (Injury+injection), RANTES (Injury+injection), PBS (Injury+injection), injury only, or uninjured control groups. A 25g needle was used to create an injury and inject 10ul of solution based on group. Explants were cultured for 6 days, media was collected for biomarker analysis, and IVDs were tested biomechanically. RESULTS : The IL-1β and injury only groups had a higher inflammatory and degradative metabolism compared to other injection groups. The biomechanical properties of the IL-1 β, RANTES, and MMP-1 groups were significantly lower than the uninjured control.

CONCLUSION : IL-1β was the most inflammatory treatment applied to the IVD, and produced significantly higher biomarker levels compared to other injection groups. Injury alone was more inflammatory than injury+injection, as the PBS, RANTES, and MMP-1 groups produced significantly lower inflammatory biomarkers compared to the injury only control. The IL-1β, RANTES, and MMP-1 resulted in physical changes to the IVD based on decreased creep modulus and higher histology scores. In conclusion, IL-1β elicited an inflammatory metabolic response, contributing to pain and inflammation in IVD degeneration and physical changes within the IVD, while RANTES and MMP-1 elicit physical changes in IVD degeneration but not a metabolic inflammatory response.

Maxwell Staab

Kearney, MO

Faculty Mentor: Dr. Victoria Shaffer, Psychological Sciences

Differences in Transgender Stigma After Engaging in Perspective Taking Narrative Writing Interventions

Maxwell Staab and Victoria Shaffer

Main Purpose: Research suggests that perspective taking narrative interventions help participants understand and empathize with others. With this study, we aimed to better develop interventions for combatting stigma against people who are transgender. Narrative writing research has previously been directed towards health interventions work (Shaffer et al., 2019), while transgender stigma interventions research primarily concerns perspective taking and contact (Tompkins et al., 2015, Boccanfuso et al., 2021). We examined differences in the transgender knowledge, attitudes, and belief scores and perspective taking scores of participants before and after engaging in a perspective taking fictional narrative writing intervention in order to determine if a narrative writing intervention would be effective.

    Procedure: The study sample was composed of participants from the Psych 1000 subject pool. Transgender stigma was assessed with the Transgender Knowledge Attitudes and Beliefs (T-KAB) Scale (Clark & Hughto, 2019) that asked participants to report their feelings towards a variety of situations involving transgender people. Perspective taking was assessed with a modified version of the Interpersonal Reactivity Index (Davis, 1983).

    Results and Conclusions: Data collection for the study ended on December 3rd, 2020. We conducted two repeated measures ANOVAs and an independent t-test. There was a significant positive increase in perspective taking, but no significant difference in reported trans stigma. This indicates that this specific intervention may not particularly decrease stigma in people who are trans, it does slightly increase perspective taking. People who are transgender face many obstacles, including difficulties accessing healthcare, employment, sexual and physical violence, and other forms of harassment and discrimination in their day to day lives. These results can be used by educators to develop more effective intervention programs to combat stigma against people who are transgender.

Seth Steinman

Hannibal, MO

Faculty Mentor: Anna Wehrwein, Art

Who's Consuming the Media Here, You or Me?

Seth Steinman and Anna Wehrwein

My works seek to define and document surface through the lens of the screen. The work lives between a number of varied states: screen vs. surface, real vs. unreal, the constructed event vs. the happened upon, as well as the distinction between the two alongside the value structures it creates. It is also contextualizing itself generationally, to the way different age groups of people view our phones, laptops, etc. My work aims to be these moments on the internet and the representation of these fragmented ideas or imagery in a familiar way. I incorporate the use of the crop and textural elements as a way to reference the format of the screen and connect the ratios of images with the ratios of screens. The meta aspect of the work frames its position as a critique of the internet, by the internet; without taking itself too seriously. The frame variation, perspectival crop and the documentary nature are aspects of the pieces that result in a work that is informational without being overly complex. The work aims to be placed somewhere between high illusion and impressionism of post-internet ideals. The way that we reference the ratios and a text placement is second nature and can be represented in shorthand in a way that the brain is still able to make the connection. The surface references the printed text, while the painterly marks document the textures and surfaces from a varied perspective, rather than just documenting an image.

Kathryn Stieglitz

St. Louis, MO

Faculty Mentor: Dr. Sherri Ulbrich, Nursing

Evidence-Based Fall Prevention Strategies for MU Healthcare

Kathryn Stieglitz, Katrina Schache, Chloe Cobb, Jessica Tompkins, Melanee Castillo, Savannah Valeria, Sophie Gordan, and Sherri Ulbrich

Patient falls are a significant problem in every hospital unit because they contribute to poor patient outcomes and increase length of stay and cost. The Fall Council at MU Healthcare collects monthly data, and data from the last year revealed an increase in in-patient and out-patient falls. The National Database of Nursing Quality Indicators sets goals for the number of patient falls per 1,000 patient days and ranks hospitals by percentile. Currently, 38% of MU Healthcare's in-patient units are performing above the 50th percentile, and 81% of the out-patient units are performing above the 50th percentile. The goal of this project is to review the literature for evidence-based fall prevention strategies and present the findings with an associated recommendation to MU Healthcare's Fall Council.

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Harrison Stoudt

Imperial, MO

Mesocarnivore Activity in the Agroforestry Landscape

Harrison D. Stoudt and Summer H. LaRose

Agroforestry – the incorporation of trees into farming systems – presents a unique landscape aimed at integrating agricultural production alongside natural resource conservation. Such solutions allow for the integration of wildlife habitat within farmed landscapes, however different species are impacted differently by human activity. Raccoons (*Procyon lotor)*, Virginia opossums (*Didelphis virginiana*), and coyotes (*Canis latrans*) often thrive within close proximity to humans, but their activity and interactions may differ in these landscapes compared to natural environments. To evaluate mesocarnivore activity in the agroforestry landscape, we conducted a camera trapping survey during fall 2019 and 2020 across five natural (edge, open, wooded) or farmed (orchard, pasture) cover types available at the Horticulture and Agroforestry Research Center. We used the statistical software R and package 'activity' to quantify and compare activity patterns for coyote, raccoon, and Virginia opossum. Raccoons and opossums both exhibited typical nocturnal behavior across each cover type, but raccoons spent the majority of their time in orchards and we rarely observed opossums outside of orchard and wooded areas. Coyotes were primarily active at night, a pattern commonly observed in other human-dominated landscapes. Most of their daytime activity was spent in wooded cover, while they used orchards and wooded areas during nocturnal hours. There were no differences in the species' activity patterns within orchards, but raccoon and opossum activity differed from coyote activity in the wooded areas. We suspect orchards are a resource-rich area during the fall months, driving high activity overlap in those areas between the species.

Jack Suarez

Bryant, AR

Senior
Psychology; Biological Sciences

The consistency of electrophysiological evidence for retrieval mode in episodic memory: A meta-analysis

Jack H. Suarez, Brittney M. Bishop, and Jeffrey D. Johnson

Disruptions in long-term memory coincide with, and sometimes preclude a variety of psychological disorders. These disruptions can take multiple forms, not only reflecting the loss of mnemonic information, but also relating to deficits in strategic processing, executive function, and decision making. The current project focuses on characterizing the neural basis of a strategic cognitive state known as *retrieval mode*, which supports retrieval by allowing the rememberer to use stimuli as cues for episodic memories. We conducted a meta-analysis of studies that include both behavioral and event-related potential (ERP) measures of retrieval mode in an attempt to explain some disparate findings regarding the presence of ERP differences when comparing episodic and semantic retrieval tasks. While evidence supporting retrieval mode has been demonstrated when using simple semantic tasks (e.g., animacy or size) as the control condition, we hypothesize that null results might arise when the semantic task is more engaging (e.g., is this object more often found indoors vs. outdoors vs. both equally?). Our analysis confirmed that the absence of ERP differences was exclusive to studies that employed location tasks that were relatively difficult and potentially required access to recent experiences (i.e., episodic in nature). The results of this project are instrumental in further developing experimental designs to test the limiting conditions of retrieval mode with ERPs and other neuroimaging techniques, such as functional magnetic resonance imaging (fMRI). With the longer-term goal of using the neural correlates of retrieval mode and other strategies to better understand age-related memory decline, we therefore argue against the effectiveness of such semantic tasks as a control condition.

Anna Sullentrup

Washington, MO

Influences of Patient Medication Use on Osteoarthritic Chondrocyte Metabolism

Anna N. Sullentrup, Spencer E. DeLucia, Nicole T. Greco, Eli L. Pratte, Allyson B. Caisley, James L. Cook, and Aaron Stoker

Introduction:

Osteoarthritis (OA) is the leading cause of musculoskeletal disability in America. OA is often managed using medication for years prior to surgical intervention, with varied results. Many patients are also prescribed additional medications to manage medical comorbidities. Previous studies have indicated that OA chondrocytes maintain key phenotypic characteristics during initial *in vitro* culture. However, it is not clear if medications prescribed to treat OA and comorbidities (thyroid medications, thiazide diuretics, proton-pump inhibitors, angiotensin-converting enzyme [ACE] inhibitors, cyclooxygenase [COX]-2 inhibitors, non-steroidal anti-inflammatory drugs [NSAIDs], corticosteroids, opioid analgesics, and statins) impact chondrocyte metabolism during initial culture. Therefore, this study was designed to identify significant differences in production of OA-related biomarkers based on patient medication use prior to surgery.

Methods:

With IRB approval (IRB #1208932) and informed patient consent, cartilage tissue normally discarded during surgery was collected from patients undergoing total knee arthroplasty. Chondrocytes from these tissues were grown to confluence, media were changed, and cells were cultured for three days; a media sample was then collected. Media were analyzed for cytokines, degradative enzymes, inflammatory indicators, and matrix molecules. A Mann-Whitney U Test was utilized to identify significant differences between treated and untreated patient groups for each medication class, with $p < 0.05$.

Results:

Significant differences in biomarker production between treated and untreated patient groups were observed for all medication classes except for COX-2 inhibitors. Differential chondrocyte expression of biomarkers was observed between medication classes, indicating unique impacts of each class upon OA chondrocyte metabolism.

Conclusion:

The findings of this study suggest that medication use prior to surgery may directly or indirectly influence biomarker production by OA chondrocytes. Each drug class may impact unique OA-related metabolic pathways through drug-specific or OA chondrocyte-specific mechanisms of action. Further investigation of these mechanisms may provide key insights regarding patient-to-patient variation in symptomatic knee OA development and progression.

Landon Swartz

Springfield, MO

Faculty Mentor: Dr. David Mendoza-Cozatl, Plant Sciences; Dr. Walter Gassmann, Plant Sciences

Funding Source: BioInformatics and Plant Sciences (BIPS)

Using High-throughput Phenotyping to Characterize the *srfr1* Arabidopsis Mutant

Landon Swartz, Maddy Creach, Walter Gassmann, and David Mendoza

As temperatures rise due to climate change and the spread of some pathogens becomes easier, the plant immune system will be even more crucial to crop survival. To know how to mitigate yield loss due to pathogen introduction we need to further understand the immune system. Our focus is SRFR1, which is a negative regulator of immunity in plants. Arabidopsis plants with a non-functional *SRFR1* gene displays stunted growth compared to the wildtype genotype Columbia. This is due to the *srfr1* mutant having a constitutive immune response that comes at the cost of growth. When growing Columbia and *srfr1* mutants side by side they are identical before a stunted appearance manifests. To characterize this phenotype, the root phenotype was analyzed in the mutant by using an inhouse automated image collection platform and an image analysis algorithm. Preliminary results suggest no significant difference in the root growth of Columbia and the *srfr1* mutant. To measure the rosette size high-resolution images were captured every two hours. By doing this we can monitor the plants' leaves in more detail than we could by hand, imaging the plants side by side and pinpointing the exact point in development when *SRFR1* becomes necessary for wild type development. Then using a computer algorithm we will be looking at rosette size and other aspects of the plant to generate a fine temporal resolution of the *srfr1* mutant phenotype. These two experiments will provide more information on the *srfr1* mutant phenotype and its affect on development of arabidopsis.

Brian Tang

Chesterfield, MO

Faculty Mentor: Dr. Dominic Ho, Electrical Engineering & Computer Science

Signal Processing Technique for Location Estimation

Brian Tang, Yang Zhang, and Dominic Ho

Determining the location of an object using sensors has become an area of research but some problems arise when some sensor data acts as outliers, for different reasons. Although there have been some proposed solutions to this problem, many run into as problem where multiple external factors affect the effectiveness of the method. Other methods might perform well in removing outliers; however, they are computationally demanding or not effective. There is a way to use algebra in conjunction with signal processing to find an object's location. By doing so, the computations are easy to manage while also providing accurate results. For the 2D case, the time it takes for the signal to travel from a transmitter to a receiver can be modeled with a simple expression that is related to the object position. Then, using the measurement data from multiple sensors we can then solve the unknowns, as long as the number of measurements equals or exceeds the number of unknowns. The object location estimate is the intersection point of the curves from the algebraic expressions and it involves only finding the roots of quadratic equations. A similar procedure can be taken for 3-D localization.

Caitlin Tate

Memphis, TN

Examining Portrayals of Minority Groups in African American focused news media

Caitlin Tate, Brandon Ford, Della Cox, Rachel Henderson, Kobe Gibson, Jackson Hale, Evelyn Mabie, Andrea Figueroa-Caballero, and Christopher Josey

This abstract has been withheld due to proprietary permissions.

Rushil Thakker

Blue Springs, MO

Junior
Computer Engineering; Electrical Engineering

Faculty Mentor: Dr. Syed Kamrul Islam, Electrical Engineering & Computer Science

Energy Efficient Machine-Learning Model Embedded on FPGA for Identification of Sleep Apnea Among Adults

Rushil Thakker, Omiya Hassan, Syed Kamrul Islam

Sleep Apnea is a type of breathing disorder caused by multiple extended pauses in breathing during sleep. This can lead to a decrease in the blood oxygen saturation level which can cause many long-term health issues such as high blood pressure or a weakened immune system. Currently, sleep apnea is diagnosed by using polysomnography (PSG) or other at-home monitors. PSG is the gold standard for detecting sleep apnea, however, it requires an expensive overnight stay monitored by sleep experts. The at-home monitoring methodologies are portable and cheaper compared to the PSG but provide less accurate results while still requiring sleep experts to analyze the results. In this project, we propose a solution by constructing a machine learning model which is inspired by a biomedical system design that can automatically detect sleep apnea with a high degree of precision. This will improve early detection of apnea and allow for constant monitoring in cases where apnea may prove fatal. A digital hardware design of this feedforward neural network is embedded on a field programmable gate-array (FPGA) to detect sleep apnea. The proposed system prototype is designed on an FPGA which analyzes data from two inputs: an ECG sensor and a pulse oximeter providing information on blood oxygen saturation level. These inputs are fed into the network by using the switches on the FPGA and the output of the network is shown on the FPGA's display. The network shows an accuracy of about 88% when detecting sleep apnea and has a power consumption of roughly 52 watts. Future applications of this research include integration into a system-on-a-chip (SOC) platform to create sleep apnea identification devices such as a smart beside apnea monitoring device.

Lauren Tigner

Kansas City, MO

Faculty Mentor: Dr. Stacy Wagovich, Speech, Language and Hearing Sciences

The Use of Mental State Verbs by Preschool-Age Children Who Stutter and Their Mothers

Lauren Tigner, Lauren Day, and Stacy Wagovich

Mental state verbs (MSVs) denote internal cognitive states (e.g., think, believe, remember, understand). They are more abstract than other types of verbs, such as action verbs, and are likely to be embedded in utterances that are more conceptually complex. For example, "She *forgot* [MSV] his name" is more abstract than "She *said* [action] his name". Logan's (2015) working model of speech fluency includes the dimension of communicative flexibility – the ability to shift among communicative contexts. In this preliminary study, through analysis of MSVs, we explored one type of communicative flexibility in children who stutter (CWS) and children who do not stutter (CWNS) as they shifted from action-based conversation with their mothers to interaction that emphasized internal mental states. We hypothesized that CWS may be less flexible than peers in shifting from action-focused language to more inward focused language about thoughts and other internal mental states. Through examination of the play-based language samples of 30 CWS and 30 age- and gender-matched CWNS (ages 3;0-5;10) with their mothers, we explored (a) the frequency of MSV use among the groups of children and their mothers, (b) the correspondence between mothers' use of MSVs and their children's use, and (c) the proportion of utterances with MSVs that contain stutter-like and other disfluencies. Results will be discussed in relation to the idea that mental state verbs may reveal information about a child's communicative flexibility in conversation.

Behavioral/Social Sciences

Jessica Tompkins

Dubuque, IA

Faculty Mentor: Dr. Sherri Ulbrich, Nursing

Evidence-Based Fall Prevention Strategies for MU Healthcare

Jessica Tompkins, Katrina Schache, Melanee Castillo, Savannah Valeria, Kate Stieglitz, Chloe Cobb, Sophie Gordan, and Sherri Ulbrich

Patient falls are a significant problem in every hospital unit because they contribute to poor patient outcomes and increase length of stay and cost. The Fall Council at MU Healthcare collects monthly data, and data from the last year revealed an increase in in-patient and out-patient falls. The National Database of Nursing Quality Indicators sets goals for the number of patient falls per 1,000 patient days and ranks hospitals by percentile. Currently, 38% of MU Healthcare's in-patient units are performing above the 50th percentile, and 81% of the out-patient units are performing above the 50th percentile. The goal of this project is to review the literature for evidence-based fall prevention strategies and present the findings with an associated recommendation to MU Healthcare's Fall Council.

The research question examines the impact of conducting post-fall debriefs on preventing further falls in the hospital setting. The research team conducted literature reviews for each of the following areas: general medical-surgical, critical care, emergency, perioperative, psychiatric, pediatric, and perinatal. Decreasing the number of falls that occur in each of these departments in MU Healthcare is a priority for enhancing patient safety and classifying the institution with magnet status. Initial findings support the hypothesis that post-fall debriefs are an effective strategy in reducing the number of repeat falls and establishing improved safety culture and communication among staff. Post-fall debriefs were found to be most effective when strong and positive leadership runs the debrief meeting and when the team has strong group safety norms. The recommendation based on evidence-based research is that MU Healthcare creates a post-fall debrief tool and initiates post-fall debriefs after each fall with all staff present on the unit at the time of the fall.

Marissa Triller

St.Charles, MO

Senior
Biological Sciences

Faculty Mentor: Dr. Andrew Scaboo, Plant Sciences

Evaluation of the Genetic Architecture of Soybean Cyst Nematode Resistance at the Rhg1 Locus

Marissa L. Triller, Mariola Usovsky, Clinton G. Meinhardt, Pawan Basnet, and Andrew M. Scaboo

Plant genetic resistance is the most sustainable management strategy to combat soybean cyst nematode (SCN). Traditionally, both PI 90763 and Peking were classified into Peking-type resistance sources, yet they show differences in the degree of resistance to virulent SCN populations including TN22. Thus, a recombinant inbred line (RIL) population of 144 $F_{3:4}$ individuals was developed crossing PI 90763 and Peking to investigate the allele status at the *Rhg1* locus. The seeds from each of the F3 plants were individually harvested and phenotyped for SCN resistance. After extracting the DNA from the $F_{3:4}$ population, QTL mapping confirmed that both parents carried the same *rhg1-a* allele and revealed two novel QTL for SCN resistance in PI 90763. This research contributes to understanding Peking-type resistance and provides more genetic diversity for breeding superior SCN-resistant soybean cultivars in the future.

Life Sciences

Abigail Turner

Brookfield, MO

Senior
Agricultural Education (Communications & Leadership)

Exploring the Leadership Attitudes and Beliefs of Mizzou Pan-Hellenic Sorority Members and Impact on Organization

Abigail Turner and Adam Cletzer

Today, leadership is not seen as a specific set of inborn traits a leader possesses but, rather, a fluid process between leaders and followers that results in the leadership of a system. This empirical research utilized a quantitative survey methodology. The Leadership Attitudes and Beliefs-III (LABS-III) questionnaire, along with a demographic questionnaire, was distributed to members of the Panhellenic Association at the University of Missouri. Dillman's Tailored Design Method was used to recruit members.

The LABS-III instrument measures the attitudes and beliefs surrounding leadership based on two scales: hierarchical thinking and systemic thinking. The study seeks to characterize the leadership attitudes and beliefs of Mizzou sorority members and explore the relationship between sorority culture and the leader produced. Results are still forthcoming. The information received will provide a foundation for improvement and reflection for not only the sorority as a whole but each sorority's leaders' dependency on, and interaction with, members. The report generated will help the Panhellenic Association and sororities at Mizzou better understand their impact on members and leadership cultures. As a myriad of extra-curricular and leadership development opportunities are available to college students, future studies will be important references when creating leadership curriculum and fostering student organization culture.

Marie Tweedle

Blue Springs, MO

Faculty Mentor: Dr. Nicole Campion-Barr, Psychological Sciences

Birth order and gender differences in family members' and observers' ratings of parent-adolescent interactions

Marie Tweedie, Julianna Bell, Yue Guo, and Nicole Campione-Barr

Previous research focusing on outsiders' views and insiders' views of family interaction ratings have found that there have been low correlations of ratings between family members and observers (Surra & Ridley, 1991), yet family members' reports have been both positively and significantly correlated (Schwarz, Barton-Henry, & Pruzinksy, 1985). Because most of the studies have focused on single dyadic subsystems, previous research may have glossed over the fact that different dyadic relationships do not occur in isolation (Dekovic and Buist, 2005) and that each parent-child dyad impacts the other family subsystems (Cox & Paley, 1997). Other findings suggest that these interaction ratings could be affected by both birth order and gender differences within the family. Some research suggests that second-borns were found to have more decision-making autonomy than firstborns, particularly during early adolescence (Campione-Barr, Lindell, Short, et al., 2015), which may affect the ways that first-borns and second-borns interact with their parents (and the quality of those interactions) during adolescence. Gender also plays a role in family dynamics, as female-only dyads (e.g., mother-daughter, sister-sister) tend to be more effectively intense than all other combinations (Campione-Barr & Smetana, 2019). Therefore the present study aimed to investigate the differences in ratings between observers, parents, and adolescents during a semi-structured adolescent disclosure task, and whether those ratings are affected by adolescent birth order and gender.

This study evaluated 123 families with at least two children (n = 246 parent-adolescent dyads), predominately White (85%) and 2-parent families (72%). The majority of the parents come from well-educated and upper-middle class incomes. First-born adolescents were on average 13.93 years old and second-born adolescents were an average of 11.47 years old. Results of a 3 (Rater: observer, mother, and adolescent) X 2 (Birth order: first- vs. second-born) X 2 (Adolescent gender: girls vs. boys) mixed model ANOVA will be presented.

Alaina Vacante

Atlanta, GA

Senior
Journalism (Strategic Communication); Political Science

Faculty Mentor: Dr. Justin Dyer, Political Science; Dr. William Horner, Political Science

Electoral Rights & Wrongs-the Effect of Shelby County v. Holder (2013) on Georgia Voters

Alaina R. Vacante, Justin B. Dyer, and William T. Horner

After the Supreme Court decision for *Shelby County v. Holder* (2013), there was the subsequent removal of Section 4b from the Voting Rights Act of 1964 (VRA), making Section 5 unenforceable. Preclearance now ceased to exist. This prompted numerous changes to election laws not only in Alabama, where the case originated, but across the South East, and especially within the state of Georgia. Many argue that there was no reason to keep preclearance requirements in place, as Georgia had maintained a large number of minority voters over many years and was seemingly unaffected by this piece of the VRA. Others saw this maintenance of minority voters as proof that preclearance requirements were fulfilling their intended purpose. As both viewpoints seemingly contradict and support one another simultaneously, we decided to study these disparities ourselves. By cataloging changes in election legislation and regulation, including the resulting impact on minority voters, from 2013 to present, in correlation with voter registration data from the Georgia Secretary of State's Office. By matching dates of the passage of these laws with the (a) demographics of Georgia voters, (b) registration dates of voters, and the (c) date of the last election voted in, allowed us to analyze whether or not *Shelby County v. Holder* (2013) negatively affected minority voters in the State of Georgia. My theory is that through the removal of preclearance requirements, there has been an intensified struggle for electoral power in this historically conservative state because of its increasing population of minority constituents. It is because of this population increase that many of these state representatives of Georgia have attempted to suppress minority voters for fear of losing their majority. However, I feel that they have been unsuccessful in their attempts to do so. The ultimate findings are to be presented at the 2021 Spring Research & Creative Achievements Forum.

Behavioral/Social Sciences

Savannah Valeria

Crystal Lake, IL

Faculty Mentor: Dr. Sherri Ulbrich, Nursing

Evidence-Based Fall Prevention Strategies for MU Healthcare

Savannah Valeria, Katrina Schache, Chloe Cobb, Jessica Tompkins, Kate Stieglitz, Melanee Castillo, Sophie Gordan, and Sherri Ulbrich

Patient falls are a significant problem in every hospital unit because they contribute to poor patient outcomes and increase length of stay and cost. The Fall Council at MU Healthcare collects monthly data, and data from the last year revealed an increase in in-patient and out-patient falls. The National Database of Nursing Quality Indicators sets goals for the number of patient falls per 1,000 patient days and ranks hospitals by percentile. Currently, 38% of MU Healthcare's in-patient units are performing above the 50th percentile, and 81% of the out-patient units are performing above the 50th percentile. The goal of this project is to review the literature for evidence-based fall prevention strategies and present the findings with an associated recommendation to MU Healthcare's Fall Council.

The research question examines the impact of conducting post-fall debriefs on preventing further falls in the hospital setting. The research team conducted literature reviews for each of the following areas: general medical-surgical, critical care, emergency, perioperative, psychiatric, pediatric, and perinatal. Decreasing the number of falls that occur in each of these departments in MU Healthcare is a priority for enhancing patient safety and classifying the institution with magnet status. Initial findings support the hypothesis that post-fall debriefs are an effective strategy in reducing the number of repeat falls and establishing improved safety culture and communication among staff. Post-fall debriefs were found to be most effective when strong and positive leadership runs the debrief meeting and when the team has strong group safety norms. The recommendation based on evidence-based research is that MU Healthcare creates a post-fall debrief tool and initiates post-fall debriefs after each fall with all staff present on the unit at the time of the fall.

Meg Vedra

Frisco, TX

Faculty Mentor: Dr. Antje Heese, Biochemistry

Investigating roles of Clathrin-coated vesicle components in cell expansion in Arabidopsis thaliana

Meg Vedra, Nga Nguyen, Tessa Jennings, and Antje Heese

Throughout a plant's life cycle, the cell wall provides structural support and protects intracellular components. A key molecule in the plant cell wall that aids in cell expansion is the polysaccharide cellulose. In the model plant *Arabidopsis thaliana*, cellulose synthases form large enzyme complexes that need to be localized in the plasma membrane (PM) to catalyze the synthesis of extracellular cellulose. To fine-tune cellulose production for polymer arrangement and expansibility of the cell wall, the plant cell adjusts the PM abundance of cellulose synthases using vesicular trafficking via clathrin-coated vesicles (CCVs). CCVs have emerged as the prominent vesicle type that transports cellulose synthases from one cellular organelle to another in form of small membrane-bound vesicles. Newly synthesized cellulose synthase complexes are secreted via the *trans*-Golgi Network (TGN) to the PM. With the help of CCVs, cellulose synthases are internalized from the PM by constitutive endocytosis, transported to the TGN and then recycled back to the PM to allow for a new round of synthesis of cellulose. Our lab's long-term interest is identifying CCV components with novel roles in cell expansion, likely by regulating the subcellular localization of cellulose synthases between the PM and the TGN.

In this study, we investigated whether loss-of function Arabidopsis mutants in specific CCV components alter cell expansion in the hypocotyl. In five independent studies, I have observed significant differences in hypocotyl length between several single and higher-order CCV mutants compared to wild-type seedlings that were grown in dark conditions and in the absence of sucrose. Currently, I am determining whether an increase in cell size or cell number are responsible for the altered hypocotyl length in CCV mutants compared to the wild type.

Mikella Vermaire

Champaign, IL

Faculty Mentor: Dr. Jeffrey Johnson, Psychological Sciences

The Effects of Lapses of Sustained Attention on the Encoding of Episodic Memories

Mikella Vermaire, John Scofield, and Jeffrey Johnson

Sustained attention, the self-maintenance of cognitive focus or vigilance, is an important factor in effectively accomplishing the various tasks of everyday life. To better understand the relationship between sustained attention and the formation of episodic memories, the current project sought to investigate fluctuations in a behavioral index of attention during a memory encoding task. Sixty healthy, young-adult subjects first undertook an incidental encoding phase in which a list of common words was presented, and a simple binary judgment was to be made for each word. The critical feature of this phase was an imbalance (90-10 split) regarding the correct judgement, which was designed to encourage subjects to sometimes rely on automatic processing. Fast response times on consecutive trials were used as an index of such lapses in sustained attention. A surprise memory test was then administered, in which subjects indicated whether or not words were previously encountered during the encoding phase. Memory test items associated with attentional lapses at encoding were contrasted with those items for which attentional focus appeared sustained. Importantly, the lapses gave rise to our predicted result of enhanced forgetting (i.e. lower hit rates). These results provide insight on how moment-by-moment fluctuations in attentional state can be informative about the quality of episodic memory encoding.

Behavioral/Social Sciences

Lilia Voss

St. Louis, MO

Junior
Interdisciplinary (Women's and Gender Studies); English

Faculty Mentor: Joe Johnson, Art

Untitled Collaboration

Lilia Voss, Petey Botts, and Joe Johnson

Untitled Collaboration concerns itself with emergent methods of reality creation. As URL space has gained primacy over IRL space, the creation of reality has become everyone's job. Through a process of improvisation, iteration, and documentation in domestic spaces, Untitled Collaboration presents a series of magickal possible realities. Household objects become sigils, charged with each burst of flash. The artists' collaborative process entails relinquishing ultimate authority over what is created, instead relying on generative glitches in communication to create something beyond their control. We have seen what happens when ideas pass from the screen into IRL space. Untitled Collaboration asks what IRL space looks like when alternative rulesets gathered from the logic of the internet are applied.

Emily Walter

O'Fallon, MO

Junior
Plant Sciences (Breeding, Biology and Biotechnology)

Faculty Mentor: Dr. David Mendoza-Cozatl, Plant Sciences

Development of automated sensors to track pH changes elicited by iron deficiency in hydroponic cultures

Emily Walter, Maria Lusardi, Dario-Alavez, and David Mendoza-Cozatl

Iron (Fe) is an essential nutrient for plant growth, and plants are the main source of Fe for humans and livestock. The World Health Organization estimates that Fe deficiency affects 30% of the world's population and is considered the most prevalent nutritional deficiency around the globe. Thus, understanding the molecular mechanisms that plants use to accumulate Fe will allow the development of biofortified crops for better human nutrition. Despite recent and significant advances in our understanding of how plants respond to Fe deficiency, the molecular and physiological mechanisms behind Fe deficiency are still poorly understood. This is due in part to the static nature of how our field currently assesses Fe deficiency responses. For instance, plants are known to acidify the root environment to make Fe more available but currently, data describing the timing and progression of this acidification is lacking. To solve this issue, we developed an automated pH tracking system to monitor pH changes in hydroponic systems. As a proof of concept, we tracked the acidification of media on maize plants grown over a week with and without Fe. We also compared the accuracy and consistency of two different sensors, PASCO's ready-to-use Wireless pH Sensor and DFRobot's DIY open-source Gravity pH Meter Pro. Overall, the PASCO sensors showed more consistent readings and required minimal software and hardware setup. DFRobot sensors on the other hand showed much more variance in their readings and required a microcontroller, a Raspberry Pi, and self-written software to read and analyze the values. However, the open-source capacity allows more possibilities for future development, such as real-time data uploads. Further experiments will focus on optimizing the sensitivity of both systems to provide an informed data-driven comparison of each sensor brand.

Erin Walton

Kansas City, MO

Faculty Mentor: Dr. Carolyn Orbann, Health Sciences

The Student Army Training Corps at MU During the 1918 Influenza Pandemic

Erin Walton and Carolyn Orbann

This research project examines hospitalizations of students in the Student Army Training Corps (SATC) at MU in the fall of 1918 during the influenza pandemic. The SATC began in October of 1918 as a way for young men to train for the military while they were enrolled in college classes. One of the chapters was on the MU campus, and there are records of hospital charges for SATC recruits in October-December 1918. While we have an estimation of the loss of life during the pandemic, we do not have data for the total case number in order to get an idea of the mortality rate. By examining these hospitalizations and comparing them to death records we will be able to draw a more accurate picture of the pandemic's impact. This data allows us to calculate a mortality rate and re-admission rate, as well as learning more about the lengths of influenza hospitalizations. Results and conclusions will be presented at the 2021 Spring Forum.

D'Angelo Walton

St. Louis, MO

hACE2 Gene Expression & COVID Susceptibility

D'Angelo Walton and James Amos-Landgraf

During the 2020 coronavirus pandemic, it was observed that people show substantial variation in how the virus can affect them. People who are infected with COVID-19 can have symptoms that range from being asymptomatic to life-threatening. COVID-19 is caused by the virus SARS-CoV-2, which infects the cells by binding to angiotensin-converting enzyme 2 (ACE2). This enzyme acts as a receptor for the virus and is located on the epithelial cells in the lung. Is there a relationship between the amount of ACE2 receptors on a cell surface to the diverse manifestations of SARS-CoV-2? We tested the hypothesis that mice with an abundance of human ACE2 (hACE2) will show more extreme indications of viral infection. For this research, a mouse model of transgenic mice carrying the hACE2 transgene was used. Lung tissue was harvested from both hemizygous male, and female mice either prior to infection or 14 days post SARS-CoV-2 infection. Ribonucleic acid was then isolated from the tissue samples using either a QIAGEN RNA isolation kit or Trizol Plus isolation kit. By using reverse transcriptase-polymerase chain reaction, or RT-PCR, the ribonucleic acid was examined quantitatively. The amount of transgenic expression of human ACE2 was then correlated with the various levels of disease outcome. We found highly variable levels of hACE2 transgene expression. These studies are ongoing and correlation with disease outcomes including histological analysis of lung tissue and protein levels are planned. The findings from this research are significant because it will lead to further insight about the significance angiotensin-converting enzyme has with infection from the coronavirus and explain the disparities in infected populations.

Brooke Watkins

St. Charles, MO

Faculty Mentor: Dr. Kristy vanMarle, Psychological Sciences

Comparing preverbal infants' numerical abilities in in-person vs. online data collection formats

Brooke Watkins and Kristy vanMarle

Purpose
Due to COVID-19, in-person data collection has been halted in order to adhere to social distancing guidelines. Many labs have begun to practice online data collection as an alternative — however, this method is unprecedented within many scientific fields, calling for testing to ensure its validity. We are testing this format of data collection by comparing in-person results of infant looking time to results achieved by online means. The method of looking time is used to determine ordinal knowledge development by having infants attempt to successfully differentiate a 1:2 ratio of objects. If a null interaction is observed between the two formats, this will suggest that data is reliable across both types of data collection.

Procedure
Xx infants, within age ranges of 5-7 months and 9-13 months were tested. In both in-person and online trials, infants were first familiarized to food items presented to them in a video format. They were then presented with eight trials (shown in a randomized order) of an adult hiding food inside of two cups and then asking another adult to pick one of the cups. In half of the trials, the choosing individual picked the larger quantity of food items, while in the other half, they chose the smaller. Infant looking time was measured in order to determine level of surprise at the choice made, differentiating between expected and unexpected choices.

Results
36 infants were tested in the in-person condition, while xx infants have been tested online to date. We will conduct an ANOVA of each in-person and online data collection, comparing overall look duration by trial type, general engagement, and number of trials dropped. 5-7-month-olds failed the task in in-person trials, while 9-11-month-olds succeeded. If online data collection is valid, 5-7-month-olds should fail and 9-11-month-olds should succeed here as well.

Rebecca Wells

Columbia, MO

Senior
Political Science; Statistics

Faculty Mentor: Dr. Jay Dow, Political Science; Dr. William Horner, Political Science

Appalachian Health Disparities Ignored : Understanding State Variations in Health Outcomes within Appalachia

Rebecca Wells and Jay Dow

   Health inequality in Appalachia is well documented, but prior research has done little to evaluate variations between states. Appalachia is failing in health, technological and water infrastructure. Despite two federally created institutions for providing relief in Appalachia, the Tennessee Valley Authority and the Appalachian Regional Commission (ARC), Appalachia remains one of the poorest and sickest areas in the United States. Prior research has established that there are qualities of Appalachian health disparity that go further than the rural penalty, meaning Appalachian inequalities in many senses are unique to the region. However, little energy has been devoted to understanding variation between Appalachian counties and states. This paper answers the question, "What social and political factors can explain differences in health quality between Appalachian states?" Appalachian counties in Kentucky, West Virginia, and Tennessee were compared using regression modeling. State and regional approaches to healthcare were examined to understand the different approaches and political influences in achieving positive health outcomes. This research indicates that variations between states are significant, meaning that healthcare outcomes do vary between Appalachian areas. The scope of this research is limited due to time constraints and the age of the data. As such, future research could expand on this by reviewing counties from all Appalachian states and replicating the regressions included in this report with newer data sets. Further, due to COVID-19, physically observing the community health programs discussed in this report was not feasible. However, this research is still impactful in that it provides a framework for achieving reduced health disparities in a high risk region. Full conclusions will be presented at the Undergraduate Research Forum.

Behavioral/Social Sciences

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Investment technology adoption among individual investors

Taohua Wen and Lu Fan

Financial technologies (or FinTech) are now widely used for the delivery of financial services with technology innovation. Understanding how investors use online and mobile investment technologies can provide implications for financial service providers and policymakers. The literature has documented online and mobile as important electronic devices used by investors. There is limited understanding about how investors' characteristics can be associated with the likelihood of using online and mobile investment technologies. The purpose of this study, therefore, is to examine the determinants of investors' usage of online and mobile tools when making investment decisions and making investment transactions. With the emerging and fast-moving trend of FinTech, understanding how investors use online and mobile investment technologies can provide implications for investors, financial service providers, and policymakers.

Using the merged data in the 2018 National Financial Capability Study and the 2018 Investor Survey and probit regression analyses, this study finds that both objective and subjective investment knowledge of investors are significantly associated with online and mobile investment technology usage. Perceived financial management skill is negatively associated whereas investment risk tolerance is positively associated with online and mobile investment technology adoption. Investment confidence and confidence in the long-term U.S. market returns are negatively associated with using online or mobile tools for investment transactions. Those with less portfolio value, younger, non-White, and higher-educated investors are more likely to use investment technologies.

The findings of this study provide significant implications for financial service providers who work with clients who may perceive online and/or mobile tools as an option when making investment decisions. FinTech industry practitioners may also find this study relevant to the factors associated with the likelihood of choosing investment technology products. Given the increase in usage of FinTech, policies, regulations, and ethical standards should be developed for mobile and online investing products and investment advisory.

Behavioral/Social Sciences

Noah Wich

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Faculty Mentor: Katrina McCann, Journalism

Two Faces of America

Noah Wich and Katrina McCann

   I am currently a student at the University of Missouri-Columbia, majoring in journalism. I discovered a passion for journalistic photography in late 2019, and have been pursuing photo opportunities ever since. I feel particularly drawn to events in which people showcase genuine emotions, and I consider it an honor to be able to capture these beautiful moments. In these four photos, I attempted to capture two sides of the growing racial divide in Missouri. The photos titled "Hawk" and "Salute" were taken at a celebration of life for police captain David Dorn in Saint Louis, Missouri. The photos titled "Shout" and "Tunnel" were taken at a black lives matter rally at Faurot Field in Columbia, Missouri. These images showcase the humanity shared between these two groups of differing opinion.

Brandy Williams

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Are social integration signals slowly evolving and widely shared in treehoppers?

Brandy Williams, Sabrina Michael, and Reginald B. Cocroft

Animal communication is studied because of its divergence across species. However, although mating signals evolve rapidly, social integration signals often evolve more slowly. For example, traits of infant distress vocalizations and parental responses are widely shared across mammals. Because social integration signals are more cooperative than competitive , there aren't many selection pressures that influence its diversification, which could explain why some similarities can be seen across species. We studied the signals involved in cooperative foraging in treehoppers, which are group-living insects that live and feed on plant sap and communicate using plant-borne vibrations. In T*ylopelta gibbera* (Hemiptera: Membracidae) treehopper nymphs, we have recognized a pattern in their social signals. While walking to search for a new feeding site, *T. gibbera* often use a signal similar to a purr, and occasionally pause; we call this individual the searcher. During this pause, individuals already at a feeding site produce short 'ticks' in response to the purr, and the searcher uses these ticks to locate and join the group. We hypothesize that treehoppers have a fundamental signaling structure, episodic walking guided by short signals from settled individuals, that represents a widely shared, slowly evolving social integration system in treehoppers. Preliminary analysis of an archive of recordings made by one of the authors reveals that the first prediction is met: multiple treehopper species share the pattern of walking bouts (with or without signals) followed by short 'tick' signals from other individuals. We next plan to run playback experiments to test whether searching *T.gibbera* nymphs will orient to tick signals from related species. The findings of this experiment can help us better understand the evolution of social integration signals in treehoppers and can give us more insight to the divergence of animal communication as a whole.

Life Sciences

Lauryn Williams

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Physics (Astronomy); Mathematics

Faculty Mentor: Dr. Yicheng Guo, Physics and Astronomy

Multi-Wavelength Identification of Extremely Young Galaxies with CANDELS

Lauryn Williams, Yicheng Guo

Understanding the formation and evolution of young galaxies in the early universe is a pivotal goal in cosmology. These galaxies reveal clues on how large galaxies, like our own Milky Way, were formed and evolved. In this project, we use data from the Cosmic Assembly Near-infrared Deep Extragalactic Legacy Survey (CANDELS) to study the physical properties of distant extremely young galaxies. CANDELS, one of the largest programs of the Hubble Space Telescope, imaged over 250,000 distant galaxies in multiple wavelengths in optical and near-infrared. To search for extremely young galaxies from this huge dataset, we use a criterion to select galaxies whose brightness in a certain near-infrared bandpass is dramatically boosted by the emission from the interstellar medium in star-forming regions. After reducing noise and uncertainties in our sample, we select 311 candidates. Their stellar masses range around 10-100 million times the mass of our sun, making them 1001000 times smaller than our Milky Way We also investigate other physical properties of these candidates (i.e. number density, mass, star formation rate, shape, etc). These candidates are analogs of the progenitors of Milky Way type galaxies, Understanding them will provide clues of the physics that drives galaxy formation and evolution.

Physical & Mathematical Sciences

Audrey Wind

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Senior
Biological Sciences

Faculty Mentor: Dr. R. Michael Roberts, Biochemistry; Dr. Toshihiko Ezashi, Animal Sciences

Most efficient BMP4 exposure and concentrations of inhibitors for pluripotent stem cell differentiation to trophoblast

Audrey Wind, Yuchen Tian, R. Michael Roberts, and Toshihiko Ezashi

Diseases of pregnancy, like preeclampsia, are believed to arise from placental trophoblast dysfunction. Human embryonic stem cells (hESCs) can be coaxed to differentiate into placental trophoblast cells resembling those in early pregnancy using BAP protocol. This involves addition of Bone Morphogenetic Protein 4 (BMP4), inhibitors of Activin/Nodal (A83-01), and FGF2 (PD173074) signaling. Our goal was to determine the minimum time hESCs need exposure to BMP4 and optimal concentrations of A83-01 and PD173074 for complete differentiation to trophoblast. To test BMP4 exposure time, BAP medium was replaced with control medium, i.e. minus BMP4, but still containing the inhibitors, at different times during a 7-day culture. The hESC (5×10^5 cells per d35 per well) were cultured under BAP conditions for either 6 h, 12 h, 24 h, or seven days (control). After each pre-determined period of BMP4 exposure, the medium only contained A83-01 and PD173074 (AP), without BMP4. These experiments were run in triplicate, with medium changed daily for seven days. The medium was collected on days 5, 6, and 7 to assess the production of human chorionic gonadotropin (hCG). We also collected photomicrographic images of the cells on these days to compare with control cells. By using the production of hCG and colony morphology as an indication of trophoblast differentiation, it appears that an exposure of 24h is sufficient to prime hESC for progression to syncytiotrophoblast. In on-going experiments, hESCs are cultured with 10 ng/ml BMP4 for 24 h and continued in culture with 1.0 M of A83-01 and adjusted concentrations of PD173074 (0.02 µM, 0.5 µM, and 2.5 µM with the control at 0.1 M). Future experiment will be done with varying concentrations of A83-01 (0.2µM, 5µM, and 25µM) with the PD173074 control at 10µM. In these experiments we expect to define conditions that favor differentiation of particular trophoblast sub-lineages.

Morgan Woolridge

Tulsa, OK

Faculty Mentor: Dr. Charles Brown, Veterinary Pathobiology

The Roles of Macrophage Subsets in Response to Borrelia burgdorferi

Morgan Woolridge, Christa Jackson, and Charlie Brown

Borrelia burgdorferi is the causative agent of Lyme disease. Lyme disease is a bacterial infection commonly acquired by being bitten by an infected tick. Early symptoms of Lyme disease include fever, headache, fatigue, and a bulls-eye shaped rash. If untreated with antibiotics, patients with Lyme Disease can develop symptoms of carditis, arthritis, and neurological issues. C3H/HeJ mice develop an infective carditis and arthritis following infection with *Borrelia burgdorferi*. Following three weeks of infection, however, the infectious arthritis and carditis that spontaneously resolve approximately 3 weeks post-infection. It is suggested that macrophages play a significant role in this spontaneous resolution of the infection's symptoms. During inflammatory responses, pro-inflammatory M1 macrophages are present early in the response and then switch to anti-inflammatory M2 cells later and induce inflammation resolution. We hypothesize that M2 cells produce cytokine and lipid mediators that induce arthritis resolution. RAW cells are a murine macrophage cell line and will be used for experiments. Cells will be treated with lipopolysaccharide (LPS) and gamma interferon (IFN-) to stimulate the M1 phenotype, or with IL-4 to stimulate the M2 phenotype. The cells will then be co-cultured with *B. burgdorferi* for various time points. Cytokine production, lipid mediator production, and bacterial killing will be measured using ELISA, EIA, and a phagocytosis assay. The contribution of M1 and M2 cells in the development and resolution of Lyme arthritis is unclear. This study will provide important information regarding the function of M1 and M2 cells during infection with *B. burgdorferi* and may provide clues for development of future therapeutics.

Ruiyao Yuan

Chengdu, Sichuan, China

Faculty Mentor: Dr. Jean Parsons, Textile and Apparel Management

Flowing White

Ruiyao Yuan and Jean Parsons

    Fashion is creative. It's an art form. I use fashion to express myself, and my personal style expresses my own personality and beliefs. The creativity courses I took last semester gave me new inspirations in a variety of different fields and helped me develop and improve my artistic skills. Fashion is not just about the clothes themselves, it's more about expressing stories and emotions. My inspiration for this project mainly comes from the architectural design called Heydar Aliyev Center of architect Zaha Hadid. Its unique use of curves establishes a continuous and flowing style. At the same time through this project, I also learned about the innovative and unique tailoring skills from a famous Japanese designer Shingo Sato. He has a high level of expertise in the transformation and reconstruction of the pattern design system. This gave me a new challenge in the field of pattern design and a whole new creative process to learn. In my design, my goal is to use various different white fabrics to give a richer sense of layering and depth. This project is both a challenge and a progress for me, and I benefit a lot from constantly trying new ideas.

Artistic Expression

Erin Zimmerman

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Junior
Biological Sciences; Ancient Mediterranean Studies

Art of Death: Can Religious Artwork Manage Existential Concerns of COVID-19?

Erin Zimmerman, Kate Bushnell, Jee Eun "Jenny" Park, Megan E. Edwards, Madhwa Galgali, Peter J. Helm, and Jamie Arndt

The human awareness of mortality perpetuates the potential for death-related anxiety. Terror Management Theory proposes that people use cultural worldviews to cope with this existential crisis, finding that people increase their reliance on cultural beliefs (and decrease openness towards other beliefs) when mortality is salient. Historically, many forms of art have displayed cultural beliefs, thus viewing worldview affirming artwork after reminders of death may return an individual to equilibrium. This study asked: can religious themed artwork help people manage existential concerns elicited by COVID-19? If threatening aspects of COVID-19 increase thoughts of death, and if worldview consistent art offers psychological protection, then Christians will rate Christian paintings more positively than Hindu paintings after reading threatening COVID-19 headlines (vs. benign headlines). Atheists were selected as a control group who should not be comforted by any religious art. An online survey recruited and randomly assigned participants (N = 390) to read threatening or nonthreatening COVID-19 headlines. Afterwards, participants rated previously piloted Christian and Hindu paintings, and reported their openness to experience.

Results indicated that threatening COVID-19 headlines increased thoughts of death. However, there was no interaction between participant religion and COVID-19 condition on painting ratings. Christians rated Christian paintings highly and Atheists rated paintings poorly regardless of condition. Interestingly, further analysis revealed a participant religion by COVID-19 condition interaction predicting openness to experience. Christians' openness remained constant regardless of condition, while Atheists' openness decreased in the threatening COVID-19 condition. Results suggest that existential threats may lower openness to experience, and worldview consistent artwork may offer psychological protection enabling people to maintain openness to experience. Specifically, Atheists' decreased openness after threatening COVID-19 headlines may be attributed to a lack of exposure to worldview affirming art. Additional studies will seek to better understand this possibility.

Behavioral/Social Sciences