2019 UNDERGRADUATE RESEARCH POSTER SESSION

Student Center Atrium

Thursday, September 5, 2019

11 AM - 2 PM

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ENGAGED LEARNING

Office of Research

2019 Undergraduate Summer Research Award Poster Session

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*McNair Projects

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*McNair Projects

An Exploratory Study to Assess Attitudes Related to Trauma-Informed Care Amongst Educators in an Urban High School Setting

College of Education and Human Services

Student Researchers: Kymaia Gadsden and Shaw Barney

Faculty Advisor: Dakota King-White

Abstract

Trauma impacts many students in urban high school settings. Experiences that are traumatic for students may have a lifelong effect on their learning and a negative impact on their academic achievement. However, educators in urban schools can have a positive impact on students academically, socially, and emotionally if they are equipped with trauma-informed strategies to support students. Assessing how trauma-informed educators are before providing interventions is an important factor. This study explored 14 educators' attitudes related to trauma-informed care in an urban secondary school using the Attitudes Related to Trauma-Informed Care (ARTIC-45) Scale. The scale has seven subscales (Underlying Causes of Problem Behavior and Symptoms, Responses to Problem Behavior and Symptoms, On-The-Job Behavior, Self-Efficacy at Work, Reactions to the Work, Personal Support, and System-Wide Support). Throughout the study, the researchers found that there were three subscales where the educators scored over 5.0 out of 7.0 which indicates favorable outcomes in these areas. This poster presentation presents a literature review pertaining to trauma-informed care in urban secondary schools, the results from the study using the ARTIC-45 Scale, and implications for practice to better support students in urban schools impacted by trauma.

A writing intervention for internalized racism among African American Students

College of Education and Human Services

Student Researchers: Ishani Pandit and Mengxi Yin

Faculty Advisor: Kelly Yu-Hsin Liao

Abstract

This study examines the effectiveness of an expressive writing intervention for internalized racism and psychological outcomes among African American students. Participants consisted of 40 African American college students who were randomly assigned to a control writing (write on a neutral topic) or an expressive writing condition (write about stereotypes and negative attitudes they have toward their ethnic group). They engaged in three writing sessions over the span of 3-days. The findings showed that there was a decrease in negative mood and an increase in positive moods in the expressive writing group compared to the control group. However, these changes were not statistically significant. Study's limitations and implications will be discussed.

Impact of dog restraint system on running gait while running with a canine – implications for injury risk

College of Education and Human Services

Student Researchers: Ryan Ambrose and Anna Brandt

Faculty Advisors: Mary Motley, Douglas Wajda, Kathleen Little, Kenneth Sparks, and Emily Kullman

Abstract

Intro: Many individuals choose to run with a dog for companionship, motivation, as well as safety. There are also many running groups dedicated to running with shelter dogs to improve their chances of adoption. However, the biomechanical impacts of running with a dog are unknown, particularly a dog that has poor leash behavior. **Purpose:** The purpose of this study was to investigate how different dog restraint system configurations affect the biomechanics of running, as well as the perceptions of runners regarding comfort, safety, and pulling behavior. **Methods:** Twenty-one healthy individuals (n=21, age = 35 y., weight = 153 lb., height = 66 in.) free of orthopedic injuries with experience running with dogs participated in the study. Participants ran a distance of 40 yds. with a 20-ft. pressure-sensitive walkway midway within the course six times without the dog for a control condition. This was followed by six more conditions each consisting of six passes over the course. The conditions of dog restraint systems were randomized and consisted of: standard nylon hand-held leash with harness, standard nylon hand held-leash with collar, bungee waist belt leash with harness, bungee waist belt leash with collar, nylon waist belt leash with harness, and nylon waist belt leash with collar. The dog utilized for this study was a 55-pound two-year-old mixed breed female. The following data were analyzed for each running condition: step length, stride length, stride width, step time, stride time, stride velocity, stance percentage, swing percentage, velocity, and cadence. Following completion of running, subjects were asked to answer a questionnaire regarding their preference of restraint configuration, regularly utilized restraint configuration, and any safety concerns. **Results:** Our data revealed that running with a dog significantly increases ($p < 0.05$) running velocity (Control = 335 cm/sec, Dog = 450 cm/sec; 34% increase), step length (Control = 118 cm, Dog = 144 cm; 22% increase), stride length (Control = 237 cm, Dog = 287 cm), stride velocity (Control = 335 cm/sec, Dog = 451 cm/sec), swing percentage (Control = 63.1%, Dog = 65.9%), and cadence (Control = 170 cm/sec, Dog = 188 cm/sec; 11% increase). Running with a dog also significantly decreases ($p < 0.05$), step time (Control = 0.35 sec, Dog = 0.32 sec), stride time (Control = 0.71 sec, Dog = 0.64 sec), and stance percentage (Control = 36.9%, Dog = 34.1%). Running with a dog does not significantly affect stride width. The majority of individuals preferred the harness. Regarding the leash system, 53% preferred the bungee waist belt leash and 47% preferred the nylon waist belt leash. **Conclusion:** Running with a dog increases step length more than cadence. This indicates over striding while running which is associated with an increased risk of musculoskeletal injury. Based on our findings, it may be beneficial for individuals running with a dog to specifically focus on increasing cadence while minimizing step length changes.

Mystery Solved: Who are TESOL faculty

College of Education and Human Services

Student Researcher: Karmel Abutaleb

Faculty Advisor: Elena Andrei

Abstract

Colleges of education struggle to recruit diverse teacher candidates and nationwide data shows college faculty are not very diverse, mostly being white. Future teachers who are trained in teacher education programs might be attracted to the profession based on who their teacher educators are. In this context, the question for this study is: Who are TESOL (teaching English to speakers of other languages) and/or bilingual teacher educators at Ohio and US universities? Data on faculty who are specialists and in charge of TESOL and/or bilingual teacher education was collected from publicly available university websites, specifically from 209 higher education institutions from a random sample of 34 U.S. states. The data collected includes 511 TESOL/Bilingual faculty. Descriptive statistics paint a portrait of who TESOL and/or bilingual teacher educators in Ohio and in the US are.

Getting What You Paid For: Online Novel Unit Plans

College of Education and Human Services

Student Researchers: Hayley Byrnes and Brooke Seitz

Faculty Advisors: Molly Buckley and Laura Northrop

Abstract

Abstract: The books that are assigned in grades 7-12 English classes are an important component of curriculum, as high-quality curriculum is linked to student outcomes and high-interest, diverse books are linked to student engagement. We have found that pre-service and in-service teachers often use online sources to to obtain instructional ideas and unit plans when teaching literature. This project examined both free and paid online resources for 14 commonly novels, including 7 classic books and 7 contemporary books. We found the overall quality of both free and paid unit plans to be high, although there was a large variation in the types of instructional activities included in the plans. Paying for a unit plan did not necessary guarantee a higher quality unit plan or one that included more instructional activities. Unit plans supported literacy as a dynamic concept, and included opportunities for multimodal activities and writing to learn. Although unit plans for classic and contemporary texts were quite similar, unit plans for contemporary novels included more projects and multimodal activities, while unit plans for classic texts included more vocabulary and organizational scaffolds, such as having a set calendar and timeline for unit completion.

Evaluating Three Methods for Recruiting Feedback in the College Classroom

College of Education and Human Services

Student Researcher: Katie O'Connor

Faculty Advisor: Paula E. Chan

Abstract

Feedback is critical to component to effective instruction in the college classroom (Hattie, 2009; Hattie & Timperly, 2007). In college classrooms, feedback is typically given through student evaluation of instruction (SEIs). SEIs are typically given near the end of the term to evaluate student's perspective on the course and instruction. This approach has limited value to the instructor during the term, because feedback is only received after the end of the course, and does not allow instructor to improve the instruction in a timely manner that impacts the current class. Further, some researchers have questioned the validity of SEIs for a number of reasons. For example, some researchers suggest high SEIs may reflect grading leniency, class size, or other variables such as gender or attractiveness (Centra, 2003; Simpson & Siguaw, 2000). The purpose of this study was to evaluate three methods of recruiting feedback in the college classroom. Authors will discuss results and discuss implications for college teaching.

Integrating Computer Science ideas in Mathematics Teacher Education

College of Education and Human Services

Student Researchers: Amanda Bosley and Katherine Sammon

Faculty Advisor: Patrick Wachira

Abstract

In recent years, significant time and resources have been invested in increasing access and opportunities to computer science (CS) for elementary school students in the US. However even with the increased advancements and initiatives to embed CS into the elementary school curriculum, little has been done to examine the curricular and pedagogical implications for teacher education, particularly for pre-service teachers. For these initiatives to be successful, there is a need to train preservice teachers to integrate CS concepts into their teaching to build capacity for k-8 ready teachers. The purpose of this project was to understand the implications of CS concepts for teacher preparation and how these can be integrated into the teaching of mathematics.

They say this is America, not Africa: Views of Parenting Challenges from Congolese Resettled Refugee Families

College of Education and Human Services

Student Researcher: Nadia Dabydeen

Faculty Advisors: Grace Huang and Eddie T.C. Lam

Abstract

In 2018, the United States resettled 45,000 refugees, forty percent of whom came from the Democratic Republic of Congo (DRC). Of the 49 states admitting refugees, Ohio was among the top three states in the number of resettled refugees. Relocated to a new country with a different language and culture than that of their own, resettled refugees face a number of challenges. One of the biggest obstacles parents face is raising their children in a new culture that comprises of different values and beliefs. The purpose of this qualitative study was to examine Congolese refugee parents' experiences and the perceptions of their own parenting challenges. The research employed semi-structured interviews. Thirty-one refugee mothers and fathers residing in the metropolitan area of Cleveland participated in this study. The findings revealed that the main challenge for Congolese refugee parents was coping with the impact of American culture and social interactions on their children and parenting. Four themes emerged: (a) *Peer Influence,* (b) *Early Pregnancy,* (c) *Children's Value of Freedom,* and (d) *Parental Involvement in Education*. The results also showed that the root of these challenges and concerns was the expectation of greater opportunity in the United States, which led to higher standards and a stronger desire for their children to achieve academic and future success. Implications were provided to inform professional practices, and a model was developed to support these research findings.

Manipulating Google? Using Search Engine Optimization ethically to increase access to community events for children with sensory and motor impairments

College of Liberal Arts and Social Sciences

Student Researcher: Mikayla L. Colston

Faculty Advisors: Anne H. Berry, Kelle DeBoth, and Madalynn Wendland

Abstract

Search Engine Optimization (SEO) allows businesses, individuals, and organizations to alter which search results appear for certain phrases as well as the order in which they show. This can be used in both ethical and unethical ways. Starting with the previous undergraduate student research on content management systems in the Summer of 2018, SEO can be used to help Participation in Leisure Allowing Access for everYone (PLAAY) on the Move reach those in the local community who can benefit from what PLAAY on the Move has to offer.

Web Pages appear in the search engines after computer generated crawlers navigate through the site. If the crawler detects that a site is worth indexing, then the site will be included in the database that the search engine pulls from. If the crawler determines the page to be unimportant or spam, the page will not be placed in the database. Based on this knowledge, the web pages needed to be altered to make sure all pages could be indexed.

Throughout researching keywords used by other local events targeting children as well as programs providing similar services, the content in the pages can be altered to increase search engine ranking. This process also allowed us to avoid redundancy and improve the navigation within the site. Through AB testing as well as studying Google trends and local keyword trends, we are working to increase the access of the PLAAY on the Move webpage. Through the research, using business profiles and phrasing such as “local fun for kids” will encourage users to engage more. Additionally, focusing on inclusivity and safety increases parental comfort as well.

Using Environmental Sensors to Collect Data and Monitoring Sensor's Data on an Android App

College of Liberal Arts and Social Sciences

Student Researcher: Goutham Bethu

Faculty Advisors: Anne H. Berry, Kelle DeBoth, and Madalynn Wendland

Abstract

PLAAY(Participation in Leisure Allowing Access for Everyone) is promoting mobility in young children through unique multi-disciplinary projects provides a PLAAY leisure experience while facilitating fun freedom, fulfillment and friendship for children of all ability levels. Conducting research on the environment sensors to collect the data like temperature, air quality, humidity, noise levels, lighting and monitoring the collected data by environmental sensors data in android app which helps for children with autism.

When Does Punishment End? Examining the Barriers to Reentry

College of Liberal Arts and Social Sciences

Student Researchers: Shelby Smith and Gabrielle Giuffre

Faculty Advisor: Meghan Novisky

Abstract

The prevalent and permanent issues surrounding mass incarceration are often forgotten when individuals are sentenced to prison. Because of the extensive formal and informal punishments individuals face from the court system, as well as from their peers in the community, formerly incarcerated individuals are likely to return to prison. Per the National Institute of Justice, forty-four percent of individuals released from prison will be arrested again within the first year of release. Although ninety-five percent of individuals held in prison will be released back to the community, resources for substance abuse, housing eligibility, job training, and a prosocial network of peers are scarce (National Reentry Resource Center). Through the analysis of thirty in-depth interviews with recently released individuals, we find five barriers are especially important to consider as formerly incarcerated persons return to society: employment, housing, a lack of social support, stigma, and mental and physical health problems. We argue that policy changes to the reentry process on the part of the prisons along with the community are theoretically likely to reduce recidivism rates and create contributing members of society.

Geophysical Investigations at the Fort Hill Earthwork Complex, Cleveland Metroparks, Rocky River Reservation

College of Liberal Arts and Social Sciences

Student Researchers: Michael Dodrill and Elizabeth Fritz

Faculty Advisor: Phil Wanyerka

Abstract

Geophysical and archaeological investigations were conducted this past summer at the Fort Hill Earthwork Complex located in the Rocky River Reservation of the Cleveland Metroparks. Our investigations have not only revealed when the earthworks were created and by which prehistoric culture group, but we also have uncovered data to suggest how they were constructed and for what possible purpose they may have served. Geophysical surveys, using both our fluxgate gradiameter and our ground penetrating radar, have turned up more than 30 magnetic anomalies suggesting that the site has many more secrets to reveal. In addition, we conducted extensive archival research at several local historical societies and museums looking for previously unpublished information about this site's initial discovery in the mid-1800s and for any additional information concerning the prehistoric occupation of the Rocky River Valley.

Was Inflation Really Missing During and After the Great Recession?

College of Liberal Arts and Social Sciences

Student Researchers: Blake Green and Timothy Skalsky

Faculty Advisor: Phuong Ngo

Abstract

In this paper we examine if inflation was really missing during and after the Great Recession based on an estimated New Keynesian Phillips Curve (NKPC). When model expected inflation is proxied by household expected inflation, actual inflation is persistently lower than the predicted inflation that is computed based on the estimated NKPC. So, inflation was missing. However, if we take into account factors that could potentially affect the price level, especially globalization and the slack of the U.S. labor market, the missing inflation puzzle disappears. In addition, if we use professional expected inflation or the breakeven rate instead of the household expected inflation as a proxy for model expected inflation, the missing inflation puzzle no longer exists. The result is robust to different measures of inflation.

The Production & Postproduction of a Documentary Film

College of Liberal Arts and Social Sciences

Student Researchers: Thomas Zavertnik and Keri Ficyk

Faculty Advisor: Cigdem Slankard

Abstract

This multimedia project is comprised of a short documentary and a virtual reality experience, tentatively titled *Say Goodbye*. This project aims to capture the story of a site-specific community art project in the Slavic Village Neighborhood in Cleveland, during which abandoned and blighted houses slated for demolition are transformed into temporary art installations.

Researching the Effects of Diversity on American Government and Politics

College of Liberal Arts and Social Sciences

Student Researchers: Sara Morgan, Seth Peaslee, and Allyson Rizer

Faculty Advisor: Joel Lieske

Abstract

Immigration is a deeply divided issue in the realm of U.S. domestic and foreign policy. The U.S. admits over one million legal immigrants per year, and although data widely varies, illegal immigrants enter at similar rates. With the newest waves of immigration comes skepticism about the impact of foreigners on U.S. communities. Arguments arise over whether immigrants benefit or hurt native born workers and community members. Do native born citizens perceive immigrants as a threat? Does this perception depend on their impact? Our research aims to answer these questions by examining three cities across Minnesota and Wisconsin. Each city varies in geographic location and population size, and therefore provides different insights on the effects of immigration. We used six indicators to measure the changing social demography of each city. Data was collected for the indicators from 1970 to 2017, and then were cross-analyzed to statewide and foreign-born averages. Qualitatively, we measured the perception of immigrants by examining news articles and city data for positive or negative attributions. Our results indicate that the impact and perception of immigrants is different across each city, and more research is needed to solidify our findings.

The Quality of Online Sex and Health Information for Sexual and Gender Minority Youth

College of Liberal Arts and Social Sciences

Student Researcher: Maranda Santoya

Faculty Advisors: Kimberly Fuller, Katherine Clonan-Roy, Elizabeth Goncy, and Shereen Naser

Abstract

Sexual and gender minority youth (SGMY) are exploring the internet and social media to answer questions about sex and health information. It is important to determine whether the information provided on online resources provides necessary and proper sex education for SGMY. The present content analysis will explore the online resources that SGMY use to learn about sexual health information and the opinions of SGMY on the quality and accuracy of the sources. Three semi-structured, in-person focus groups were conducted with 17 youth (aged 14-19) who identified as lesbian, gay, bisexual transgender, or queer/questioning. The transcripts were coded and analyzed using an inductive approach. Common themes were identified across youth narratives. Analysis indicates that much of the information SGMY explore has been educational and relevant when searching for sexual health information; however, the youth mention that not all of the information is realistic, safe, or inclusive to their needs. Results indicate the need to create easily accessible and accurate resources on the internet for SGMY. To provide quality services to SGMY, social workers must be educated on the opportunities and risks of online resources and be able to connect youth to accurate and applicable online sex and health resources.

**Supported by the McNair Scholars Program*

An Examination of the Relationship between Humiliation and Social Participation

College of Liberal Arts and Social Sciences

Student Researcher: Whitney Tyree

Faculty Advisor: Elaine Harper

Abstract

This study examines the relationship between humiliating experiences in both childhood and adulthood and social restriction level as an adult. Participants completed a two-part, web-based survey that included adapted versions of the Humiliation Inventory and the Participation Scale as well as demographic questions. Non-binary persons were found to have a significantly higher restriction level than men or women. Statistical analysis also indicated a strong positive correlation between humiliation and social restriction. The possible life-altering effect of being humiliated, particularly as a child, undergirds the need for dignity-based school policies that prevent humiliation from occurring in the school environment.

**Supported by the McNair Scholars Program*

The Role of STEM faculty in supporting African American Females in their Courses

College of Liberal Arts and Social Sciences

Student Researcher: Briana Nichols

Faculty Advisors: Edward J. Magiste and Julia C. Phillips

Abstract

African American women, and student of color, are disproportionately underrepresented in the fields of Science, Technology, Engineering, and Mathematics (STEM) in recent years. The completion rate of undergraduate studies among African American women must be increased to address this inconsistency in the STEM fields. This study will address the role faculty play in helping to improve graduation rates among African American women in the STEM fields.

This methodology will utilize a survey in four parts: (a.) faculty Demographics at a large Urban University; (b) faculty Teaching Strategies and Pedagogical beliefs; (c) Teaching Behavior; and (d) faculty-student interaction and success rate. The results will focus on the completion rate among African American women in the STEM fields. Results are currently pending.

**Supported by the McNair Scholars Program*

Therapies Used to Treat School-Aged Victims of Sexual Abuse

College of Liberal Arts and Social Sciences

Student Researcher: Ariel Bell

Faculty Advisor: Edward J. Magiste

Abstract

There has been a rapid increase in sexual abuse against school-aged children in recent years. These crimes are detrimental to school-aged children and frequently result in damaging effects bio-psychosocially. When the effects of sexual abuse are not addressed with effective treatments, the issues may manifest throughout the child's lifespan, into late adulthood, and beyond. This can lead to risky behavior as an adult and mental illnesses. Identifying effective therapies used to treat school-aged victims of sexual assault can be useful in moderating and mediating the consequences of sexual abuse and decrease the likelihood of the effects manifesting into adulthood. The objective of the present inquiry is to evaluate the most commonly used evidence-based therapies to treat school-aged victims of sexual assault. A meta-analysis will review 15 articles for therapies by frequency and categories: trauma-focused cognitive behavioral, play, and art. Preliminary results seem to indicate artistic forms of therapy are most frequently used to treat this population. The final results are currently pending.

**Supported by the McNair Scholars Program*

Intersections of Dance Artistry and Wellness: A Personal and Community Based Experience

College of Liberal Arts and Social Sciences

Student Researchers: Brittany Baran, Chelsea Davis, Alexandra Troicky, and Brian Ward, Jr.

Faculty Advisors: DeAndra Stone, Taylor Augustine, and Lynn Deering

Abstract

Four dance students engaged in two experiences exploring the intersection of dance artistry with wellness. The first was personally directed: using research on injury prevention and dancer wellness in application to the dancing body through artistically choreographed sequences. The second was community directed: creating and assisting in presenting a series of dance classes for participants at the Cleveland Clinic Rehabilitation Center to provide artistic experiences that encourage and motivate rehabilitation patients to participate in movement sessions.

Group 1 dancers learned choreography and studied general musculoskeletal anatomy. They created choreographic-specific cross-training routines to increase strength of particular muscle groups and other performance elements. Group 2 dancers helped create and present dance classes for patients at the Cleveland Clinic Rehabilitation Center. Lessons developed from the Dance for PD® curriculum model and interactions with community members diagnosed with Parkinson's Disease. Dances included movement initiated from environmental and story cues to foster engagement in expressive and rhythmic motion.

Group 1 recognized targeted choreographic-specific cross training as an effective process in which to prepare a dancer's body for the unique demands of performance, ultimately improving aesthetic qualities. Using choreographed sequences as part of regular training routines helps safeguard against injury and address particularly desirable aesthetics, which may not be adequately obtained from a standard dance class. Group 2 gained appreciation for sharing dance experiences outside of the dance studio. Community participants enjoyed opportunity for individual expression inspired by varied music styles used to accompany eclectic movement, ranging from fine to gross motor patterns. There was increased communication between the participants in the shared dance activities and social interaction was recognized as valuable, creating a sense of community that impacted participation.

Cleveland Linguistic Corpus

College of Liberal Arts and Social Sciences

Student Researchers: Lauren Vitas and Brenden Vanover

Faculty Advisor: Antonio Medina-Rivera

Abstract

The Cleveland Linguistic Corpus is a five-year project with the purpose of starting a collection of recordings from speakers of different languages in the Greater Cleveland Metropolitan Area. This year we focused on Spanish and Italian immigrants. In this presentation, we describe the profile and demographics of Italian and Hispanic immigrants in Cleveland. The linguistic corpus consists of 10 recordings from each group that include narratives and experience they encountered during their time of arrival, as well as their general experience living in the Cleveland area. The collection of recordings is a resource for future studies/research, and it will be available primarily to our linguistic students, so they can use them for their research projects in sociolinguistics, phonology, morphology and syntax. Recordings will also be available to other students and faculty member who show interest in working with these specific ethnic groups.

Genetic effects on gamete formation of mutations in Fanconi anemia complex and other cellular components

College of Sciences and Health Professions

Student Researchers: Ariana Chriss, Ala Elmashae, Maria Donatelli, Francisco Monge, and Jesus Monge

Faculty Advisor: Valentin Börner

Abstract

Gamete formation in mammals depends on the haploidization of parental genomes to maintain ploidy through generations. During meiosis, cells can identify and segregate homologous chromosomes based on homology-dependent physical linkages. Recently our lab has identified the proteasome and components of the Fanconi-anemia-pathway as key players involved in the formation of these linkages. Whereas proteasomes facilitate pairing between homologous chromosomes, Fanconi-anemia components oppose the formation of these linkages between identical sister chromatids. This project aims to identify the specific roles these cellular components play in these processes. Cells with proteasomes lacking the alpha 3 subunit, encoded by PRE9 in yeast, arrest in prophase I and for the most part fail to exit meiosis. We are currently developing a forward genetic screen that takes advantage of these mutants to find genes involved in this process to help us understand the role proteasomes play. To identify these candidates, we checked the effects of overexpressed genes in the sporulation efficiency (spore formation) and spore viability of pre9 mutants. During the development of the screen, I found that pre9 mutants fail to maintain the high copy plasmid containing the genes to be overexpressed. Therefore, hindering our ability to identify other cellular components that may have a weaker effect on pre9 mutants. Nevertheless, I was able to identify a proteasomal chaperone as a suppressor and a ubiquitin interacting protein as an enhancer. The loss of the high copy plasmid was dependent on the incubation time suggesting a role of PRE9 in 2u plasmid homeostasis. I will use the suppressor and an enhancer found as controls to optimize the screen. I will introduce an anchor away system to remove pre9 from the nucleus to control for the presence of Pre9 doing this along with having an enhancer and suppressor will help us to optimize the genetic screen.

Prey-Capture Response of African Clawed Frogs, Xenopus laevis, as a Function of Wave Size and Visual Features

College of Sciences and Health Professions

Student Researchers: Tatiana Ally, Jackson Casteel, Adam Syed, Katarina Tomac, and Kristy Tachji

Faculty Advisor: Jeffrey Dean

Abstract

Of the two primary mechanisms by which the African clawed toad, *Xenopus laevis*, exhibits prey-capture responses, lateral line detection is used to detect inconspicuous prey. Through the lateral line system present on the frog's body, the frog can predict the location and angle of the prey relative to its own location. One aspect that remains not strongly studied in the primary literature is the pattern of response as a function of wave size. The present study compares the responses of frogs to large and small waves, as well as choice between the two when both simultaneously occur. Swim distance is analyzed as a function of stimulus distance for each wave size.

The Effects of Large vs Small Wave Stimuli on the Swim Distance of African Clawed Toads (Xenopus laevis)

College of Sciences and Health Professions

Student Researchers: Tatiana Ally, Katarina Tomac, Adam Syed, Jackson Casteel, and Kristy Tachji

Faculty Advisor: Jeffrey Dean

Abstract

The aquatic amphibian, African Clawed toads, also named Xenopus laevis, have been used to conduct experiments to analyze their sensory system. Toads use their lateral line system to detect water movement on the surface of the water to locate and catch their prey. This experiment analyzes the toad's sensory system and the effectiveness of large and small wave stimuli on the toads' ability to detect and swim to their prey. The purpose of this experiment was to determine whether the swim distance of African Clawed toads is longer with large wave stimuli or small wave stimuli. Toads were put in an octagonal, glass-bottom aquarium where experiments were conducted using plastic rods and a motor to create wave stimuli. All experiments were recorded on video and analyzed by each frame to find similar trends in the data. The toad's swim distance was found by using a Delphi program to digitize the stimulus origin, initial, and final positions of the toads during testing. Statistical analyses for the data was calculated using Stat graphics.

Data Analysis of this study is pending.

**Supported by the McNair Scholars Program*

Optimization of Isolation of O-Linked Glycopeptides

College of Sciences and Health Professions

Student Researcher: Juwan Lee, Earnest James, and Victoria Rich

Faculty Advisor: Thomas Gerken[1]

Abstract

Mucin type O-glycosylation is a common modification of proteins in higher organisms found on cell surfaces and secreted proteins. O-glycosylation is important in a variety of biological processes from development, the control of serum phosphate levels, and playing role in vascular and heart diseases and cancer. A family of 20 transferases (GalNAc-Ts) initiate mucin type O-glycosylation in humans by adding the sugar GalNAc onto Ser or Thr residues on targeted proteins. Since several diseases and cancers are specifically linked to the expression of individual GalNAc-T isoforms, there is a need to fully understand and characterize their specificities and determine what their protein targets are. The GalNAc-Ts contain a lectin domain and a catalytic domain that our lab has shown are involved in what their protein targets are. Therefore, each GalNAc-T has its own unique combination of specificities that recognizes peptide sequence and prior remote and neighboring GalNAc substrate glycosylation.

There is a poor understanding of what sites glycosylated *in vivo* tissues and what transferase isoform(s) performs the glycosylation. This is difficult due to the heterogeneous nature of the O-linked glycans due to glycan chain elongation. In addition, the elongated glycans interfere with nearby protease sites, making it difficult to isolate O-linked glycopeptides. Together, these aspects make it difficult to obtain it and analyze sites of O-glycosylation in tissues. The Gerken Lab has developed a chemical approach using mild trifluoromethanesulfonic acid (TFMSA) that can trim the extended O-linked glycans to the GalNAc residue. This approach eliminates glycan heterogeneity, permits better protease cleavage by trypsin and allows efficient glycopeptide isolation by lectin chromatography and in addition, greater ease of mass spectrometry (MS) analysis. My work was involved in helping to optimize the TFMSA, Trypsinolysis and lectin isolation steps. This involved performing lectin based Western blotting of the TFMSA reaction time course, demonstrating the inactivation of trypsin after sample digestion and to demonstrate the GalNAc-glycopeptide binding capacity of the lectin columns. My work on the TFMSA reaction time course gave inconclusive results thus more work needs to be done here. My study of the trypsin inactivation by heat was successful and my binding studies of the lectin column demonstrated that one of the columns had been partially inactivated. In addition, I began the processing of heart and muscle tissues from mice. Overall, these studies will be useful for the development of analytical approaches for determining sites of O-glycosylation in multiple tissues and will eventually be very useful in understanding what steps are O-glycosylated and which GalNAc-T isoforms are involved.

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**Supported by the McNair Scholars Program*

How does knocking down specific genes cause dysregulation in metabolic pathways?

College of Sciences and Health Professions

Student Researcher: Jasline S. Rosario

Faculty Advisor: Shamone Gore Panter

Abstract

Atrial Fibrillation (AF) is an arrhythmia that can cause stroke, heart failure and several other complications. The purpose of this research is to see how knocking down specific genes can cause dysregulation in metabolic pathways in the mitochondria. Oxidative stress on the mitochondria aids in the development of Atrial Fibrillation. A technique called gene knockdown is essential because we can manipulate and reduce genes in favor of what we are trying to find. [We use this technique in C2C12 myotubes because they relate to the way a human's system works.] This needs to be done because if we can knockdown a certain gene, it could possibly aid in the prevention of atrial fibrillation and reduce the number of cases in patients.

**Supported by the McNair Scholars Program*

Testing effect of Co-enzyme A on longevity

College of Sciences and Health Professions

Student Researcher: Jordyn Musi

Faculty Advisor: Roman Kondratov

Abstract

Caloric restriction, the reduction of food intake without malnutrition, is a dietary intervention that has been proven to delay aging and increase lifespan in multiple organisms, ranging from the simple unicellular to complex primates. Caloric restriction (CR) affects many physiological systems and several cellular signaling pathways are implicated in the molecular mechanisms of CR, but the exact mechanism is still not well understood. Recently we found that CR increased the levels of coenzyme A (CoA) in the liver of mice. CoA is a cellular metabolite with a crucial role in a multitude of metabolic processes in the cell including beta oxidation and the tricarboxylic acid cycle. We hypothesize that increased CoA levels will affect metabolism and contribute to the beneficial effect of CR. In order to test for the possible involvement of CoA in control of lifespan, we will take advantage of one of the most popular animals models in the study of lifespan—the nematode Caenorhabditis elegans. In this pilot study we plan to increase CoA levels in C. elegans and assay its possible effect on lifespan.

Confirmation of interactions between TbTRF/TbTIF2 and several candidates identified from a large-scale pulldown of the TbTRF/TbTIF2 protein complex

College of Sciences and Health Professions

Student Researchers: Kylie Scott, Mustafa Husein, and Syntyche Ngalula

Faculty Advisor: Bibo Li

Abstract

Trypanosoma brucei is a protozoan parasite that causes fatal human African trypanosomiasis. While proliferating inside the mammalian host, *T. brucei* regularly changes the major surface antigen, VSG, expressed at its cell surface. This antigenic variation serves as a defense mechanism against the host's immune response. VSGs are expressed exclusively from loci immediately upstream of the telomere, a nucleoprotein complex at the chromosome end. Our lab identified *Tb*TRF that binds the duplex telomeric DNA directly and *Tb*TIF2 as a *Tb*TRF-interacting factor. *Tb*TRF and *Tb*TIF2 play essential roles in maintaining the telomere structure, stability, and integrity and also in suppressing VSG switching. To better understand telomere functions in antigenic variation, we have identified a number of *Tb*TRF/*Tb*TIF2-interacting candidates by a large-scale IP pulldown. The goal of this project is to establish *T. brucei* strains that express the tagged version of *Tb*TRF/*Tb*TIF2-interacting candidates. We have generated two plasmids as the template for PCR-based gene tagging. PCR products were transfected into *T. brucei* cells, and we have verified expression of the tagged-proteins in several resulting transfectants. Subsequently, we will confirm the interaction between these candidates and *Tb*TRF/*Tb*TIF2 by co-IP.

Growth and environmental conditions of trees in a forest management experiment: establishing baseline data and understanding spatial variability

College of Sciences and Health Professions

Student Researcher: Brooke Seitz

Faculty Advisor: Kevin Mueller

Abstract

Much land that was previously used for agriculture is now covered in young forests that have a high density of trees and invasive species, including non-native shrubs. As a result of these high densities, the trees in the forest are growing at a relatively slow rate which minimizes the value of the forest in regard to timber production, recreational use, and biodiversity. The purpose of this experiment is to assess alternative management strategies to increase the value of these forests at a more rapid rate. This experiment implements two treatments: *improvement cuts* in which poor quality and unhealthy trees are removed through both felling and girdling and *improvement cuts plus timber stand improvement* in which non-native shrubs and grapevines are removed through cutting and herbicide application.

The Working Woods at Holden Arboretum is a young forest on land previously used for agriculture. It is dominated by three tree species, *Acer rubrum* (red maple), *Acer saccharum* (sugar maple), and *Liriodendron tulipifera* (tulip poplar). Although many patches of the Working Woods contain dense clusters of non-native shrubs such as multiflora rose and glossy buckthorn, un-invaded patches are also common. Prior to initiation of the forest management treatments, growth rates were generally slow (<1% increases in size) for more than 200 monitored trees. Other preliminary findings of this experiment include substantial variation in growth rate among tree species, a positive correlation between tree growth and shrub cover (especially that of multiflora rose), and a positive correlation between tree growth and canopy openness (an indicator of light availability).

Plant community homogenization across an urbanization gradient

College of Sciences and Health Professions

Student Researchers: Caleb Lumsden and Megan Herrmann

Faculty Advisor: Emily Rauschert

Abstract

Biotic homogenization is a global phenomenon in which local specialist species are being replaced by non-native generalist species. This process reduces regional uniqueness by increasing the similarity of biological communities across space. This homogenization of taxa across the globe is due to human-mediated alterations to the environment, known as anthropogenic disturbances. Urbanization is a major process that drives local extinction of native species, replacing them with non-native, often invasive species. The purpose of this study is to assess the diversity of floral communities on an urban-rural gradient in the Cleveland metropolitan area. Using data from parkland surveys in the greater Cleveland area, we quantify alpha (site) diversity and beta diversity (species turnover between sites). In addition to assessing diversity of standing vegetation, the microbial and seed bank communities found in the soil of these various locations will be assessed as well. In analyzing data from exurban, suburban, and urban sites, we expected that the diversity of standing vegetation, as well as seedbank and microbial communities, will decrease with proximity to the urban core.

DNA isolation and fluorescent staining of Colpodella species in diprotist culture

College of Sciences and Health Professions

Student Researchers: Darshita Siddhpura, Troy Getty, and Kush Addepalli

Faculty Advisors: Tobili Sam-Yellowe and John W. Peterson

Abstract

Abstract: *Colpodella* sp. (ATCC 50594) was investigated using fluorescent labels targeting the cytoskeleton, RhopH3 specific antibodies targeting rhoptries and specific antibodies targeting the inner membrane complex (IMC) proteins IMC3 and IMC7. *Colpodella* sp. are free-living predatory protists phylogenetically closely related to the apicomplexan phylum, which includes important human pathogens causing malaria, toxoplasmosis and cryptosporidiosis. Two cases of human *Colpodella* sp. infections were reported in the literature and apicomplexan related lineages (ARLs) have been isolated from environmental samples. There are currently no antibody or nucleic acid probes for detecting Colpodellids in culture, clinical and environmental samples. In this study, *Colpodella* sp. were maintained in *Enterobacter aerogenes* bacterized Hay medium at 24ºC with the prey protist *Bodo caudatus*. We isolated genomic DNA from trophozoite and cyst stages from a *Colpodella* sp. diprotist culture and performed polymerase chain reaction (PCR) using primers targeting 18S RNA and RhopH3 genes. Antibodies specific for RhopH3, IMC3 and IMC7 were used in immunofluorescence assay for confocal microscopy to identify life cycle stages of *Colpodella* sp. in culture. RhopH3 specific antibodies was used in western blotting. Fluorescent actin-green 488 was used to fluorescently label and identify the distribution of actin in life cycle stages of *Colpodella* sp. and cells were treated with cytochalasin D to determine the role of actin in life cycle stages of *Colpodella* sp. Antibodies detected protein reactivity in different trophozoite and cyst stages by confocal microscopy, actin staining was distributed over the cell bodies of predator and prey and cytochalasin D treatment of cells in culture resulted in distortions of the tubular tethers connecting predator to prey. A 110 kDa protein was detected in *Colpodella* sp. by RhopH3 antiserum in western blotting. The morphological features identified in this study will aid identification of life cycle stages in clinical and environmental samples using nucleic acid and antibody probes in future studies.

Understanding consequences of meiotic cohesin formation in mitotic cells

College of Sciences and Health Professions

Student Researchers: Chris Cory and Elijah Smith

Faculty Advisor: Aaron Severson

Abstract

Cell division occurs through two processes, mitosis and meiosis. Mitosis is how somatic cells divide, whereas meiosis is how gametogenesis occurs. In mitosis, DNA is replicated then formed into chromosome pairs (sister chromatids) and pulled apart into two identical diploid (same chromosome number as parent) daughter cells. In meiosis, two cell divisions occur, the first resulting in homologous chromosome separation and the second resulting in sister chromatid separation; the net result is four daughter cells, each with only half of their mother cell's genetic information, all different from each other. In both of these processes, sister chromatids are held together by a tetrameric protein complex called cohesin with a ring-like structure. The cleaved kleisin subunit causes sister chromatid separation. Different kleisins are used in meiosis and mitosis. The roundworm nematode *Caenorhabditis elegans* (*C. elegans),* is widely used in genetic studies regarding cell division (meiosis and mitosis) due to its transparent anatomy, simple genetics, and similarities to human genetics. In *C. elegans,* the meiotic kleisins are REC-8 and COH3/4, whereas the mitotic kleisin is SCC-1. Only mitotic kleisins bound to chromosomes are degraded, allowing sister chromatid release, whereas unbound meiotic kleisins are degraded. It has been observed in our lab and others that REC-8 disappears right before meiosis in *C. elegans*, which is hypothesized to prevent missegregation, a possible result of meiotic kleisin presence in mitotically dividing cells. We hypothesize that if REC-8 persisted into mitotic cells, it would cause aneuploidy and infertility in the worms. To test this, PCR, gateway cloning, and plasmid construction will be used to create a transgene that has a heat shock promoter that will allow us to induce REC-8 into mitotically dividing cells in *C. elegans*. The transgene will have the heat shock promoter, the gene of interest, and a 3' untranslated region. Results of segregation will be analyzed with GFP tagging.

Crystallization of an Archaeal Dihydroorotase with ligands

College of Sciences and Health Professions

Student Researchers: Ryan T. Godin, Mohammed N. Alsabony, and Haley E. Newman

Faculty Advisor: Jacqueline Vitali

Abstract

Dihydroorotase (DHOase) is an enzyme which catalyzes the reversible cyclization of N-carbamoyl-L-aspartate (CA) to L-dihydroorotate (DHO) in the *de novo* biosynthesis of pyrimidines. At lower pH values, the biosynthetic reaction is favored (CA → DHO) while at higher pH values the hydrolysis of dihydroorotate dominates (DHO → CA). We are working with the enzyme from the hyperthermophilic archaeon *M. jannaschii*. We are interested how the structure and function of this enzyme adapt to high temperatures that are the normal environment of *M. jannaschii* and how these differ from other DHOases. In addition, *M. jannaschii* serves as model organism for research purposes. During this summer we prepared the protein using a known procedure (Vitali et al, *Protein J*, **36**, 361-371, 2017). This involves ammonium sulfate precipitation, a heat step, and then cation exchange and hydrophobic interaction chromatographies. We then focused in preparing crystals of the enzyme with the two substrates, CA and DHO, at different pHs using the hanging drop method. In addition we prepared crystals in the presence of 5-fluoroorotic acid (FOA), a DHO analog. The results of these efforts will be presented. The structures of the complexes at different pHs will give insight in the DHOase reaction at the molecular level.

Regulation of the transcription factor p53 in skeletal myoblasts cultured in differentiation media

College of Sciences and Health Professions

Student Researchers: Regina Bellian and Victoria Bensimon

Faculty Advisor: Crystal M. Weyman

Abstract

Programmed cell death (apoptosis) is induced by the same culture conditions as differentiation in skeletal myoblasts, yet these processes result in distinct physiological endpoints. Dissecting this coordinate regulation could enable selective manipulation relevant to the effectiveness of regeneration or treatment utilizing skeletal myoblast transfer. We have recently reported that the transcription factor p53 cooperates with the MyoD transcription factor to increase the expression of PUMA and thus regulate apoptosis. This increase in PUMA ocurrs only during S-phase of the cell cycle implicating a role for DNA damage in the form of replicative stress. Acetylation of p53 is an indicator of the activation of p53 in response to DNA damage. Herein, we report that total p53 levels remain constant in G1-phase and S-phase of the cell cycle. However, levels of acetylated p53 are detectable only in S-phase of the cell cycle, consistent with the increase in PUMA levels during S-phase. To further these studies, morphological differentiation (fusion of individual myoblasts into multinucleated myotubes) must also be assessed. To this end, we have determined that plating myoblasts at 2 million cells/100 mm dish followed by culture in 15% horse serum for 48 hours was the optimal condition to assess morphological differentiation.

Temporal Changes in Cuyahoga River Water Chemistry

College of Sciences and Health Professions

Student Researcher: Alexandra Ferkul

Faculty Advisor: Julie A. Wolin

Abstract

Point source pollutants, such as untreated sewage rich in phosphorus and nitrogen, have been regulated by the Clean Water Act of 1972 and should be in decline in local river systems. On the other hand, non-point source pollutants, such as runoff with road salt are harder to regulate and an increase in urbanization has likely led to an increase in the usage of road salt in the winter months. Data collected from November 1981 to September 2018 and compiled by the National Center for Water Quality Research will be used to show changes in ion concentrations in the Cuyahoga River and the possible effects of the implementation of the Clean Water Act. For days with multiple values recorded, an average is taken to create a set of average recorded daily values to compare across three periods of time: 1982-1986, 1998-2002, and 2013-2017. A One-Way ANOVA in addition to a Games-Howell or Tukey post hoc tests are ran to show any statistically significant differences between time periods. The results of the statistics tests suggest that there has been a significant decrease in Total Phosphorus and Total Nitrogen levels, but that the current values are still above recommended concentrations. Chloride levels have increased, but have not exceeded recommended maximums indicating chronic toxicity.

Investigating Discharge Patterns and Trends in Flood Frequency in the Cuyahoga River, OH

College of Sciences and Health Professions

Student Researcher: Lauren Egensperger

Faculty Advisor: Julie A. Wolin

Abstract

Understanding the risks associated with flood events and elevated discharge levels is essential in order to ensure that homeowners and institutions are prepared for potential hazards. Monitoring discharge patterns may also provide insight regarding fluctuations in water quality and remain an important factor when determining how to manage these resources. This research aims to reveal whether or not current precipitation and discharge circumstances are among the most extreme seen in recent history. The study also seeks to examine average discharge data and evaluate how the streamflow experienced in the spring and summer of 2019 compares to historical trends. This may lead to conclusions about how frequently periods of extreme flooding, associated with prolonged instances of heavy precipitation have occurred. These patterns were determined by analyzing United States Geological Survey data from the 1920s to the present at three different locations along the Cuyahoga River (Hiram, Independence, and Old Portage). This information was used to create recurrence interval graphs which quantify flood frequency. Results from this investigation suggest that in some regions, current discharge levels have a less than 0.10% chance of occurring in a given year. We can also conclude that discharge has been increasing in recent decades as earlier years show peak discharge events with lower values. Implications associated with these findings include increased ability to forecast high discharge events. Future studies should focus on determining how other factors such as land use modifications and shifting climate conditions may impact peak discharge.

Beyond Total Phosphorus: A historical comparison of phosphorus loading in Lake Erie tributaries

College of Sciences and Health Professions

Student Researcher: Edward Plumb

Faculty Advisor: Fasong Yuan

Abstract

Eutrophication contributing to harmful algal blooms has been a problematic phenomenon in freshwater systems globally for the last half century. Phosphorus is widely considered the primary micronutrient contributing to algal growth, and while total phosphorus (TP) loads to Lake Erie have declined, eutrophication continues to be a problem, as evidenced by the massive algal events in 2011 and 2015. Suspended sediments from five Lake Erie tributaries were collected and analyzed for phosphorus fractions, using the methods of Logan et al. [*Journal of Great Lakes Research*, **2**, 112-123 (1979)]. Sediment was fractionated sequentially by NaOH, citrate-dithionite-bicarbonate (CBD), HCl, and persulfate digestion. The results confirmed a decline in total phosphate concentration of Eastern tributaries since 1979 but did not provide evidence of a similar decline in Western tributaries since 1979. A decrease in the CBD-P fraction, associated with non-apatite phosphorus was noted across all tributaries except the Maumee River relative to 1979 levels.

DHI-Melanin Polymerized Glassy Carbon Electrode as Potential Interfaces for Peroxynitrite Determination

College of Sciences and Health Professions

Student Researchers: Gina Pignataro and Ousama Al-Mahmoud

Faculty Advisors: Haitham Kalil[1] and Mekki Bayachou

Abstract

In vivo, excessive concentrations of peroxynitrite are associated with several pathologies, such as arthritis, inflammation, and carcinogenesis, as well as aging-associated diseases. Accurate detection of this analyte in biological media is highly important to understanding the causes of ailments at the cellular/tissue level; it is also essential to the design of potential therapies for such conditions. Melanin is a natural pigment that has many physiological functions involving the neutralization of highly oxidative species. Recent studies have suggested that melanin can act as an antioxidant; scavenging the reactive oxygen-nitrogen species (RO-NS) including peroxynitrite (PON). A derivative of tyrosine, 5,6-dihydroxyindole (DHI), is a precursor of eumelanin. Eumelanin is a dark colored form of melanin that is photo-stable. DHI was used to polymerize a synthetic melanin film on glassy carbon electrodes (GCEs). This study focused on the potential of DHI-melanin modified GCEs as an electrochemical sensor for determination of peroxynitrite concentration through differential pulse voltammetry (DPV). Furthermore, the physicochemical characteristics of the polymerized DHI as a model of synthetic melanin were examined using ultraviolet-visible (UV-Vis) spectroscopy and Scanning Electron Microscopy (SEM). Scanning electron microscopy (SEM) was used to provide images of the change on the synthetic melanin films coated ITO slides before and after exposure to PON. We aimed to evaluate the implication of the changes of the electrochemical signal of DHI films due to exposure to PON. Previous research using UV-Vis spectroscopy has provided evidence supporting a dramatic difference between the decomposition rates of peroxynitrite alone and in the presence of DHI films. The reactivity of peroxynitrite in the presence and absence of DHI films will be examined in this work. Henceforth, we shall report on the possibility of using the synthetic melanin nanoparticles as a quantitative, sacrificial peroxynitrite sensor though the electrochemical analytical technique, differential pulse voltammetry.

[1]*Research Associate*

Synthesis of a fluorescent tag probe of a Prazosin analog to study the anti-trypanosome mechanism

College of Sciences and Health Professions

Student Researchers: Jovana Hanna and Cody Orahoske

Faculty Advisor: Bin Su

Abstract

African Trypanosomiasis is neglected tropical disease which is predominately diagnosed in Sub-Sahara Africa. It is carried by a tsetse fly that infects the host during a blood meal. The end effects of the sickness are fatal due to the invasiveness of the trypanosomal pathogen into the brain of the patients. Current medications do not adequately cure patients; they suffer from major side effects and or economic constraints. Therefore, we are currently synthesizing new drugs to target Human African Trypanosomiasis, also known as African sleeping sickness. Previously, from high throughput screening assay, our lab identified two lead compounds, prazosin and doxazosin, which are clinical alpha 1 blockers to treat high blood pressure and benign prostate enlargement. In fact, these drugs target Trypanosomal cells with an unknown novel mechanism, since trypanosomal cells do not have alpha adrenoceptors. A synthesized analog library of prazosin was tested which led to the identification of compounds with much better activity against trypanosomal cell growth. To identify the new molecular target of these compounds for their anti-trypanosomiasis activity, a biotin-streptavidin affinity chromatography pulldown assay was performed, and with LC/MS/MS and a target protein was identified. The potential target is translational elongation factor 1 beta (EF-1b) (Tb 927.10.5840). Evidence suggests that EF-1b plays an essential role in blood stream form of trypanosoma[1]. The mechanism of how it affects fidelity in non-conical and not fully understood, the protein has yet to be crystalized[2]. To further explore the molecular mechanisms of these prazosin analogs, we synthesized fluorescent compounds that will potential show the location where the drug is binding. The synthetic pathway takes advantage of click chemistry by using a terminal alkyne to react with an azide moiety. This “click chemistry” reaction is performed in an aqueous workup with recrystallization to purify. We used nuclear magnetic resonance carbon and proton spectrum to confirm the structure of the two fluorescent compounds. To check if the compounds retained the anti-trypanosomal activity, MTS assay was preformed, and these probes will be used in the imaging with alive trypanosomal cells in future studies.

Synthesis and Evaluation of Sialidase Inhibitors

College of Sciences and Health Professions

Student Researchers: Taryn Boslett and Joseph Keil

Faculty Advisor: Xue-Long Sun

Abstract

Sialic acids (SA) are 9-carbon acidic monosaccharides that present on the terminal of both glycoproteins and glycolipids on the cell surfaces. The regulation of SA on cell surfaces is due to sialidase catalytic activity. Sialidase is the enzyme that cleaves the terminal SA off cell surfaces. Cleavage of SA from cell surfaces elicits an immune system response by initiating a cascade that results in an increase of pro-inflammatory cytokines, causing a cellular immune response. Sialidases becomes highly present to the cell when there is an increase of LPS that binds to the TLR-4 receptor on the cell surface, causing more SA to be cleaved, and a pro-inflammatory cytokine release. We propose that the immune response can be manipulated by inhibiting the endogenous sialidases in LPS-stimulated cells through sialidase inhibitors. In this study, novel sialidase inhibitors were designed and synthesized in a multi-step reaction using the typical sialidase inhibitor structure of Neu5Ac2en, along with an N_3 group at the 9-C position. The resultant sialidase inhibitors were characterized by ^{1}H and ^{13}C NMR spectra. Their sialidase inhibition assay with THP-1 macrophages is planned by evaluating pro-inflammatory cytokine production. It is expected that the novel inhibitors will be effective in manipulation of LPS-induced immune response of macrophages.

The role of RNase L in macrophage lipid homeostasis

College of Sciences and Health Professions

Student Researchers: Mustafa Alrahem and Ruhan Wei

Faculty Advisor: Aimin Zhou

Abstract

Macrophage-derived foam cell formation is a milestone of the atherosclerotic lesion initiation and progression. The formation of foam cells results from the disruption of a homeostatic mechanism that manipulates the uptake, intracellular metabolism and efflux of cholesterol within macrophages. Although studies have yielded much information about the homeostatic mechanism, the molecular basis of foam cell formation remains to be fully understood. RNase L is an enzyme that plays an important role in interferon action against viral infection and in the control of cell proliferation. Interestingly, we found that deficiency of RNase L attenuated macrophage functions and mediated the expression of certain pro- and anti-foam cell genes as well as proinflammatory factors in macrophages. In addition, lack of RNase L significantly increased the formation of foam cells in BMDMs. The increase of foam cell formation was associated with up-regulation of the expression of scavenger receptors such as CD36, SR-A, and PPAR-gamma. Our findings elucidate the role of RNase L in the function of macrophages and provide mechanistic insights into foam cell formation, novel therapeutic strategies for atherosclerosis may be designed through the regulation of RNase L.

Development of Kinematic Measures of Intensity for Balance Training Activities

College of Sciences and Health Professions

Student Researchers: Emily Meisterheim and Drew Matthews

Faculty Advisors: Debbie Espy and Ann Reinthal

Abstract

After a severe injury or health incident, physical rehabilitation is crucial to regaining adequate balance and mobility. Videogaming is growing in popularity as a form of therapy, but a method to objectively measure training intensity has not yet been developed for this treatment. The purpose of this study was twofold: 1) analyze the Kinect games used for balance training and determine what elements of the game reflect its intensity as a balance/mobility training intervention and 2) to automate the ability to analyze motion capture data to quantify the intensity elements identified. Observations and motion capture data from individuals playing video games were used to determine intensity measures including single-leg stance, medio-lateral stepping, anterior-posterior stepping, weight shifting, and rotation. Intensity related kinematics were then identified for each game.

The videogame "Table Tennis" on the Xbox Kinect ® was analyzed first and that process is described here as the exemplar for the overall project. The excursion and velocities of the swinging arm were two intensity measures for this game, thus, it is necessary to know when each swing in a given trial is occurring. Code was developed using Matlab to identify swings, setting conditions on the direction-dependent velocity data from the motion data in order to find the number and timing of swings. Swings were defined as at least 1000 (mm/s). The beginning of each swing is found by searching for local minimums below zero that are located behind a local maximum greater than 1000 (mm/s). The end of the swing was determined to be when all velocities in each direction (x, y, and z) were within some tolerance of 0. The code then uses the swing location information to analyze intensity measures between the start and end of each swing.

The researchers identified the movements that represent greatest balance challenge points, for example arm swing in table tennis. The code was successful in identifying the occurrence of an arm swing during this game. This allows researchers to more easily analyze the balance intensity of gameplay. The ability to objectively determine intensity while videogaming will assist in analyzing it as a form of care and facilitate its movement into the clinical setting.

Rodent Neurophysiology/Molecular Biology in Brainstem Stress Response

College of Sciences and Health Professions

Student Researchers: Jerrell Walker and Justin Wobser

Faculty Advisors: Michael Hammonds, Tony Sahley, and Brian Woodside

Abstract

PURPOSE: Was to investigate the locus coeruleus stress response by measuring corticosterone levels in blood and urine using a corticosterone Enzyme-linked ImmunoAssay Kit (ELISA). The process of performing in-vivo stereotaxic neuron simulation in mice was followed by fixation of the brain by perfusion with formalin and brain removal.

METHODS: Prior to the experiment baseline urine samples were collected from the mice in the morning when corticosterone levels are the lowest. Mice were later anesthetized then placed into a stereotaxic surgical apparatus. Stimulating and recording electrodes were inserted in the brain using anterior-posterior, medial-lateral and dorsal-ventral measurements from bregma located on the skull of the mouse in order to record neuronal activity. Once the simulation was completed, a blood sample was collected and perfusion started. After the perfusion, the brain was removed for histological verification of electrode placement. Using molecular biology, both blood and urine corticosterone levels were measured using an Enzyme ImmunoAssay Kit.

ANTICIPATED RESULTS: Locus coeruleus-stimulated mice were expected to show higher levels of corticosterone than non-stimulated controls.

Development of a Tool that Captures Student Adaptation to University

College of Sciences and Health Professions

Student Researcher: Diana Leonardo

Faculty Advisor: Karen Keptner

Abstract

The theory of occupational adaptation proposes that human beings move through transitional phases of life where they must adjust their expectations, roles, habits, and behaviors in order to achieve "success". Currently there is not a tool that captures the experience of emerging adults that attempts to quantify their feelings of 'success'. The objective of our research was to develop a tool that can capture emerging adult perceptions of the transition to adulthood. The steps to creating an assessment tool include creating the first drafts, expert review, field testing, and pilot testing. During the first draft, we compiled questions targeting occupations needed to transition through emerging adulthood. These questions were evaluated by experts and occupational therapists who use occupational adaptation in their practice. Feedback from two students were collected and then revisions were made to the questions and format of the tool. Literature review was conducted on established tools that will be used during the pilot phase of testing. Pilot testing will not commence until all occupational therapists achieve consensus on all questions.

First Generation Students and the Influence of Support Resources

College of Sciences and Health Professions

Student Researcher: Nautica Bell

Faculty Advisor: Karen Keptner

Abstract

First generation college students who enter in to a 4 year university will not all make it through those 4 years because of lack of support or not having the proper skills that are needed to be successful. The purpose of this study is to focus on undergraduate students and executive functioning skills in correlation to first generation students versus non-first generation students. The question investigated is: Does a non-first generation student have better executive functioning skills than first generation students? Does having support from friends, family, professional advisors, and professors make a difference in a college student getting through school successfully? It is hoped that this study will inform researchers and others about how there is a difference between first generation students and non-first generation students in correlation to executive functioning skills. The correlation of emotional and academic support to first generation students will also be analyzed and hopefully understood. For this study we asked students to take a demographic survey and 2 self-reports/assessments, Brief-A and ATMS for executive functioning skills. After analyzing all data and variables, we found that there was no correlation or significant findings to executive functioning skills and being a first generation college student. We did find some variables that stood out such as the correlation of first generation students and the emotional and academic support that they receive. Results showed that the most emotional support was received from family and friends/peers and academic support was received more from professional advisors and professors.

**Supported by the McNair Scholars Program*

Adapted Explicit Instruction for Teaching Letter-Sound Correspondences to Individuals with Complex Communication Needs

College of Sciences and Health Professions

Student Researchers: Amy Roth, Emily Sternad, and Carley Shermak

Faculty Advisor: April M. Yorke

Abstract

Literacy is important for all individuals. However, for people with severe communication disabilities who require augmentative and alternative communication (AAC), literacy skills are crucial. For this population, literacy is the gateway to endless communication—the ability to communicate any message you wish. This freedom of communication is a fundamental right. Unfortunately, approximately 90% of individuals who require AAC are entering adulthood without functional literacy skills (Foley & Wolter, 2010). Letter-sound correspondences, blending, and segmenting are the primary skills necessary for teaching reading (decoding) and writing (encoding). This study reviews methods that have been used to teach letter-sounds to individuals who require AAC and presents two new access methods, 3D letters and a velcro QWERTY board. These new access methods are then used in combination with explicit instruction to teach letter-sound correspondences to two children with autism spectrum disorder and intellectual disability. Results indicate gains in letter-sound correspondences for both participants.

The Contributing Factors of the Retention of Math Corps Cleveland participants

College of Sciences and Health Professions

Student Researcher: Saiida Bowie-Little

Faculty Advisor: Carol Phillips-Bey

Abstract

The Math Corps at Cleveland State University provides children with a sense of family and peer development, high standards and expectations, and challenging mathematics that incorporates cooperation as a skill of strength. The Math Corps at Cleveland State University Summer Camp has been operating for 7 years and has seen a return of participants, where participants are people who have applied, been accepted, and attend the program (in any role that Math Corps at Cleveland State University offers). This paper serves as an investigation of why participants have returned (or not) to Math Corps at Cleveland State University over the course of the Summer Camp operation.

**Supported by the McNair Scholars Program*

Characterizing the Relationship of Temperature, Ethanol Concentration, and Turbidity of Absinthe

College of Sciences and Health Professions

Student Researcher: Anna Ellis

Faculty Advisors: Andrew Resnick and Jessica Bickel

Abstract

Oil flavored alcohols are traditionally served by mixing them with cold water to form a louche: a microemulsion that turns the drink opaque. This is because of how the alcohol interacts with the water, which it dissolves, and the oil, which it disperses. Thus, when there is sufficient water the oil phase precipitates, forming a microemulsion (the louche). This means that a characterization of the louche depends on the concentration of water, alcohol and oil. The louche of absinthe has not been as well characterized as other oil flavored alcohols such as Limoncello or Ouzo. This study aims to investigate the emergence of the louche phase in Absinthe by measuring the optical transmittance of Absinthe as a function of both: (1) the concentration of ethanol and (2) the temperature, which can be separately varied. The laser transmission was measured through a temperature-controlled sample of absinthe. The change in transmission was recorded as water was added to the sample, revealing an inverse relationship between temperature and ethanol concentration at which louche forms. This unique project provides a light-hearted introduction to the fields of critical phenomena and materials science.

Uncovering the relationship between entrainment and cloud size

College of Sciences and Health Professions

Student Researcher: Theresa Lincheck

Faculty Advisors: Shawn Ryan and Thijs Heus

Abstract

Clouds are one of the most important contributors to the regulation of the weather and global climate, yet their complexities make them extremely difficult to accurately predict in climate models. One of these complexities is entrainment, or mixing, of environmental air into clouds which causes clouds to cool and evaporate over time. In this study, we investigate the dependency of entrainment on cloud size by evaluating data from several Large Eddy Simulations. Results from this study demonstrate that the amount of entrainment varies across simulations and cases and may depend on the order of averaging in calculating entrainment values, the precision of the simulation, or the type of simulation used itself. However, in general we only find a dependency of entrainment on cloud size for the smallest clouds, which is in contrast with common assumptions in climate models.

Cloud Watching: Using Images to Analyze Shallow Cumulus Clouds

College of Sciences and Health Professions

Student Researcher: Justin Thompson

Faculty Advisors: Shawn Ryan and Thijs Heus

Abstract

The interaction between clouds and the environment is a driving force in climate models, and we are seeking to create techniques to analyze these phenomena. Total Sky Imager (TSI) is an observational technique through the use of images. In this study, we use cloud fields generated through Large Eddy Simulations (LES), then converted into imitation TSI videos using blender, to validate algorithms used on real would TSI cloud fields. Through a three way comparison, we can validate not only the TSI algorithm against a simulated truth, but also the LES simulations against the observations.

Using Depolarized Dynamic Light Scattering to Study Microgel Volume Phase Transition

College of Sciences and Health Professions

Student Researcher: Andrew Scherer

Faculty Advisor: Kiril A. Streletzky

Abstract

Microgels, for the purpose of this study, are crosslinked polymer (hydroxypropyl cellulose, HPC) particles suspended in water. These microgels exhibit a thermally reversible volume phase transition as a result of the amphiphilic properties of the parent polymer. Specifically, the microgels deswell above a volume phase transition temperature, Tv. Microgel dynamics below and above Tv have been studied extensively by dynamic light scattering (DLS) before. Here, HPC microgel shape fluctuations and/or geometric anisotropy is investigated through the technique of depolarized dynamic light scattering (DDLS). The technique has previously been used in our lab to examine geometric anisotropies in nanorods, nanorice, nanodiscs and other shapes. It has also been used in the literature to study shape fluctuations in microgels that have a hard, polystyrene core and a soft, polymer shell ("core-shell microgels). The current study shows that HPC microgels, consisting only of polymer with no built-in hard core, do exhibit a DDLS signal distinct from a polarized signal, both below and above the transition. The origin of this signal, which can arise from either geometric anisotropy or shape fluctuations, is being examined in detail for a series of microgels of different densities crosslinked at various synthesis temperatures. Preliminary results suggest that our samples undergo shape fluctuations, but further experiments are needed to confirm this.

The Effects of Personality on Dyadic Discussions of Dating Violence

College of Sciences and Health Professions

Student Researcher: Kayla Barillas

Faculty Advisor: Elizabeth Goncy

Abstract

Dating violence in the United States is a prevalent topic of discussion that has recently accumulated a heavy amount of discussion both from influential leaders as well as the general public, especially in regard to the MeToo Movement. Dating violence has significantly impacted the way we study intimate young adult relationships. Personality traits affect every aspect of daily behavior and responses to situations individuals experience throughout their lifetime, including the way partners in a relationship behave and respond. Using McCrae and Costa's Five Factor Model of Personality, the "Big Five" traits that were examined are Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. By analyzing the results of a personality inventory, four traits: Openness, Conscientiousness, Agreeableness, and Neuroticism, were hypothesized to show correlated data to responses on dyadic dating vignettes. After the study was completed, only Extraversion and Openness showed significant results. Through the use of this study, the effect that personality has on young adult relationships can be better understood. In addition, this study may be beneficial to the development of new measuring techniques.

**Supported by the McNair Scholars Program*

Border Keepers and Work/Nonwork Balance

College of Sciences and Health Professions

Student Researchers: Katie Kyser and Christine Lowe

Faculty Advisor: Michael Horvath

Abstract

Innovations such as technology allow for an increased blending of work and family roles (e.g., working from home at night, answering texts from family during work hours). Consequently, individuals may engage in different styles of boundary management – some allowing and encouraging the domains to mix and others keeping work and family as separate as possible. Differences between preferred and actual boundary management may lead to work-family conflict. Furthermore, borders are maintained not just by the employee but by the rest of the family (i.e., border keepers), and differences in preferences of family members may also lead to conflict. In our study we examined how couples manage these boundaries. At Time 1 we surveyed the partners of employed individuals, assessing factors such as marital satisfaction, preferences for boundary management, and enacted boundary management. We then taught a random sample a technique designed to communicate boundary management preferences and instructed them to use this technique when communicating with their partner. Approximately one week later we surveyed the participants (again) as well as their employed partners to examine effects on satisfaction, communication, and boundary management.

The Role of Future Time Perspective and Role Identity in Work Behaviors

College of Sciences and Health Professions

Student Researcher: Kiara Gray

Faculty Advisor: Michael Horvath

Abstract

Socioemotional Selectivity theory developed by Carstensen, Isaacowitz, and Charles (1999) has established that the way time is perceived (as expansive and full of opportunities or limited and full of limitations) influences the way an individual behaves. This is known as future time perspective. There is very little research applying this concept to job performance. Therefore, the present study analyzed the impact of future time perspective on the engagement in counterproductive work behaviors and organizational citizenship behaviors with respect to an individual's role identity. We found that a focus on limitations at work and at home are both positively related to CWB, but not related at all to OCB.

**Supported by the McNair Scholars Program*

Electrophysiology of Repetition Priming for Pseudowords and Words

College of Sciences and Health Professions

Student Researchers: Ashley Banks and Megan Farrell

Faculty Advisors: Robert Hurley and Conor M^{c}Lennan

Abstract

Listeners typically recognize words they have heard recently more efficiently than words they have not heard recently; this is known as a *repetition priming effect*. When looking at Event Related Potentials (ERPs), which are the averaged encephalographic brain responses to a class of stimuli, it has been demonstrated that the repetition priming effect is observed in both early and late ERP time windows (Massol, Grainger, Midgley, & Holcomb, 2012). ERPs in early time windows (~150-300ms) are thought to reflect auditory sensory processing (Woodman, 2010) (Massol et al., 2012) (Coch & Mitra, 2010), while ERPs in late time windows (~400-700ms) are more sensitive to access of stored lexical representations (Kutas & Dale, 1997). We hypothesize that the repetition of pseudowords will primarily be reflected in early time windows (indicating only auditory sensory processing), while repetition of real words will occur in both early and late time windows. While we have yet to complete the study and obtain ERP data, preliminary data from 10 participants who participated in the visual norming piloting of stimuli has shown that averaged reaction times (RT) for pseudowords (RT=672.63ms) were significantly greater that reaction times for their corresponding low frequency words (RT= 612.96ms). The low frequency range for words was increased from 0-2 to 2-3 (Log SUBTLEX Frequency) in order to create a stronger set of stimuli.

**Supported by the McNair Scholars Program*

Understanding school level variables in discipline disproportionality

College of Sciences and Health Professions

Student Researcher: Geetha Somarouthu

Faculty Advisor: Shereen Naser

Abstract

African American, Latinx and Native American youth are disciplined at disproportionately higher rates than their peers (Ksinan et al., 2019; Skiba et al., 2008). These discrepancies in disciplinary practices are most prevalent in schools serving students from lower SES communities, and in schools in the Midwestern U.S. (Ksinan et al., 2019). Researchers have long advocated for better aggregation of school level data to address these discrepancies, but few studies exist that take a person centered approach to understanding why these discrepancies exist. Evidence exists to suggest that teacher perception of student behavior, facilitated by teacher characteristics such as implicit bias, plays a significant role in who gets disciplined in schools and who doesn't (Okonofua & Eberhardt, 2015). This study uses a qualitative approach to analyze teacher reactions to student behavior in a vignette study. Results indicate that that when teachers are given vignettes indicating student race as African American, they are more likely to make overgeneralizations regarding student behavior. Study results provide guidance for teacher focused interventions regarding school disciplinary practices.

How various forms of microaggressions impact identity development

College of Sciences and Health Professions

Student Researchers: Ashley Guilford, Alexandra Piedra[1], and Emily Peterson[1]

Faculty Advisor: Amy Przeworski[1]

Abstract

Microaggressions a subtle form of racism that can be seen as insults towards a certain group. They include comments based on racial assumptions about criminality, intelligence, and even minimization or denial of the racialized experiences of people of color (Lewis, Mendenhall, Harwood, & Huntt, 2016). Microaggressions also occur based on other aspects of identity such as gender, disability, and sexual orientation (Lewis et. al., 2016). The purpose of this study is to understand members of marginalized groups experiences of microaggressions and how this may impact self-esteem, mental health, and body image satisfaction. The study will include an online survey which will ask about these experiences, as well as racial identity and body image satisfaction. Participants will also be asked for their demographic information.

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**Supported by the McNair Scholars Program*

Visuomotor feedback processing and the structure of motor output time series

College of Sciences and Health Professions

Student Researchers: Zachary Whitenack, Allyson Fedor, Victoria Oeftering, and Jeffrey Eder

Faculty Advisor: Andrew Slifkin

Abstract

In recent studies, human participants were required to generate long sequences of targeted hand movement when task difficulty varied between conditions, and where full vision of the hand and target was always available (Slifkin & Eder, 2012, 2014). The movement amplitude—i.e., the actual distance travelled—for each movement was measured; consecutive movement amplitude values were formed into time series; then, the time series were submitted to spectral analysis. The results showed that as task difficulty increased, there was a pink-to-white noise shift in movement amplitude time-series structure. Those changes could be attributed to difficulty-induced increases in the engagement of visuomotor feedback processing. Such processing is needed for the accurate guidance of the hand to the target as task difficulty increases. The current study was designed to provide a more direct test of the hypothesis that variations in the engagement of visuomotor feedback processing determines movement amplitude time-series structure. To that end, we examined performance under four unique conditions created from the crossing of two difficulty (low, high) and two visual feedback (no vision, full vision) conditions. That is, performance in each difficulty condition was examined under a no-vision and a full-vision condition. Under low difficulty, if performance does not depend on use of the available visual feedback, then a pink-noise structure should be seen under both visual feedback conditions. In contrast, under high difficulty, if performance depends on use of the available visual feedback, then under full vision and no vision, white noise and pink noise, respectively, should be observed. The results confirmed our predictions, which provides further support for the hypothesis that variations in the engagement of visuomotor feedback processing determines variations in movement amplitude time-series structure.

Effects of Item Frequency on the Contingency Effect in Color-Word Contingency Learning

College of Sciences and Health Professions

Student Researchers: Lauren C. Koleszar and Krishna Patel

Faculty Advisor: Albert F. Smith

Abstract

When people are asked to identify the print color of words when there is a relationship between word identity and color, response time can be influenced by irrelevant word identity. A color maintains perfect contingency when words occur exclusively in that color; a color has low contingency when words in that color occur at a similar or identical frequency as in another color. When observed, the response time advantage for perfect contingency items over low contingency items is the color-word contingency effect. In experiments on contingency effects, contingency and frequency are often confounded. Lin (2015) found that equating frequencies of colored items while varying contingency eliminated the color-word contingency effect. We investigated the relation between word frequency and color association by manipulating the number of perfect-contingency and low-contingency items to which 24 participants responded. We constructed four experimental conditions by crossing one or two perfect-contingency words with one or two low-contingency words. Each of the four conditions was comprised of six 36-trial blocks, each of which contained 12 perfect-contingency items and 24 low-contingency items. The size of the color-word contingency effect depended on the combination of number of perfect and low-contingency items: Averaging over the last five blocks of trials, relative to conditions in which items varied in frequency (each perfect or low-contingency word occurring either six or 12 times in a particular color), the contingency effect was essentially eliminated in the condition in which each of four items (two perfect-contingency, two low-contingency) occurred six times and appeared attenuated in the condition in which each of three items (one perfect-contingency word and one low-contingency word) appeared 12 times. Item frequency contributes beyond the conditional probability of a color given a word to the manifestation of the color-word contingency effect.

Do Emotion Regulation Deficits Mediate The Relationship Between Sympathetic Nervous System Arousal and Substance Use?

College of Sciences and Health Professions

Student Researchers: Joseph Lancaster and Keri Stewart

Faculty Advisor: Ilya Yaroslavsky

Abstract

Abuse of alcohol and illicit drugs costs the U.S. $520 billion each year in healthcare, crime, and lost productivity. This price warrants investigation aimed toward improving substance abuse treatment and prevention methods, reducing the societal burden. One common supposition explaining problem substance use considers substance use as strategy for regulating emotions (coping). As difficulties in regulating emotions have been associated with alcohol, marijuana, and opiate use problems, further elucidating the role of emotion regulation in substance use is an approach that could prove worthwhile for treatment efficacy (Aurora & Klanecky, 2016. Bon-Miller, Vujanovic, & Zvolensky, 2008. Gold, Stathopolou & Otto, 2019). One limitation in the literature has been the examination of emotion regulation exclusively through subjective means (i.e. the use of surveys). Inviting objectivity, the study of emotion regulation incorporates physiological substrates relating to the autonomic nervous system, namely sympathetic arousal. Examining the physiological aspects of emotion regulation could enhance the aggregate work regarding deficits relating to substance use problems. Low electrodermal reactivity has been linked to coping inability among substance users (Bobadilla & Taylor, 2006). It is likely another measurement of autonomic nervous system activity (pupillometry) will show similar sympathetic arousal patterns amid this population indexing emotion regulation deficits.

To test this, we administered a survey to participants to identify substance use problems. We then showed a neutral and sad film and measured emotional reactivity via surveys (subjectively) and pupillometry (objectively). We also assessed emotion regulation repertoires in response to sadness to see if deficits here mediate the relationship between pupillary reactivity and substance use.

Do Borderline Personality Disorder Features Predict Negative Life Event Intensity and Interpersonal Dependence via Emotion Regulation Deficits?

College of Sciences and Health Professions

Student Researchers: Keri Stewart and Joseph Lancaster

Faculty Advisor: Ilya Yaroslavsky

Abstract

Borderline personality disorder (BPD) is a disorder of emotion dysregulation, marked by intense and unstable emotional states, often presenting as heightened affective reactivity to everyday stress. Individuals with elevated BPD features have been shown to exhibit greater emotional responses to stressors that are interpersonal in nature. Past studies have looked at how elevated BPD features relate to subjective ratings of stress for chronic and acute stressors. Previous studies also indicated that individuals with elevated BPD features present a stronger reliance on maladaptive emotion regulation (ER), techniques used to downregulate distress while paradoxically exacerbating it. While research has analyzed the influence BPD features have on stress ratings and how ER tactics are used by those with elevated BPD features, little research has combined the two to see how a reliance on maladaptive ER by individuals with elevated BPD features can influence the reported severity of stress. The present study will test how elevated BPD features may produce higher subjective stress ratings, lower objective stress ratings, and higher ratings of how dependent the event was on the individuals' behavior. The present study also will test how a reliance on maladaptive ER may heighten these outcomes.

Communication Through the Chaos: How City Governments Use Social Media During Disasters

Maxine Goodman Levin College of Urban Affairs

Student Researchers: LaNiqua Jones and Jose Mendez

Faculty Advisor: Clayton Wukich

Abstract

During disasters, city government officials use social media applications to interact with residents in different ways. Using the three primary resident roles identified from public management scholarship (i.e. citizen, partner, and customer) as well as two secondary types of information (e.g., symbolic presentation and transparency), this project helps to create identify distinct engagement opportunities for social media managers. In addition, city managers use several communication modes to disseminate information, depending on the situation and the resident role being used (one-to-many, one-to-one, many-to-many). These two factors—resident role and communication mode—can be used together to give researchers a better understanding of government social media use. In this study, we analyzed approximately Facebook posts from 62 cities affected by Hurricane Florence in order to further describe the communication that takes place between governments and residents on social media during disasters, and how resident roles and communication modes translate into practice.

Do Hedge Fund Activists Prefer Local firms?

Monte Ahuja College of Business

Student Researcher: Greg Davis

Faculty Advisor: Yinjie Shen

Abstract

With the rise of activist investment, as well as the prevalence of activist investment hedge funds, it has become more imperative to understand more about them. This study aims to look at the relationship of the physical separation between investment and investor. Does the modern activist hedge fund focus on local activist investment, or are firms more likely to invest further from their own base of operations? Is there a specific region that has a higher rate of activist investment opportunity that these firms focus on? These are some of the questions we hope to gain insight into with this study. We carried this study out by mapping over 2000 activist investment events in the United States occurring over more than the last two decades. It became clear very quickly the hedge funds themselves were fairly concentrated, but their investments were very spread out.

Physician Benefits and Challenges using Health Information Exchange: A Systematic Review

Monte Ahuja College of Business

Student Researcher: Rachelle Brown

Faculty Advisors: Michele Heath and Tracy Porter

Abstract

This paper contributes to the healthcare literature by conducting a systematic survey of the existing literature surrounding HIE implementation and specifically those led by physician leaders. This research sought to understand how physician leadership assisted in supporting organizations in achieving HIE success or failure? To do so we assessed the barriers and successes in the HIE change process and sought to understand how physician leaders might have impacted the process. No previous research has looked to synthesize the current literature surrounding this topic to date. Previous research has demonstrated the importance of physician leader in the HIE implementation process and we are seeking to understand if the literature demonstrates physician leaders lead more often to success or failure.

Catalytic Waste Gasification as a Route to Sustainable Living Environments

Washkewicz College of Engineering

Student Researcher: Nicholas W. Plentovich

Faculty Advisor: Jorge E. Gatica

Abstract

Landfills are taking on a higher and higher load to the point where many states ship their waste to other states for processing and disposal. There is very clearly a problem with the current waste disposal system and one possible solution is gasification. Waste gasification is a process that converts organic materials to a gas typically called syngas. This syngas can then be used for other purposes such as energy generation or chemical production. The goal of this research is to examine the possibility of using waste gasification as a route to sustainable living both on Earth as well as in space exploration.

An Integrated Plate System for Tissue Engineering and Disease Modeling

Washkewicz College of Engineering

Student Researchers: Sumaiya Ahmed, Sangjoon Lee, and Soo-Yeon Kang

Faculty Advisor: Moo-Yeal Lee

Abstract

In response to the need for predictive cellular models such as human mini-tissues derived from pluripotent stem cells (a.k.a., organoids), we have fabricated an integrated plate system consisting of a 36-pillar plate with sidewalls and slits (36PillarPlate) and a supplementary 36-perfusion well plate with reservoirs and microchannels (36PerfusionPlate) *via* injection molding of polystyrene. The 36PillarPlate was designed to print and encapsulate human organoids including liver, intestine, and pancreas, which was sandwiched with the 36PerfusionPlate to support unidirectional supply of growth media to simulate type II diabetes. For prototyping, we have designed and tested the structure of the integrated plate system using SolidWorks and CNC machining. This was followed by simulating the flow rates within the 36PerfusionPlate with COMSOL Multiphysics software. The results of COMSOL simulation were compared with experimental data measured with the 36PerfusionPlate. Since the surface of the 36PerfusionPlate was highly hydrophobic due to the property of polystyrene, it was necessary to treat the surface with amphiphilic molecules to convert it into a hydrophilic surface. We found that the flow rates slow down over time and reach an equilibrium within 3 – 5 hours. With these promising results, we have tested culturing Hep3B human hepatoma cell line encapsulated in alginate and Matrigel in the integrated plate system. Hep3B cells cultured in 3D grew over 11 days in RPMI media and formed spheroids on the 36PillarPlate sandwiched with the 36PerfusionPlate. We envision that the integrated plate system with human organoids can provide highly predictive safety, efficacy, and pharmacokinetic information needed to advance therapeutic candidates into clinical trials or prioritize environmental toxicants.

Formation of Misaligned Grains in Al-7%Si Samples Solidified from the [1 0 0] Oriented Seed Rods on the Space Station

Washkewicz College of Engineering

Student Researcher: Brian Chaya

Faculty Advisor: Surendra Tewari

Abstract

The aim of the research is to try to determine why misoriented dendrites were formed on three [100] oriented Al-7wt%Si alloy cylinders that were partially re-melted and directionally solidified on the International Space Station. All three MICAST samples showed surface depressions along their length. This means that during directional solidification the melt column detached from the crucible walls. In order to determine the origin of the misaligned dendrites, transverse microstructures were examined by serial sectioning the MICAST samples near the surface detachments. MICAST samples were sectioned using silicon carbide papers (180 through 1200 grit) and then were polished using diamond suspension. The microstructure of the entire sample transverse section was recorded by optical microscope (montages using as many as 70 individual images). The major findings are that dendrites have uniform morphology and distribution when grown at a faster rate. Second, the detachment of melt column from crucible surface generates Marangoni convection via melt flow driven by change in the liquid-vapor surface tension due to existing thermal gradient. This causes the melt in the vicinity of detachment to flow towards cooler end, i.e., towards the tips of the growing dendrite array. This leads to radial macrosegregation and side-arm fragmentation. The fragmented side arms get rotated by convection and become misoriented grains.

Effects of pH on Optical Properties of DNA-Wrapped Single-Wall Carbon Nanotubes

Washkewicz College of Engineering

Student Researcher: Ana DiLillo

Faculty Advisor: Geyou Ao

Abstract

Single-wall carbon nanotubes (SWCNTs) have unique optical, electronic, and chemical properties which can be utilized for an extensive range of potential applications, including biosensing and bioimaging. The DNA wrapping of SWCNTs has been proven an efficient method for dispersing nanotubes in an aqueous medium and their subsequent purification of chirality-defined SWCNTs. By increasing the surface coverage of SWCNTs by DNA coatings, stable and brighter DNA-wrapped SWCNT hybrids (DNA-SWCNTs) with increased photoluminescence can be obtained. In this work, we monitored the effect of pH on optical properties of DNA-SWCNTs using $(GT)_n$ (n = 6, 10, 15, 20) single-stranded DNA with varying length at a broad range of pH 1-13. It was hypothesized that the site-specific deprotonation of nucleotide bases in basic regime at pH ≈ 12 potentially promotes hydrogen bonding between the bases in DNA; therefore, causing conformational changes in nucleic acids. This conformational change led to increased fluorescence emission of nanotubes by effectively shielding quenching species in solvent from the surface of SWCNTs. In addition, the effect of nanotube concentration and excess unbound DNA on optical properties of DNA-SWCNTs were explored. The phenomenon of pH-controlled, conformational change of DNA on nanotubes will be further explored for separating pure-chirality SWCNTs with improved yield.

Assessing the Toxicity of Boron Nitride Nanotubes against Hep3B Cells in Dispersion State and Assembled Films

Washkewicz College of Engineering

Student Researchers: Jacob Vitale and Soo-Yeon Kang

Faculty Advisors: Moo-Yeal Lee and Geyou Ao

Abstract

Boron nitride nanotubes (BNNTs) are nanostructures with a one-dimensional cylindrical structure similar to that of carbon nanotubes (CNTs). BNNTs are mechanically robust, stable under air oxidation up to 900 ^{o}C, having an experimentally measured thermal conductivity of 2400 W/mK that is an order of magnitude higher than that of CNTs, and exhibiting optical absorbance and florescence in the ultraviolet region. These features make BNNTs a desirable material for a wide range of potential applications, including protective thermal coatings of medical devices. Prior to using BNNTs for biomedical coatings, it is necessary to confirm their biocompatibility and low basal toxicity. In this work, aqueous dispersions of BNNTs were prepared using $(GT)_{30}$ single-stranded DNA in deionized water by ultrasonication followed by exchanging the solvent from water to serum-free and 10 % (v/v) fetal bovine serum (FBS)-containing RPMI cell culture media. In addition, BNNT films were produced *via* the layer-by-layer (LBL) assembly approach using aqueous dispersions of negatively charged DNA-BNNTs and positively charged lysozyme-stabilized BNNTs. Thin films were characterized by UV-vis absorption spectroscopy and scanning electron microscopy. DNA-BNNTs were exposed to Hep3B cells at varying concentrations of nanotubes, at the maximum concentration of 64 μg/mL 80% of cells survived in the serum-free cellular environment while 50% survived in the FBS-containing cellular environment.

Diffusivity through Naive/Delipidized Bone

Washkewicz College of Engineering

Student Researcher: Lance A. Gentile

Faculty Advisor: Joanne M. Belovich

Abstract

Bone tissue contains compartments consisting of both polar and nonpolar molecules. Important physiological and pharmaceutical solutes have specific polarities that may favor transport by diffusing through one or the other compartment. We hypothesized that sodium fluorescein, a highly polar salt, would diffuse faster after removal of nonpolar hydrophobic lipids. This research consisted of examining the rate of diffusion through 400 nm wafers of cortical bone. A rig, consisting of two chambers with a wafer between them were filled; one with potassium buffered saline (PBS) to simulate bone fluid and one side with a 90 nM sodium fluorescein solution dissolved in PBS. Aliquots were taken over a two week period and analyzed using spectrofluorometry to determine the concentration of the two chambers. Using Fick's law of diffusion we were able to measure the effective diffusion coefficients, ranging from ~$9x10^{-7}$ to ~1 $x10^{-8}$ cm^2/s. Then, after removal of the lipids through successive washes in a polar solvent (acetone/methanol), the experiments were run again. These experiments are currently ongoing.

Active particles near an air/water interface

Washkewicz College of Engineering

Student Researcher: Steven Bengele

Faculty Advisors: Shawn Ryan and Chris Wirth

Abstract

The inspiration for this research comes from the observation that self-propelled particles, also known as active particles, behave differently near air-water interfaces when compared to their behavior in the bulk of a solution. Active particles have been known to create a zone of decreased concentration, known as a depletion zone, near an air-water interface. This research is focused on whether the depletion zone of a solution of active particles differs from that of a solution of passive particles. Additionally, this research is also interested if adding surfactant affects the depletion zone in any way. Solutions of passive and active particles both with and without surfactant were put in capillary tubes and the concentration profile near the interface was investigated under a microscope. Ultimately, the active particles' concentration was lower near the interface when compared to the concentration of the passive particles. However, it does not appear that adding surfactant changed the concentration of the active nor passive particles near the interface.

Mixing on the micro-scale: using bends and grooves to engineer flows

Washkewicz College of Engineering

Student Researcher: Tyler D. Rhoades

Faculty Advisors: Chandra Kothapalli and Petru Fodor

Abstract

Microfluidic mixing devices combining the previously optimized staggered herringbone with serpentine geometries were developed, and finite element analysis was applied to model the fluid flow and transport of a diluted substance within the system. Three devices were based upon this concept, and by analyzing concentration slices for their mixing entropy, an index value was calculated to represent the efficiency of mixing. Each geometry's simulation was then ran for equivalent travel time and then compared to determine the optimal device design. Once an optimal design was identified, comparative simulations were ran across a variety of Reynolds numbers for the new design, SHB, and serpentine geometries. Some prototypes of the developed micromixers have been 3D printed in PLA to experimentally test their mixing performance.

Freeway On-Ramps: Are Two Lanes Better Than One?

Washkewicz College of Engineering

Student Researcher: Ahmed Jadallah

Faculty Advisor: Jacqueline Jenkins

Abstract

The Highway Capacity Manual (HCM) procedure for analyzing right-hand, one-lane, on-ramp freeway merge junctions, estimates the average density within a 1500 ft ramp influence area. An adjustment to the density equation is made when the on-ramp has two lanes. To investigate which ramp configuration results in lower traffic densities, 17 one-lane and 25 two-lane on-ramp models were developed in VISSIM and simulated under 48 combinations of freeway and ramp flow rates. The average density for comparably long one-lane and two-lane on-ramps were similar and consistent with that estimated by the HCM density equation. However, averaging point densities introduced a bias when the density distribution was skewed longitudinally. An examination of the point densities showed that the one-lane ramps resulted in larger maximum point densities that occurred further downstream.

Optimal Design & Cost for Water Distribution Networks

Washkewicz College of Engineering

Student Researcher: Mark Magda

Faculty Advisor: Ungtae Kim

Abstract

Optimal design of water distribution networks (WDNs) can save energy and costs of construction and maintenance. Identifying that there is no easy-to-use toolkit and instructions for WDN design optimization, a student and faculty of Civil and Environmental Engineering developed 1) a simple Excel-based user-interface that tightly couples a industry standard hydraulic simulator (EPANET developed by U.S. Environmental Protection Agency) with optimization algorithms and 2) detailed user instructions along with typical WDN example problems. The developed toolkit showed stable simulation capabilities for 1) automatic sensitivity analysis without manual iteration of EPANET, 2) parameter calibration to match a user-defined design value, and 3) cost optimization of WDN design while satisfying various constraint conditions. The developed toolkit will be demonstrated and practiced in CVE 361 Hydraulic Engineering and CVE 464/564 Water Resources Engineering.

Interfacing with Prosthetic Limb Replacements

Washkewicz College of Engineering

Student Researcher: Michael Albertone

Faculty Advisor: Daniel Simon

Abstract

For as long as people have lost limbs doctors have constructed artificial limb replacements to help those in need. These artificial limbs however have primitive at a best and could only do the most basic of tasks. It is only in the modern era that significant progress has been made. Computers allow limbs to programed with the most basic of tasks. However, the goal would be the integration of the limbs into the nervous system of the patient. Though this is may seem incredibly advanced it isn't that farfetched. The Nervous system sends signals in the form of electrochemical waves, and it is not that much of a stretch to getting computer sensors to recognize these signals and act on them. This and other advancements in the field of bionics will be the focus of my poster project

Blockchain-based Energy Transactions

Washkewicz College of Engineering

Student Researcher: Zhongyu Liu

Faculty Advisor: Hongxing Ye

Abstract

Energy transactions are settled by the system operator in existing electricity markets. With growing distributed energy resources, the role that many energy users plays in the power system is switching from consumer to a mix of consumer and producer, so called prosumers. There are emerging need of new business model and mechanism that could adopt the p2p energy transactions with more trading freedom. Inspired by the well-known Bitcoin, which is a secure system that records cryptocurrency transactions on the blockchain, the objective of this work is to record energy transactions, instead of cryptocurrency transactions, on a blockchain.

Complex Human Activity Recognition

Washkewicz College of Engineering

Student Researcher: Michael Fasko, Jr.

Faculty Advisor: Wenbing Zhao

Abstract

In this project, we developed a complex human activity recognition system in the context of human patient simulation for nursing education. We used the OpenPose framework to recognize the skeleton of the mannequin and the nurse trainee, TensorFlow deep learning algorithms for human pose and action recognition, as well as object recognition for the wristband and the neck support. Specifically, we successfully tested a complex activity that involves patient identification and the placement of a neck support on the real mannequin. Furthermore, we developed a scoring mechanism to automatically evaluate the trainee's performance. We incorporated the mechanism in an Android app, which allows the trainee to view his/her performance.

The Truth behind the YouTube Recommendation Algorithm

Washkewicz College of Engineering

Student Researcher: Shadi Zogheib

Faculty Advisor: Ye Zhu

Abstract

YouTube has become a common part of a typical person's life in today's society. It can be used for educational purposes, entertainment, etc. When a user watches YouTube more frequently, they start to see videos that relate to what they have been watching. This is a result of the YouTube algorithm. The YouTube algorithm takes data on a user's viewing habits, and even Google searches, in order to recommend a list of videos to that user. In this project we study on YouTube algorithms for recommendations.

Random Linear Network Coding Simulations

Washkewicz College of Engineering

Student Researcher: R.J. Pereira-Castillo

Faculty Advisor: Ye Zhu

Abstract

Network coding is a widely studied theoretical networking scheme with the potential for improving digital communications. The scheme allows a network node to combine information from multiple edges onto a single edge. Message symbols are represented as elements in a finite field of the form 2n. In a broadcast scenario, network coding achieves information transmission rates at the network's mincut max-flow bound. This potential for improving network efficiency has motivated researchers to consider the practical implications of the scheme.

**Supported by the McNair Scholars Program*

The Effect of TiC content and Spark Plasma Sintering Processing Parameters in the Ni-TiC Composites

Washkewicz College of Engineering

Student Researchers: Anthony Bearden and Ganesh Walunj

Faculty Advisor: Tushar Borkar

Abstract

The influence of variations in the TiC content employed during spark plasma sintering (SPS) of nickel-titanium carbide composites on its microstructure and mechanical properties has been investigated in a systematic manner. Mechanical alloying has gained special attention as a powerful non-equilibrium process for fabricating amorphous and nanocrystalline materials, whereas spark plasma sintering (SPS) is a unique technique for processing dense and near net shape bulk alloys with homogenous microstructure. Mechanical alloying was performed using planetary high energy ball mill with 400 rom and ball to powder ratio 15:1 for 24 hours. Bulk Ni-TiC composites (with TiC content varying from 5 to 50 wt%) were fabricated via mechanical alloying followed by SPS at 50 MPa pressure and 900-1200° C temperature. There is an increase in microhardness as well as TiC peak intensity has been observed with increasing TiC content in these composites. These Ni-TiC composites exhibits excellent microhardness and tribological properties as compared to pure nickel.

Variability and Stability of Gait in Stoke Survivors

Washkewicz College of Engineering

Student Researchers: Jemima Kennedy and Hala Osman

Faculty Advisor: Antonie J. van den Bogert

Abstract

Individuals who have survived a stroke have unstable gait due to poor balance control which jeopardizes the safety of that individual. We analyzed the stability and variability of gait before and after exercise- interventions for individuals who have survived stroke to determine the effect of these interventions on the individual as well as any correlation between measured and perceived stability. 9 randomly assigned participants participated in three exercise interventions: (a) clinical physical therapy, (b) reactive slipping, and (c) video gaming. Kinematics of the participant were obtained using motion analysis and a treadmill equipped with force plates. There was an overall correlation between measured and perceived stability of gait. Exercise- interventions did not greatly improve perceived or measured stability of gait. Improvement of variability of gait varied between participants.

**Supported by the McNair Scholars Program*

Flying spiders: Effects of the spider mass and the length of a dragline in free fall

Washkewicz College of Engineering

Student Researchers: Ryan Courtney and Tessa Stevens

Faculty Advisors: Longhua Zhao[1] and Wei Zhang

Abstract

Many species of spiders travel by using a remarkable aerial dispersal "ballooning", which allows them to reach distances as far as 3200 km and heights of up to 5 km. Despite of many observations of spider ballooning, it remains a mysterious phenomenon due to the limited scientific observation of spider ballooning in the field, high uncertainties of the meteorological conditions, and insufficient controlled laboratory experiments. As a result, the mechanics of the three phases of the spider ballooning -- takeoff, flight, and settling -- are not well-established. To shed some lights on the free-fall or settling phase, experiments using spheres of different masses and thin threads to simulate the spider-dragline system were carried out. Under controlled conditions, each trial in free-fall was recorded using a high speed camera, and the displacement of the spider-dragline was tracked using the image analysis software. Time series of vertical velocities were extracted for cases of different masses and various dragline lengths. It was found that the greater the mass of the spider and the shorter the dragline, the faster the spider-dragline system falls. Ongoing efforts are put on acceleration and drag forces of the spider-dragline. Experimental results from controlled laboratory settings are expected to produce an improved understanding of the settling phase of spider ballooning and inform future experiments and numerical models.

[1]*Department of Mathematics, Applied Mathematics and Statistics, Case Western Reserve University*

Assessing the Feasibility of Multi-rotor Drone-based Wind Measurement

Washkewicz College of Engineering

Student Researchers: Malavika Patel, Ellen Rea, and Mark Travis

Faculty Advisor: Wei Zhang

Abstract

As wind energy becomes a major contributor to renewable energy sources, accurate wind measurements for wind resource assessment becomes crucial for large-scale investments in wind power generation. While several established methods of wind measurement such as implementation of tall meteorological masts or towers and advanced remote sensing (RS) devices currently exist, they are often expensive and mostly static thus cannot meet the demand of rapidly growing wind energy installation onshore and offshore. The use of Unmanned Aerial Vehicles (UAVs) to measure wind and other meteorology properties has been introduced to provide viable, cost-effective solutions while keeping the comparable data quality.

Weather data collection based on quadcopters or drones is a relatively nascent technology, but with great potential that may transform the wind resource assessment. This research aims to evaluate the feasibility of using UAVs for collecting wind data at an altitude (30 m to 100 m) that is relevant to wind turbine deployment. A quadcopter was constructed and mounted with a wind sensing system comprised of a cup anemometer, a wind vane, and a data logging device. The cup anemometer and the vane were calibrated in the lab prior the flight test. Several trials have been conducted to evaluate the stability of the hovering drone with and without mounting the wind sensor. Results suggest that it is feasible to employ multi-rotor quadcopters to collect wind data of acceptable quality. But the data quality highly depends on the stability and robustness of the drone in the hovering mode. Future work can consider the use of a better controller to improve the performance of drone-based wind measurement system.