2018 UNDERGRADUATE RESEARCH POSTER SESSION

Student Center Atrium

Thursday, September 6, 2018

11 AM - 2 PM

ABSTRACTS

ENGAGED LEARNING

Office of Research

2018 Undergraduate Summer Research Award Poster Session

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3	Evaluating Three Methods for Recruiting Student Feedback in the College Classroom
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2018 Undergraduate Summer Research Award Poster Session

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Assessing the Social, Emotional, and Mental Health Needs in Urban Schools to Support Academic Achievement

College of Education and Human Services

Student Researcher: Sade Vega

Faculty Advisors: Dakota King-White and Nicholas Petty[1]

Abstract

The ability for students in K-12 academic settings to learn can be significantly impacted by their overall social, emotional, and mental health needs. Needs assessments must be conducted to better determine and understand the social, emotional and mental health needs of students in academic settings. Using a survey-based approach, this study examined the social, emotional and mental health needs of high school age students in an urban school setting. Survey design and item development was informed by prior research. The results of this study showed discrepancies between what students identified as areas of need versus the teachers' observations of the needs of the students. Implications for practice are discussed to further support the importance of assessing the social, emotional, and mental health needs of students in urban school settings.

[1]*Director, Undergraduate Inclusive Excellence*

The Harmful Effects of the Strong Black Women Ideal: A Mediation Model

College of Education and Human Services

Student Researcher: Tyler Musial

Faculty Advisor: Kelly Yu-Hsin Liao

Abstract

The Strong Black Woman (SBW) ideal depicts someone who is nurturing, self-reliant, hides their emotions, and strong willed (Nelson, Cardemil, & Adeoye, 2016). This ideal is associated with psychological distress, low self-esteem, and chronic health conditions (Thomas, Witherspoon, & Speight, 2004). We hypothesized a serial mediation model wherein SBW would be associated with maladaptive perfectionism (MP), which would be associated with low self-compassion, in turn leading to negative psychological outcomes (depression, anxiety, and loneliness). Two hundred and thirty-seven female African American undergraduate students participated in the online survey. Results from structural equation modeling supported the hypothesized serial mediation model. All the paths were significant except for the path from SBW to MP and to loneliness. The study's clinical implications highlight the importance of creating coping strategies for MP and to cultivate SBW's self-compassion.

Evaluating Three Methods for Recruiting Student Feedback in the College Classroom

College of Education and Human Services

Student Researchers: Marissa Burrell and Melissa Montague

Faculty Advisor: Paula Chan

Abstract

Abstract not provided

How can content management systems be customized for better user experience?

College of Liberal Arts and Social Sciences, College of Education and Human Services, and College of Sciences and Health Professions

Student Researcher: Mikayla Colston

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

Abstract

PLAAY (Participation in Leisure Allowing Access for everYone) on the Move is a program promoting independence, mobility, and access for young children with sensory and mobility impairments. As PLAAY on the Move emerged from the pre-existing GoBabyGo program at Cleveland State University, a collaborative program, showcasing research and educating the community about the services provided, became a necessity.

Conducting primary research as well as secondary research helps determine the best content management system (CMS) to fulfill the needs of the program. Additionally, user testing and surveys about the website, created with the CMS, proves the effectiveness of the platform while considering individuals limitations. Squarespace ultimately proved to have the best calendar, image gallery, and RSVP or reply features. These components are vital for families to be able to learn more about what PLAAY on the Move provides and inform the faculty of the parent's interests in their services. After the webpages were formatted and designed, the surveys and user testing allowed for any issues that arose to be addressed. This testing also confirmed the ability for the website to load onto multiple devices and browsers.

Creating a platform for PLAAY on the Move to use provided the resources for a program that creates a huge impact on local families, allowing more people within the community to learn about what they do and hopefully get involved in the future. As many of these families must prioritize their child and their child's impairments, the website serves as a form of communication for the parents looking for resources and support.

Bubble Suit Animation

College of Liberal Arts and Social Sciences

Student Researchers: Austin DiLorenzo and Brock James Fahringer

Faculty Advisor: Qian Li

Abstract

While the number of violent crimes is still far below historic highs, the rate of violent crimes is on the rise. On top of that mass shootings are also on the rise, especially those in schools. In order to raise awareness on the issue we've created a short animation focusing on the repercussions of not facing this issue head on.

The Impacts of Trauma Exposure and Differential Access to Medical Services on the Incarceration Experience

College of Liberal Arts and Social Sciences

Student Researchers: Laura Wimberley and Shelby Smith

Faculty Advisor: Meghan Novisky

Abstract

Incarceration is an important social determinant of health. Generally, men and women who experience incarceration face elevated risks for physical health issues, infectious disease, mental health disorders, homelessness, and unemployment. Yet, while the criminological literature clearly identifies incarceration as a powerful predictor of health, it is less clear what particular aspects of the prison experience constitute the greatest challenges for the well-being of the men and women who reside there. This study involved completing 30 in depth, qualitative interviews with men and women who were recently released from state prisons about their incarceration experiences. After a process of open coding, data from these interviews show that, at least among this sample, incarcerated men and women are exposed to extreme acts of violence on a regular basis as a result of their incarceration and that access to medical services in prison is heavily stratified. These two areas were particularly stressful for respondents and contributed to their adjustments not only to prison life, but to the difficulties they faced during community re-entry. Findings are consistent with Strain Theory, which emphasizes the impacts of trauma exposure and other stressful life events on risks for recidivism. It is suggested that future studies explore trauma exposure and differential access to medical services during incarceration as specific risk factors for health disparities and diminished social capital.

Archaeological Investigations at the Fort Hill Earthwork Complex

College of Liberal Arts and Social Sciences

Student Researchers: Michael Dodrill and Bridget Coyne

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. 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.

Oral Histories: Out of the Archive and Into the Classroom

College of Liberal Arts and Social Sciences

Student Researcher: Patrick Basista

Faculty Advisors: Shelley Rose and J. Mark Souther

Abstract

Social Studies educators argue that primary sources are the preferred method of introducing material to students, as opposed to textbooks. By using this method, teachers aid students in developing critical thinking skills by studying sources to reach their own nuanced historical conclusions. Primary sources such as oral histories provide an aural, intimate, and a richly detailed way for students to engage with the past. The purpose of this research was to provide high-quality teaching materials aligned to Ohio Department of Education standards, and that utilize audio clips of interviews conducted in 2016. These materials were posted on two CSU blogs: Social Studies @ CSU and History Speaks. These blogs were designed for keyword searches, increasing their discoverability online. This project was supported by an Undergraduate Summer Research Award from the CSU Office of Research.

RAS Expanded: Visual and Tactile Cueing for Individuals with Gait Disorders

College of Liberal Arts and Social Sciences

Student Researcher: Leah Reinhart

Faculty Advisor: Carol A. Olszewski

Abstract

Based on the investigations of cognitive function and the processing of music, a system of techniques for music therapy called Neurologic Music Therapy (NMT) was developed by Dr. Michael Thaut. Thaut (2014) defines NMT as "the therapeutic application of music to cognitive, sensory, and motor dysfunctions due to neurologic disease of the human nervous system" (p. 1). This project proposes further study of one of the NMT techniques: Rhythmic Auditory Stimulation (RAS), which addresses sensorimotor rehabilitation. RAS is supported by extensive research in laboratory settings, resulting in improved gait and coordination with patients who suffered a cerebrovascular accident or were diagnosed with Parkinson's or Huntington's (Thaut, Mertel, & Leins, 2008). There is a specific protocol for RAS; however, simply, it uses a specific auditory beat as an external cue for the timing of walking. This primes the premotor cortex for movement and entrains the brain to activate the lower extremities at the specified beat. Extant literature indicates priming and entrainment result in improved gait parameters, such as cadence, velocity, and stride length (Clair & O'Konski, 2006). This study aims to test whether this temporal priming still occurs if the rhythmic cue is given visually as well as through tactile sensation.

Trumped: How Donald J. Trump Defied the Odds and Won the Presidency

College of Liberal Arts and Social Sciences

Student Researchers: Nick Mintern, Chad Wright, and Joe Massaroni

Faculty Advisor: Joel Lieske

Abstract

Against all odds, Donald J. Trump shocked the world when he won the 2016 presidential election and became the 45th President of the United States. Few foresaw such a victory for the Republicans; it was widely believed among political scientists, election analysts, media pundits, and reportedly even Trump himself that victory would ultimately go to the Democratic party.

So how and why did he win? We examine the multitude of factors that contributed to his electoral victory, including his iconic "Make America Great Again" campaign, how his policies resonated with voters (as well as his primary opponent's policies), and shifts in voters' party preferences prompted by racial diversity.

Our findings indicate that his campaign was boosted most by strategically using social media, having a message that resonated with supporters of the rising Populist movement, and aggressively campaigning in swing states. We also found that his primary opponent, Hillary Clinton, failed to attract key swing voters, many of which instead voted for Trump. Finally, we found that diversity increases Democratic or Republican party support among particular social groups based on the level of diversity in an area, thus prompting some of the unexpected electoral outcomes of the election.

How Does Current Sex Education Perpetuate Rape Culture

College of Liberal Arts and Social Sciences, College of Education and Human Services, and College of Sciences and Health Professions

Student Researchers: Alec DeBoard and Alyssa Williams

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

Abstract

Rape culture as it is used within this analysis refers to the general trend as a society to normalize the occurrence of sexual violence and can encompass behaviors such as acceptance and perpetuation of common rape myths, “slut-shaming”, and victim-blaming. These behaviors are taught from a young age, mostly through the media or socialization. However, through examining sixteen sex education textbooks, certain themes seem to highlight the notion that children are exposed to rape culture through school systems. The aspects explored include discussions of consent (or lack thereof), forced stigma towards sexuality, perpetuation of harmful misconceptions including gender stereotypes, and the tendency to teach individuals how not to be raped rather than teaching how not to rape.

Intercultural Bilingual Education in the Urban Andes

College of Liberal Arts and Social Sciences

Student Researcher: Brenda Castañeda Yupanqui

Faculty Advisor: Antonio Medina-Rivera

Abstract

In Peru, there are 3 million people whose primary language is the indigenous Quechua. Further, in the provinces where it is most prominent, the language enjoys co-official status with Spanish and is a symbol of cultural and ethnic identity that has deep roots. Despite the vitality of indigenous languages on the decline worldwide, especially in urban settings, Quechua has remained strong in Peru. Intercultural Bilingual Education (IBE) is a language-planning model that has been criticized for attempting to normalize Quechua from a purely Spanish-speaking context in its application, stripping the language of its agency and cultural power.

The current study seeks to gain an understanding of the potential effects of IBE on the bilingual population in urban Cusco. Data was collected at the Pukllasunchis Institute, a center of higher education for those looking to implement an IBE approach. The institute conducts classes in both languages while teaching both cultures and respecting their impact on teaching methods. Over the course of the study, approximately 100 students completed questionnaires and 28 students were interviewed. The data suggests that conscientious application of IBE does promote acceptance and greater use of Quechua on the part of the urban bilingual population of Cusco, Peru.

Influence of stimulus amplitude on African Clawed Frogs' choices between two stimuli

College of Sciences and Health Professions

Student Researchers: Geetha Somarouthu, Austin Shaffer, and Joseph Taraba

Faculty Advisor: Jeffrey Dean

Abstract

African clawed frogs locate prey using their lateral line systems to sense water movements the prey make. We've previously studied how the frogs choose between two stimuli; their choice is influenced by several factors including most importantly which stimulus is more rostral (i.e. more in front of them) and which is closer, which also means it arrives first with a larger amplitude. Here, we test whether stimulus amplitude affects choice. We generated surface waves by dipping two rods of different sizes into the water. Rods make waves both entering and leaving the water; both the material and diameter affect wave size. We first tested Plexiglas rods of 1/8"and 1/16" diameter; waves from the latter were 63% that of the former. We replaced the 1/16" rods with size 00 insect pins (diameter 0.3mm), dipped point first, producing waves that were only 6% of that of the larger rod. Frogs could detect waves from the smaller Plexiglas rod and even from the insect pins, as shown by orienting turns to each. Our hypothesis was that when given a choice between a large and small stimulus, frogs would show a bias for the larger stimulus simply because larger waves represent a stronger stimulus.

Retinoic Acid to Promote Differentiation of Atrial-Like Cardiomyocytes for Atrial Fibrillation Research

College of Sciences and Health Professions

Student Researcher: Nautica McCully

Faculty Advisor: Shamone Gore-Panter

Abstract

Atrial fibrillation (AF) is the irregular contraction of the atria, which are the top chambers of the heart. AF is the most common cardiac arrhythmia, affecting nearly 2.3 million people in the United States, common among people 40 and older. When AF is present the electrical signals that control this process is unbalance. Without proper diagnoses and treatment AF can be a life-treating condition. The use of human cell-derived cardiomyocytes will allow the study of cells involvement in atrial fibrillation development. The addition of retinoic acid during a 30-day time course to myocytes allowed us, to investigate retinoic functions, by comparing RA treated cultures to non-treated cultures. As data analysis is currently being reviewed future investigation is needed to determine results.

**Supported by the McNair Scholars Program*

Roles of H3v in Trypanosoma brucei

College of Sciences and Health Professions

Student Researcher: Sandra Haswani

Faculty Advisor: Hee-Sook Kim

Abstract

African trypanosomiasis, or sleeping sickness, is caused by the parasite *Trypanosoma brucei*, a protozoan that affects the central nervous system. This unicellular eukaryote can be transmitted to mammals by the bite of a tsetse fly. *T. brucei* evades the host's adaptive immune response by carrying out antigenic variation of its protective coat of Variant Surface Glycoprotein which allows the infection to persist and be further transmitted. *T. brucei* lacks the sequence-specific transcription factors found in other eukaryotes, thus chromatin structures at PTU (polycistronic transcription units) boundaries are thought to play important roles in control of gene expression. This paper focuses on identifying and characterizing the roles of the chromatin mark H3v in several cellular processes. H3v plays a key role in DNA replication and transcription, thus studying it will be very beneficial for progress in research about trypanosomes. This research project will focus on creating a library of 63 single point mutations in H3v by site-directed PCR mutagenesis, then cloning them into a vector, transforming the ligated products into E. coli competent cells, and finally introducing this H3v mutant library into a trypanosome strain. Mutations will be examined for DNA replication, transcription, and antigenic variation. The non-functioning mutants will be identified to understand the roles of H3v in DNA replication and transcription.

**Supported by the McNair Scholars Program*

Circadian clock proteins CRYs are involved in control of diet dependent Acot expression

College of Sciences and Health Professions

Student Researchers: Marc Edwards, Allan Poe, and Kuldeep Makwana

Faculty Advisor: Roman Kondratov

Abstract

Circadian clocks are evolutionarily conserved molecular timekeeping systems that generate rhythms in physiology and behavior in almost all living organisms and synchronize them with external environment. Living organisms have multiple circadian clocks which control numerous physiological functions. The light entrained circadian clock involves a transcriptional-translational feedback loop which regulates locomotor activity and metabolic processes and coordinates them with daily rhythms. The food entrainable oscillator (FEO) clock also generates near 24 hour circadian rhythmicity by driving food anticipatory behavior in mice. Mice entrained on 12:12hr light-dark cycle have been shown in previous studies to generate circadian rhythms in food anticipatory behavior, suggesting that this clock runs not on light independent, but food dependent cues. Availability of nutrients regulates metabolic pathways, which promotes cell growth and proliferation. Acyl-CoA Thioesterases (ACOTs) catalyze the hydrolysis of CoA esters leading to the production of free fatty acids and CoA. It is hypothesized that ACOTs are critical in regulation of intracellular levels of CoA and fatty acids. Regulation of ACOTs by circadian clock mechanisms is not well studied. In particular, the mechanism by which circadian clock proteins cryptochrome (CRY) are involved in ACOT protein expression is understudied. To study the effect of feeding regimen on ACOT expression we sampled tissue from wild-type (WT), and CRY 1,2 double knockout mice. Both genotypes were also tested based on different feeding regimen; either *ad libitum* (AL) or 30% calorie restricted (CR). Effects on aging and the circadian clock from CR feeding regiments is well studied and thus critical to test when investigating metabolic pathways controlled by circadian clock proteins.

Effect of Feeding Regimens of YAP Signaling

College of Sciences and Health Professions

Student Researchers: Xhuliana Fafaj and Nikkhil Velingkaar

Faculty Advisor: Roman Kondratov

Abstract

Many mammalian physiological and behavioral aspects show 24-hour circadian rhythms such as metabolism, sleep-wake cycle, body temperature and blood pressure. These 24 hour rhythms are regulated by circadian clocks, which are internal timekeeping systems located in every body cell and tissue, and synchronize these rhythms with the external environment. At the molecular level, CLOCK and BMAL1 are core clock genes involved in transcription-translation feedback loop which in turn regulate biological processes and coordinate them with daily rhythms. Circadian clock has been demonstrated to regulate cell cycle, cell proliferation and differentiation, but the mechanism in liver is not clearly known. Hippo pathway is an evolutionarily conserved pathway that plays an important role in regulating organ size, cell growth and cell differentiation. Hippo acts as a negative regulator of YAP1 by inducing phosphorylation and sequestration in the cytoplasm, thereby inactivating YAP1; on the other hand, switching off Hippo activates YAP1, thus enabling the translocation to the nucleus and promoting the transcription of pro-proliferative genes. How Hippo signaling and circadian clocks interact is not known. It is also established in multiple studies that peripheral clocks such as in liver are regulated by feeding cues; how these cues affect Hippo signaling in liver is also not known. Hence we plan to investigate the interaction of feeding cues and circadian clock with Hippo signaling. We applied two different feeding paradigms and analyzed transcriptional and translational activity of YAP1. Our initial observations suggest that feeding regimens have differential effect on YAP1 phosphorylation and YAP1 downstream targets. We further investigated this interaction at the transcriptional level in clock mutant mice (*Bmal1* and *Cry1,2*$^{-/-}$) using two of well-known targets of YAP1, *Ctgf* and *Cyr61*. While circadian control of Ctgf is CR dependent, on the other hand, Cyr61 rhythmicity is regulated in a time dependent manner and is independent of circadian control and feeding paradigms, thus above results suggest a complex interaction between Hippo, clocks and feeding cues.

Abstract Removed

Screen for interacting factors for Trypanosoma brucei telomere protein RAP1

College of Sciences and Health Professions

Student Researchers: Annelise Radzin and Elizabeth Beran

Faculty Advisor: Bibo Li

Abstract

Trypanosoma brucei is a protozoan parasite that causes human African Trypanosomiasis (sleeping sickness) in people and nagana in cattle, both of which are fatal without treatment. This parasite is injected into the host through the bite of the tsetse fly and is able to evade the host's immune response due to changes in its major surface antigen, variant surface glycoproteins (VSGs). This constant switching prevents the host from making a single antibody that can recognize the antigen and eliminate the parasite. VSG expression sites have been found to be near the telomeres of *Trypanosoma brucei,* and studies from our lab have shown that a telomere protein called *Tb*RAP1 is essential for regulating VSG silencing. In order to better understand the mechanisms of how *Tb*RAP1 silences VSGs, we aim to identify proteins that interact with *Tb*RAP1. We have done a yeast 2-hybrid screen using the *Tb*RAP1 full-length protein as bait previously, but *Tb*RAP1 itself has a weak transcription activation function that leads to identification of false-positive candidates. *Tb*RAP1 protein has several functional domains, among which the BRCT domain has a weak transcription activation activity while others do not. In the current study, we aim to perform a yeast 2-hybrid screen using *Tb*RAP1-aa426-761 fragment as bait. Without the basal transcription activation activity from the *Tb*RAP1 BRCT domain, we will be able to identify true interacting factors of the *Tb*RAP1-aa426-761 fragment. One initial screen has been performed, resulting in 10 candidates. We are currently performing another screen, hoping to identify more interacting candidates.

Quantifying the ability of common invasive shrubs to acquire and use water, to tolerate drought, and compete with native plants within Holden Arboretum, Ohio

College of Sciences and Health Professions

Student Researchers: Sean Fenton and Brooke Seitz

Faculty Advisors: Emily Rauschert and Kevin Mueller

Abstract

There is very little data on the interaction between native and invasive shrubs in Eastern North America. There are a number of traits that make the establishment and impact of shrubs different than other species. Early emergence of leaves and varying rates of photosynthesis play a significant role. How plants use water, and how plants are influenced by drought have not been studied thoroughly. This is important for a better understanding of how plants will respond to the alteration of precipitation regimes that occur from climate change. Research has been predominantly focused on how water availability can shape the interspecies plant competition. Species of interest are Honeysuckle (*Lonicera Morrowii, Lonicera x Bella*), Sugar Maple (*Acer Saccharum*), Red Maple (*Acer Rubrum*) and Multiflora Rose (*Rosa Multiflora*). Photosynthetic rates were measured by observing gas exchange vs light level for each species. Water potentials of leaves are recorded to better understand the depth of water usage and water stress levels of the plants. Drought tolerance for each species is measured by recording the turgor loss point of a leave after complete saturation. The species interaction between native and invasive shrubs should be taken into account when assessing the impacts they pose on Eastern North American Forests.

Weed communities in urban agriculture

College of Sciences and Health Professions

Student Researcher: Joshua Ryan

Faculty Advisor: Emily Rauschert

Abstract

Urban agriculture has been increasing all over the United States, especially in shrinking cities such as Cleveland, where increases in vacant land have brought opportunities for farming. There has also been a more interest in sustainable farming, as more people prefer locally sourced and organic food. However, like rural agriculture, urban agriculture also faces the problem of weed management, especially when growing organically eliminates some control options such as chemical means. As there is little to no research available on urban agricultural weeds, this research aims to identify and examine urban weed communities to obtain a better understanding of them, and to be able to compare urban weed management with rural weed management.

Expression and purification of full-length recombinant Plasmodium falciparum PfMC-2TM Maurer's cleft protein

College of Sciences and Health Professions

Student Researchers: Alberto R. Williams-Medina and Kush Addepalli

Faculty Advisor: Tobili Y. Sam-Yellowe

Abstract

Malaria caused by *Plasmodium falciparum* remains the most virulent form of malaria, resulting in 216 million cases and 445,000 deaths globally. Invasion of red blood cells by *P. falciparum* leads to the formation of membranous structures known as Maurer's clefts (MC). Virulence markers of *P. falciparum* such as PfEMP1 are transported across the MC to the surface of the infected red blood cell. Insight into the formation and function of the MC will be important for the discovery of new vaccine and drug candidates. The PfMC-2TM is encoded by a multi-gene family of 13 members. PfMC-2TM is a protein localized to the MC. We induced expression of PfMC-2TM encoded by 1 family member [PF3D7_0114100 (PFA0680c)] in BL21 DE3 strain of *Escherichia coli* following transformation with recombinant pET-28a plasmid containing a chemically synthesized gene. The purpose of this study was to determine immunogenic properties of the resulting recombinant protein using western blot analysis. The recombinant plasmid was isolated and analyzed in 1% agarose gel and an approximately 5kb band was identified. Pilot expression of transformants showed expression of recombinant PfMC-2TM by western blot. Recombinant PfMC-2TM protein will be expressed and purified for antibody production to allow subsequent domain analysis and characterization.

Simulation of Abiotic Hurricane Effects on Lotic Meiofauna Abundance and Composition

College of Sciences and Health Professions

Student Researcher: Jamil Wilson

Faculty Advisor: Josué Santiago[1]

Abstract

Freshwater meiofauna are essential in our understanding of freshwater biomes. Their previous lack of attention in literature have sparked many to undergo research about their overall composition and distribution relative to many of the factors on which they depend. While more of these investigations have surfaced, few have looked at community adaptably or lack thereof when confronted with drastic changes to their environment. Therefore, this study observed what kinds of possible changes that can take place in these populations after the lingering effects of an enormous natural disaster. It is the objective of this study to identify the most influential and impactful variables to effect lotic Meiofauna abundance and spatial distribution post Hurricane disturbance. It is hypothesized that the meiofauna composition should change significantly due to the alterations in light, organic matter and sediment. To analyze these relationships, correlations between these factors and their effect on the communities in post- and pre- hurricane settings were observed using several statistical analyses. ANOSIM and Ordination test were used to procure results which exhibited significant differences between treatments and how the different treatments effected certain populations over time. These results indicate that residual disturbance effects caused by hurricanes can impact meiofauna communities.

**Supported by the McNair Scholars Program*

[1] Department of Biological Sciences, University of Puerto Rico

A Targeted Genetic Screen to Identify Meiotic Cohesin Regulators

College of Sciences and Health Professions

Student Researchers: Urja Patel, Emilia Kalutskaya, Alexis Brown, and Ali Ahsan

Faculty Advisor: Aaron F. Severson

Abstract

During oogenesis in animals deficient for REC-8, a cohesin subunit required for sister chromatids cohesin (SCC), Co recombination fails and sister chromatids segregate away from one another prematurely in meiosis I. Consequently, zygotes inherit two copies of each chromosome. Chromosome segregation in meiosis II fails and the progeny of rec-8 mutant mothers usually survive as viable polyploids. In contrast, homologs segregate randomly during meiosis I in oocytes produced by spo-11 mutants, which lack the transesterase required for crossover recombination. This results in aneuploidy, and nearly all the embryos die. We have shown that mutations disrupting SCC mediated by REC-8 cohesion, but not the related COH-3/4 cohesion complex, dramatically suppress the lethality of spo-11 mutants (88% vs 8% viable). Thus, a screen for spo-11 suppressors can identify kleisin-specific regulators critical for the formation of healthy gametes, including factors required for loading of REC-8 cohesion, for stepwise release of SCC mediated by REC-8 cohesion and for establishment of SCC by REC-8 cohesion, for example, mutations within subunits of REC-8 cohesion or in factors that couple premeiotic DNA replication to SCC establishment. A pilot screen of 4000 haploid genomes identified three suppressors. The first cloned was a null allele of htp-3, which encodes a component of the synaptonemal complex. This mutation revealed differential loading mechanisms of REC-8 and COH-3/4 and demonstrated the first evidence that HTP-3 regulates cohesin. We will continue this screen to identify additional regulators. Our analysis will provide insight into how cohesion and SCC are regulated during C.elegans meiosis. We expect our results will be relevant to plants and mammals, which also require multiple, functionally specialized meiotic kleisins.

Meiotic Drive in C. Elegans: A Violation of Mendel's Second Law

College of Sciences and Health Professions

Student Researchers: Alexis Brown, Emilia Kalutskaya, Urja Patel, and Taylor R. Schilling

Faculty Advisor: Aaron F. Severson

Abstract

Under normal conditions, alleles segregate randomly during meiosis so that each one has an equal chance of being passed onto the next generation. However, in some cases, a given allele is more likely to be passed on, along with any nearby alleles. These cases are said to exhibit meiotic drive. Meiotic drive allows biased segregation of particular alleles instead of independent assortment. This process is significant because it can drive evolution by altering the genetic makeup of a population. Such a case exists in *C. elegans*, in which the offspring of males who carry the genetic balancer *qC1* along with an inserted DNA sequence exhibit a ratio of male to hermaphrodite progeny of 80:20. Under normal meiosis, this ratio should be 50:50. With the ultimate goal of discovering the genes responsible for meiotic drive, *qC1* males are mutated and crossed with hermaphrodites in order to find a set of offspring whose ratio of males to hermaphrodites is 50:50, indicating that the gene responsible for the skewed ratio has been mutated. Understanding meiotic drive in *C. elegans* is relevant because normal mechanisms of meiosis are comparable to those in humans and other organisms, so deviation from the normal process may be applicable as well.

Toward the Crystallization of an Archaeal Dihydroorotase

College of Sciences and Health Professions

Student Researchers: Haley E. Newman and Ryan T. Godin

Faculty Advisor: Jacqueline Vitali

Abstract

Dihydroorotase catalyzes the conversion of N-carbamoyl-L-aspartate to L-dihydroorotate in the *de novo* biosynthesis of pyrimidines. *M. jannaschii* is an archaeon that thrives in extreme environments such as the hypothermal vents at the bottom of the oceans in which both temperature and pressure are extremely high. It can serve as a model organism for research purposes. This experiment is a first step toward elucidating the structure of this enzyme in *M. jannaschii*. Our summer research started using a partially purified enzyme preparation from previous experiments. We further purified the enzyme primarily using hydrophobic interaction and hydroxyapatite chromatographies. Twenty-four closely related conditions were tested to determine if a crystal of dihydroorotase could be formed. Several conditions led to whisker-needle clusters and preliminary needle crystals. These findings can be utilized to determine additional steps and other conditions to test. Once a crystal is formed, it can undergo X-ray crystallography to determine its structure. The structure of dihydroorotase in *M. jannaschii* can elucidate what structural characteristics allow this archaeon to survive in extreme heat and pressure. It also provides further understanding of the diversity within the dihydroorotase family of proteins. It can also give further insight into this pathway in humans.

Anti-thrombotic Coatings for Medical Devices and Implants Based on Nitric Oxide Release

College of Sciences and Health Professions

Student Researchers: Celine El-Khoury, Shaimaa Maher, and Haitham Kalil[1]

Faculty Advisor: Mekki Bayachou

Abstract

Blood-contacting medical devices, are often used to treat cardiovascular diseases. These implantable medical devices, even if labeled as biocompatible, can cause serious complications in patients. Thrombus formation and infection are the main causes of failure of these devices. In contrast to the healthy endothelium, which actively resists thrombosis, artificial surfaces promote clotting through a complex series of interconnected processes that include protein adsorption, adhesion of platelet, leukocytes and red blood cells, ending with thrombosis.

Using a layer-by-layer thin film building strategy to form layers of polyethyleneimine (PEI) and iNOSoxy as NO-releasing coatings allows for assembly of multi-component protein/PEI films. Here, the iNOSoxy enzyme protein used is negatively charged and adsorbed onto the positively charged matrix layer, polyethyleneimine. When discs coated with PEI/iNOSoxy films are exposed to arginine, a source of reducing equivalent, and other required ingredients, nitric oxide is formed and released. We characterize the PEI/iNOSoxy thin films in terms of structure of iNOSoxy within the films as well as the amount of active concentration. Fourier transform infrared (FTIR) spectroscopic analysis characterized structure-activity relationships of these NOS-containing thin films. Cyclic voltammetry determined the active catalyst (iNOSoxy) concentration on the modified surfaces, and how this relates to enzymatic activity and resulting NO release fluxes from PEI/NOS-containing thin film. Platelet adhesion assays determined if the amount of platelets adsorbed on the PEI/iNOSoxy films is inversely proportional to the amounts of NO released from coatings.

[1]*Post-Doctoral Fellow*

Increasing the Efficacy of Doxorubicin Against Breast Cancer

College of Sciences and Health Professions

Student Researchers: Jovana Hanna and Jung-Suk Choi[1]

Faculty Advisor: Anthony Berdis

Abstract

In the United States, breast cancer accounts for one in three cancer diagnoses in women, making it the most common type of cancer in women. One important chemotherapeutic agent used to treat breast cancer is doxorubicin, an anthracycline compound that causes cell death by damaging DNA in addition to producing reactive oxygen species. Previously, the Berdis lab developed an artificial nucleoside analog designated 5-NIdR that improves the efficacy of DNA damaging agents used against brain cancer. This nucleoside works by inhibiting the replication of damaged DNA created by certain chemotherapeutic agents. In this project, we tested the ability of 5-NIdR to increase the efficacy of doxorubicin in the treatment of breast cancer. This was accomplished by comparing the effects of doxorubicin in the absence and presence of 5-NIdR using MCF-7 breast cancer cells and non-cancerous fibroblasts as models. Our studies show that breast cancer cells are highly resistant to doxorubicin, displaying an LD_{50} value of 840 nM which is 8-fold higher than that measured against non-cancerous fibroblasts (LD_{50} = 105 nM). Combining 5-NIdR with doxorubicin kills more cells compared to treatment with either doxorubicin or 5-NIdR used alone.

[1]*Post-Doctoral Fellow*

Dodecanedioic Acid Treatment in VLCAD Fibroblasts

College of Sciences and Health Professions

Student Researchers: Igor Radzikh, Rohan Shah, Erica M. Fatica, and Ryan Pearce

Faculty Advisor: Yana Sandlers

Abstract

Very-long-chain acyl-CoA dehydrogenase deficiency is the second most common disorder of fatty acid oxidation in the USA, with an incidence of 1:25,000-1:100,000 newborns (Tucci, Floegel, Beermann, Behringer, Spiekerkoetter, 2017, pg. 196). The current dietary therapeutic strategies are designed to avoid long chain fatty acids, instead providing carbohydrates and medium chain triglycerides as an energy source. Despite the controlled and biochemically balanced diet, it has a limited success in treatment of clinical symptoms and metabolic decompensations in VLCAD affected individuals. It has been proposed that defect in long chain fatty acids catabolic pathway leads to the severe energy deficiency, that primary reflected by depletion of citric acid cycle (TCA) intermediates. This research study explores the effect of dodecanedioic acid (DODA) as potential anaplerotic reagent in fibroblasts from healthy and documented VLCAD individuals. To investigate effect of DODA cells were depleted from glucose and supplemented with L-Carnitine and palmitic acid. Cells were treated for 16 hours with 50μM of DODA. Then, we analyzed levels of acylcarnitine TCA intermediates, fatty acids and glucose.

We found accumulation of long chain acyl carnitines (C14 and C16) in VLCAD fibroblasts which is consistent with the VLCAD presentation in human. We also observed increase in TCA intermediates levels, post DODA treatment indicating DODA anaplerotic effect, however, glucose levels were not rescued post DODA treatment. In conclusion, our data support that hypothesis that DODA can replenish TCA and thus it represents a potential anaplerotic therapy for VLCAD disorder.

Further studies in vitro are warranted to further explore DODA effects on energy metabolism.

**Supported by the McNair Scholars Program*

Off targets toxicological investigation of anti-cancer tubulin inhibitors

College of Sciences and Health Professions

Student Researchers: Abboud Sabbagh and Yaxin Li

Faculty Advisor: Bin Su

Abstract

We have developed a class of novel tubulin inhibitors based on NSC751382 (Figure 1), Benzo[1,3]dioxole-5-carboxylic acid [3-(2,5-dimethyl- benzyloxy)-4-(methanesulfonyl-methyl-amino)-phenyl] -amide, as the lead compound. This compound showed potent tubulin polymerization inhibitory activity by binding at the colchicine's binding domain, and suppressed cancer cell growth with an IC_{50} of 200nM. It has molecular weight of 482, logP of 4.1, only one hydrogen bond donor, and eight hydrogen bond acceptors. The compound meets the Lipinski's Rule of Five and is a highly drug-like molecule.

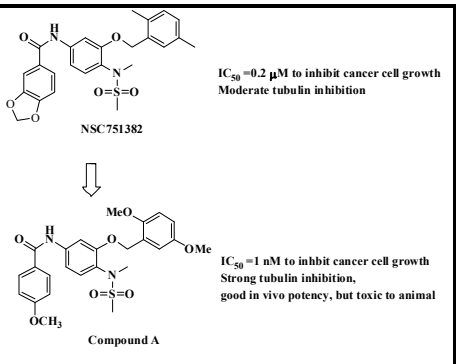

Figure 1. structures of the compounds

In addition, NSC751382 significantly inhibited the growth of Taxol resistant cancer cells, suggesting it is not a substrate for P-glycoprotein. Furthermore, it exhibited potent in vivo anti-cancer activity and excellent pharmacokinetic parameters. We further optimize the structure of the compound and generated a new analog with much improved potency (IC_{50} of 1nM) to inhibit cancer cell growth (Figure 1). The new compound also showed much better potency to inhibit tubulin polymerization, cause cell cycle arrest, and inhibit in vivo tumor growth as well. However, we did notice mouse weight lost during the treatment, suggesting toxicity to the animals. We speculate that the lead optimization may result in off target effect, i.e., the new compound possibly bind to other proteins besides tubulin and cause toxicity. It seems that the structural optimization might cause target changing of the lead compound, and the new off target proteins may cause the toxicity. To investigate the toxicity, we synthesized 6 structure very similar analogs to compound A, and all the compounds showed similar in vitro activity to inhibit cancer cell growth. These compounds will be tested in the animals to correlate the toxicity to the structures, and elucidate the toxic moiety of the compounds. We also synthesized a biotinylated compound A to investigate the potential off target proteins that bind to the compounds, and explore the toxic inducing factors. This analysis can help us understand what structural characteristics lead to the target switching phenomenon. Understanding the structural difference correlated to the molecular targets will help us to design new analogs with reduced toxicity.

Synthesis of Sialic Acid Derivative for Modifying Cell Surface Sialylation

College of Sciences and Health Professions

Student Researchers: Isaac Turan and Joseph Keil

Faculty Advisor: Xue-Long Sun

Abstract

The exterior of cell surfaces express a dense layer of glycans which are often terminated by sialic acid (SA). SA is an acidic monosaccharide whose presence is found on the terminal ends of glycans of either glycoproteins or glycolipids. Due to its hydrophilic and electronegative nature, SA is often involved in both physiological and pathological processes, such as in regulating cellular interactions with ligands, microbes and neighboring cells. In addition to these functions, SA is also implicated in controlling cellular activation, differentiation, transformation and migration. Cell surface glyco-metabolic engineering provides a useful tool to remodel cell surface SA. In this study, a di-methyl amide derivative of SA, which lacks anionic character, was designed and synthesized for modulation of cell surface SA application. By treating cells with this amide derivative of SA, it is possible to modify the native SA expressed on the cell surface (sialylation status) and study the functions of cell surface SA. The di-methyl amide derivative of SA is synthesized from free SA via benzyl-*O*-sialoside, amidation and hydrogenation in 6 steps. We hope that the di-methyl amide derivative of SA will provide information regarding the specific mechanisms that are involved in SA biosynthesis and binding events as well as possible cellular consequence due to SA derivation. Eventually, by modifying the cell surface sialylation status, it may be possible to modify cellular functions.

TMCO1 is a novel target for cancer chemotherapy

College of Sciences and Health Professions

Student Researchers: Ashley Przybylowicz, Ruhan Wei, and Qiaoyun Zheng

Faculty Advisor: Aimin Zhou

Abstract

Transmembrane and coiled-coil domains 1 (TMCO1) is a protein of 22 KDa highly conserved in amino acid sequence among mammalian species and functions as an endoplasmic reticulum (ER) Ca^{2+}load-activated Ca^{2+}channel. Homozygous frameshift mutation in TMCO1 causes distinctive craniofacial dysmorphism, skeletal anomalies, and mental retardation. However, its physiological functions are largely unknown. In this study, we found that TMCO1 was co-localized with microtubules as determined by immunohistostaining and a co-sedimentation assay. Interestingly, TMCO1 was highly expressed in the invasive front of high grade lung cancer and metastatic cancer cells of clinical specimens. To further investigate the biological role of TMCO1 in lung cancer, we knocked it down in A549 cells, a human lung adenocarcinoma cell line, by using shRNA lentiviral particles. Disruption of TMCO1 in the cells resulted in delayed microtubule polymerization and remarkably increased acetylation of α-tubulin. In addition, A549 cells lacking of TMCO1 grew significantly slower than the control cells. Taken together, our findings suggest that TMCO1 may be a therapeutic target for lung cancer treatment.

Peer Quizzing: Are Two Heads Really Better Than One?

College of Sciences and Health Professions

Student Researcher: Leah Bunnell

Faculty Advisors: Jessica Bickel and Thijs Heus

Abstract

Instructors are often plagued with a difficult opened ended question; what measures can be implemented during class that will maximize students' academic benefit? During this research project, the impact of frequent peer quizzing in introductory college level physics courses on subsequent learning assessments, such as midterms and percent gain, are examined. A peer quiz is initially administered to a student individually and graded but not returned to the students until they are given the opportunity to revisit the same quiz question with a partner. Two physics instructors' student data is included in the data set, which is comprised of Introductory Calculus Based Mechanics ("PHY 241") and Introductory Calculus Based Electricity and Magnetism ("PHY 242") classes that either have peer, individual or no quizzes. The results of this project show that peer learning quiz classes yield a higher correlation between various assessments than individual quiz classes. This suggests that peer quizzes are more effecting in teaching college level introductory physics courses than individual quizzes. These results hold true when top ranking pretest scorers are removed from the data sets, thus indicating that peer quizzes are beneficial to both students that do and do not have prior understanding of the course material.

Characterization of Microgels in Ionic Liquid

College of Sciences and Health Professions

Student Researcher: Daniel Terrano

Faculty Advisors: Petru Fodor and Kiril A. Streletzky

Abstract

Microgels are thermoresponsive polymeric nanoparticles whose size in aqueous solution is dependent on temperature. The microgels were studied using both dynamic light scattering (DLS) and scanning electron microscopy (SEM) to better understand the nanoparticles dynamics. The first part of the study focused on developing a controlled preparation procedure which would generate reproducible SEM images on a wet sample. The ionic liquid was mixed with a dilute solution of microgels and water was dried using nitrogen gas. This technique allowed a large volume of microgels to easily transition from their natural water solvent to a low vapor pressure ionic solvent. The second part of the study attempts to correlate the diffusion found from microgels in ionic liquid using scanning electron microscopy to the statistical average diffusion measured with dynamic light scattering. The microgels in ionic liquid observed with SEM exhibited the same radius that was measured with DLS for microgels in a water based solvent.

Construction and Applications of an Inexpensive Muon Detector

College of Sciences and Health Professions

Student Researcher: Nicholas Knyszek

Faculty Advisor: Andrew Resnick

Abstract

Muons are important due to the abundance of them on earth. Muons that are on earth originate from the Sun and enter Earth's atmosphere as decaying cosmic rays. Muons are somewhat unstable, with a lifespan of roughly 2.2 microseconds. Muons decay into electrons and two types of neutrinos. Since Muons travel near the speed of light they can still go thousands of meters into the Earth's crust before stopping. Muons account for most of the cosmic radiation at sea level. Muons are harmless to humans. In this study, we built detectors and measured muon counts at different elevations. This research project was inspired by Cosmic Watch, which was funded by MIT in 2016. These detectors are inexpensive to make compared to previous models. There are three main components of the detector which are the Arduino Nano, scintillator and photodector. We find that the higher in altitude the higher the count rate is on the detector. Theses detectors can encourage future students and classes at Cleveland State University to pursue physics.

The Effects of Chemical Crosslinker on Polymeric Microgels

College of Sciences and Health Professions

Student Researchers: Samantha Tietjen and Jacob Adamczyk

Faculty Advisor: Kiril A. Streletzky

Abstract

Microgels are nanoparticles suspended in solution and comprised of crosslinked polymer chains. Due to the amphiphilic property of the parent polymer, microgels exhibit a reversible volume phase transition. The standard behavior of these microgels is to deswell from a large to small size with an increase in temperature. Microgels in this study were synthesized by crosslinking hydroxypropylcellulose (HPC) in a surfactant solution. The amount of crosslinker used for synthesis was varied by a factor of a hundred. Using dynamic light scattering, microgels were characterized at various temperatures and scattering angles to determine the particles' hydrodynamic radius (R_h) and dynamics both in the swollen and deswollen states. It was recently shown that for low crosslinker concentrations, microgels exhibit standard behavior, with a decrease in radii as crosslinker concentration increases. Above a certain concentration, the behavior switches from standard behavior to microgel growth with temperature increase. Using a new polymer stock, both behaviors were reproduced using the same synthesis procedure; however, the point at which microgel deswelling switches to growth appeared to shift towards a lower crosslinker concentration. Also observed was that some particles exhibiting standard microgel behavior increase in size at very high temperatures, possibly due to nonuniform crosslinker distribution. Lastly, it was found that microgels synthesized at intermediate crosslinker concentrations exhibit a spike in size at the transition temperature. These newly observed phenomena led to further light scattering studies and investigation into the synthesis procedure: including tests on pH dependence, mixing time, heating rate, and comparisons between the polymer stocks themselves.

Towards Understanding Microgel Volume Phase Transitions

College of Sciences and Health Professions

Student Researchers: Jacob Adamczyk and Samantha Tietjen

Faculty Advisor: Kiril A. Streletzky

Abstract

Microgels are polymer-based particles which are able to change size and shape during volume phase transition in response to external stimuli. We have investigated microgels which respond to changes in temperature for eventual use in drug-delivery systems on the nano to micro scale. Light scattering data on Hydroxypropylcellulose (HPC) microgels has been analyzed to determine microgel parameters such as radii, molecular weight, and polydispersity at various temperatures. The classic Flory-Huggins (FH) approach to mixing polymer-solvent solution is used to model a temperature-size dependence for the microgels. Existing theory on the microgel size dependence on the amount of crosslinker is examined. A new term is added to account for a minimum microgel size at large crosslink densities. We find that many microgels behave with the expected Lower Critical Solution Temperature (LCST) and are generally matched with FH theory despite not accounting for the crosslinker in the model. Several sample runs have exhibited other interesting temperature dependent functions which are likely due to non-homogeneous crosslinking occurring during synthesis. We discuss such inhomogeneities and the relevant models at length. New attempts at reconciling the Flory-Huggins theory with a crosslinker-dependent model as well as ways to model unusual swelling behaviors are being considered.

An Alternative Means for Observation-Based Cloud Size Distributions

College of Sciences and Health Professions

Student Researcher: Adam Stead

Faculty Advisor: Thijs Heus

Abstract

Clouds are a poorly understood phenomenon that have a significant impact on climate and day-to-day weather. This research aims to measure cloud size distributions for shallow cumulus clouds from observational data. Clouds are sampled via a ceilometer, which indicates both the presence of cloudy air and the base height of the respective cloud. When combining this data with the recorded horizontal wind velocity, we can infer a cloud transect size distribution. After sufficient sampling, we can use an algorithm to deduce an approximate cloud area distribution for the specified time range and cloud field. Once the cloud size distributions are obtained, they are compared to cloud size distributions acquired through Large-Eddy simulations. The data used is sourced from Atmospheric Radiation Measurement (ARM) facilities in the Southern Great Plains (SGP) region, which are established by the Department of Energy (DOE).

Characterizing the Turbulent Structure of the CBL and the Entrainment Zone

College of Sciences and Health Professions

Student Researcher: Wei Jia

Faculty Advisors: Shawn Ryan and Thijs Heus

Abstract

The convective boundary layer (CBL) is the lowest part of the atmosphere. The turbulent motions in the CBL are important for redistributing trace gases, particles, heat, and momentum between the surface and the free troposphere thus it is important that this process is properly represented in numerical models that attempts to simulate the atmosphere. This study is trying to characterize the water vapor structure in the quasi-stationary CBL, using statistical way to build the turbulent model and uses a high resolution model: Large Eddy Simulation (LES) to investigate the adequacy of the model. We found that the water vapor flux at the entrainment zone could be predicted by the variance of water vapor. We are using the data from LES to development this relationship further.

Determining Cloud Cover with Machine Learning

College of Sciences and Health Professions

Student Researcher: Sarah Sesek

Faculty Advisor: Thijs Heus

Abstract

The cloud cover provided by boundary layer cumulus clouds is one of the greatest uncertainties in climate and weather prediction models. It is difficult with current technology to cheaply and accurately collect cloud cover data. The TSI (Total Sky Imager) provides a hemispheric field of view in order to maximize the area it can see. The farther away from the center of the image, the more angled the view of the the cloud is. Therefore, more of the side of the cloud is captured in addition to the cloud base. Machine learning is well suited to seeing through this bias. In this study, LES (Large Eddy Simulation) generated fields are used to train a convolutional neural network based on DeepLab to use semantic segmentation distinguish between the cloud side and base.

Investigating the Influence of Cloud Size on Cumulus Cloud Entrainment

College of Sciences and Health Professions

Student Researcher: Theresa Lincheck

Faculty Advisors: Shawn Ryan and Thijs Heus

Abstract

Clouds play a crucial role in determining the weather on local and global scales, yet their complexity accounts for some of the largest uncertainties in weather forecasts and climate models. Environmental air mixing or being drawn into a current, called entrainment, is one source to blame for this complexity. When air entrains into a cloud evaporation of in-cloud condensates increase and temperatures in the cloud drop, reducing buoyancy. The overall effect of entrainment inhibits a cloud's development, and usually results in the dissipation of a cloud. With the use of data generated from a high-resolution computer model known as Large Eddy Simulations, this project studies the entrainment in shallow convective cumulus clouds. Entrainment rates are estimated across a distribution of cloud sizes and heights, and the dependence of entrainment on these cloud characteristics is investigated.

A Study Inquiry of the Impact of the Mother-Daughter Relationship with Teen Pregnancy

College of Sciences and Health Professions

Student Researcher: Klarissa Zeno

Faculty Advisor: Elizabeth Goncy

Abstract

The relationship a teenage girl and her mother hold is vital in the outcome and the decisions the teen makes. This relationship is influenced by many different things including communication patterns the mother and teen have. The aim of this study is to look at the way the two communicate throughout the teen years of the daughter to see if there is an association with whether or not the teen becomes pregnant. Teen pregnancy has been an obstacle many girls have had to face during their adolescent years. This is due to the numerous teenagers that are sexually active during this time and other factors that play a role leading up to teen pregnancy. I will be asking about different aspects within the relationship the teen and her mother held as well as any changes the teen would have liked to see within this relationship. With my study, the sample will include women between the ages of 18-35. There will be an online survey they will answer that will inquire about the individual participant's thoughts and feelings about the relationship she had with her mother. I will also be looking for other factors that may have influenced the outcome of teen pregnancy, if this was the case, for each participant. The goal is to understand in what ways teen pregnancy can be prevented and if one of those ways can start with the relationship between the teen and their mother.

**Supported by the McNair Scholars Program*

Perspectives on Adolescent Drug Use: Interviews with Community Providers

College of Sciences and Health Professions

Student Researcher: Noelle Naser

Faculty Advisors: Elizabeth Goncy and Shereen Naser

Abstract

With a striking rise in drug related deaths over the past few years, researchers have looked towards improving prevention methods as a way to not only react to substance abuse with treatment, but learn to better prevent individuals from following these risk taking behaviors. Adolescents specifically are prone to risk taking behaviors such as substance use as they navigate through the challenges of adolescence and transitioning into their identities. Therefore, research in understanding how and why youth decide to get involved in substances is important for creating stronger prevention. Using qualitative data obtained from semi-structured interviews with community providers (N=4), the current study identifies themes revolved around adolescent substance use as well as use in their communities. Along with information gathered from the interviews, partnerships were created with a local community center, Recovery Resources, in order to learn and observe the prevention programs already in place. Themes revealed from the interviews showed the following factors: (1) motivation for teen substance use such as a coping mechanism, (2) where teens get access to substances such as from peers, and (3) the perception of teen attitudes towards substances such as drugs not being a big deal. Personal quotes from these interviews highlight the themes being drawn as well as give first-hand thoughts to the big picture of substance use in society. Limitations included recruiting participants for the study and therefore further research needs to be conducted to verify the themes being drawn.

Perception of Time and Post-Surgery Physical Rehabilitation

College of Sciences and Health Professions

Student Researcher: Karmen Love

Faculty Advisor: Maria Rowlett

Abstract

Physical rehabilitation is an important part of a patient's recovery after surgery. Physical therapists are crucial to the success of that patient's healing process. Physical rehabilitation can determine how quickly the patient's healing progresses. It is difficult to determine how long a person will be in rehab and every patient has different expectations of how long their recovery will take. In this study, I explored how a patient's perception of time affects the estimated versus actual recovery time post-surgery. The participants were patients admitted to the inpatient rehab at Mercy Regional Medical Center in Lorain, Ohio. Each patient was assessed on their perception of time as well as their expected recovery time compared to their actual recovery time. All patients were surveyed and placed on the Zimbardo Time Perspective Inventory subscale. I was seeking to determine if there is a strong relationship between a patient's perception of time and how long they expect their recovery to take. As a result of this study, it was found that there was a negative correlation between a patient's perception of time and how long they expected their recovery to take. Further, those who scored Present Hedonistic on the Zimbardo's subscale, showed a significantly negative correlation with a patient's expected time of recovery. This study is relevant because the results may aide in physical therapist treatment strategies. If a physical therapist knows how the patient perceives their time, they can alter their treatment skills to help them heal more efficiently.

**Supported by the McNair Scholars Program*

The Impact of Adjacent-Letter Flanking Bigrams on Lexical Decision Performance

College of Sciences and Health Professions

Student Researchers: Gina M. Cascone and Deion L. Colbert

Faculty Advisor: Albert F. Smith

Abstract

Some models of word identification hypothesize that the word recognition system includes units responsive to bigrams (letter pairs). Grainger, Mathot, and Vitu (2014) and Palinski (2016) found that target-flanking bigrams consisting of letters adjacent in targets (e.g., OG FROG FR) affect decisions about whether letter strings are words: Bigram-letter order, but *not* proximity of bigram letters to their locations in the targets, affected performance. (Average performance was better with FR FROG OG and OG FROG FR than with RF FROG GO and GO FROG RF, but no different with FR FROG OG and RF FROG GO than with OG FROG FR and GO FROG RF.) In a second experiment, Palinski (2016) included nonadjacent-letter flanking bigrams (e.g., FO FROG RG). For adjacent-letter bigrams she found, as did Araya, Russo, and Smith (2017) in an exact replication, significant effects of *both* letter order and letter proximity. To investigate whether performance with adjacent-letter bigrams depends on the presence of non-adjacent-letter bigrams, we presented these in different blocks of trials. The results were consistent with those of Palinski and of Araya et al. Lexical decision performance with adjacent-letter flanking bigrams appears to depend on the presence of non-adjacent letter bigrams in the experimental context.

Reading Between the Bigrams

College of Sciences and Health Professions

Student Researchers: Gina M. Cascone and Deion L. Colbert

Faculty Advisor: Albert F. Smith

Abstract

In lexical decision experiments in which target strings were flanked by pairs of bigrams, Grainger, Mathot, and Vitu (2014) and Palinski (2016) found, for words, better performance when flanking bigrams contained target-string letters (e.g., FR FROG OG; OG FROG FR; RF FROG GO; GO FROG RF) than when they did not (e.g., EX FROG IT); better performance when flanking bigrams contained letters ordered as in the target (e.g., FR FROG OG; OG FROG FR) than switched (e.g., RF FROG GO; GO FROG RF); and no effect on performance of proximity of flanking letters to their locations in the targets. We plan (and have programmed) an experiment to investigate (1) whether the effects of whether flanking bigrams contain target-string letters are facilitative, interfering, or both; (2) the general effect of flanking characters; and (3) whether proximity of flanking letters to their locations in targets affects performance when flanking letters are ordered as in targets. This experiment will include three previously used display conditions (e.g., FR FROG OG; OG FROG FR; EX FROG IT) and two control conditions—one in which no characters will flank targets and one in which targets will be flanked by special character bigrams (e.g., #* FROG %&).

Programming to Transition Psychological Experiments from SuperLab to Matlab

College of Sciences and Health Professions

Student Researcher: Mudra R. Savaliya

Faculty Advisor: Albert F. Smith

Abstract

For the past six years, our laboratory has conducted experiments programmed in Superlab, a software package designed exclusively for psychological experiments. Although Superlab has some attractive features, it also has some severe limitations. For example, Superlab cannot read files, meaning that for an experiment in which each participant has a unique stimulus list, a unique program has to be assembled for each participant. For an experiment in which each participant has a unique order of conditions, a unique program with the conditions in that order has to be assembled for each participant. Preparing numerous unique programs provides numerous opportunities for errors. Matlab, with Psychophysics toolbox, permits these limitations to be surmounted so that there need be only one program prepared for an experiment. For example, a general Matlab program can read a file containing the unique stimulus list for each participant, or a table that contains condition orders for all participants. We will describe the program we have devised for a set of classification experiments. We will address some of the problems we have encountered and how we have solved them.

Development of a Controlled Harness System to Increase Flexibility in Balance Testing and Training

College of Sciences and Health Professions

Student Researchers: Kimmie Berkovich and Emily Meisterheim

Faculty Advisor: Debbie Espy

Abstract

Falling can be a life-threatening event, especially for older adults. Clinicians use balance training to reduce fall incidents in at-risk individuals. There are various forms of balance training, and they often employ a harness system to prevent patient injury. Current harness systems are capable of supporting a percentage of an individual's body weight and catching people in the midst of falling, and some may even perform both of these functions. However, injury can still be incurred from using a harness, particularly among the frail elderly. This lab has developed a new, controlled harness system that will be able to perform all the functions of the body-weight support and fall-arresting harness systems, with the additional feature of decelerating the rate of a person's fall. This harness will be tested in a pilot study among adults aged 55 years or older with balance impairments. The subjects will experience slip training progressions with this new harness system and their response will be tracked using a motion analysis system called CORTEX. Results from tests completed with this harness system will be analyzed to understand the role of the motorized harness in a holistic balance training regimen.

Learning To Do in Vivo Neural Responses in Mice

College of Sciences and Health Professions

Student Researchers: Timothy Mogan, Justin Wobser, Riley Faulhammer, and Tyler Erker

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

Abstract

Timothy Mogan, Tyler Erker, Riley Faulhammer and Justin Wobser were the target students for this stereotaxic neurosurgery and electrophysiology lab experience. They are Pre-Nursing, Pre-Neuroscience (Pyschology) or Pre-Med majors. This richly educational and hands-on investigation significantly enhanced their confidence and experience in RODENT HANDLING, ANESTHESIA, ELECTROPHSYIOLOGY, PERFUSION, BRAIN REMOVAL and GENERAL LAB SKILLS. An animal use protocol was created for the project under the guidance of the Mentors and the students followed it competently. Students completed CITI online animal research training and animal handling training was provided by Lou Turchyn, DVM. Animals for the research were generously donated by Dr. Turchyn and other animal investigators at CSU so that this investigation did not require any additional research animals. A poster presentation of the first stages of the study covering background and significance, data collection methods and specimen preservation was academically instructive. Next, the molecular biology analysis of the specimens is expected to generate a proof of concept for methods necessary to conduct ongoing research in cochlear (inner ear) dysfunction ostensibly caused by dynorphins released during acoustic over-stimulation stress by Drs. Tony Sahley, David Anderson, Michael Hammonds and Karthik Chandu.

Case Concentration: An Academic Arcade Game for Physical Therapist Education

College of Sciences and Health Professions

Student Researcher: Araxie Demirjian

Faculty Advisor: John J. Jeziorowski

Abstract

Case Physical Therapy is the study of patient/client cases to augment a practitioner's clinical thinking, reasoning, and decision-making skills. Game-based learning, as part of an academic arcade, can add enjoyment and competition to an otherwise mundane process of acquiring knowledge and understanding and may serve to incentivize the student. The development of a case-related match game to teach physical therapy (PT) students about patient/client focused examination and interventional relationships is at the very heart of the design of *Physical Therapy Case Concentration*. Based in part on the successful, long-running (1958-1991) NBC game show, Physical Therapy Case Concentration features a computerized board consisting of 30 trilons (3 sided rotating boxes) with numbers, physical therapy related case content, and rebus text/graphics. The rebus is intended to convey a relevant lesson to the student that corresponds to the unique features of the selected PT patient/client case. The Undergraduate Summer Research Award (USRA) was used to initiate the development of the coding component of this endeavor. Coding in C# with Unity was employed to create a user interface and subsequent scripting of smaller game elements. The Game Manager scripting is currently underway. With completion of the script, the first clinical case sample content will be added and beta testing will commence.

Indication of Abdominal Wound Complication within Breast Cancer Reconstruction

College of Sciences and Health Professions

Student Researcher: Taylor Lawson

Faculty Advisor: Rebecca Knackstedt[1]

Abstract

Following a mastectomy, breast reconstruction can be performed immediately with one possible procedure being the use of the body's own tissue. Natural tissue breast reconstruction surgery can result in abdominal wound complications. My research focus is on Retrospective Chart Review of patient's pre- op risk factors for abdominal wound complications post- surgery; including factors such as diabetes, smoking, prior C-section, etc. Patients' charts will be examined for medical history and health concerns and if patient had any issues after one- year post surgery such as hematoma, seroma, wound breakdown, and/or belly umbilical necrosis.

**Supported by the McNair Scholars Program*

[1]Cleveland Clinic Department of Plastic Surgery

Effects of greater palatine nerve anesthesia on the activity of hyoid musculature during swallowing

College of Sciences and Health Professions

Student Researcher: Besa Bunjaku

Faculty Advisor: Andrew Lammers

Abstract

Feeding is an important activity for all animals. An expansive array of sensory provide information to the brain about food handling during feeding. The brain then coordinates muscles to push the bolus into the esophagus, bypassing the airway. Previous work shows considerable coordination among sensor arrays and the nerves supplying them. Therefore it is likely that anesthetizing part of the oral cavity (in this case, the tissue covering the hard palate) will cause changes in the timing of muscles that are active during swallowing, even though these muscles are supplied by completely different nerves. We examined the timing of the mylohyoid (floor of the mouth) and thyrohyoid (a muscle that contracts during swallowing) via electromyography in three infant pigs while they drank milk from a bottle. Control data, with all sensory systems intact, were collected first, and then the tissue covering the hard palate was anesthetized. We used the electrical activity of the muscles to determine the timing of their contractions. We are still analyzing our data, but we expect to find that the muscles contract for longer periods of time, reflecting a more forceful push on the milk in the absence of sensory information to provide negative feedback.

Balance Training Using the Multi-directional Harness System

College of Sciences and Health Professions

Student Researchers: Kristy Tachji and Araxie Demirjian

Faculty Advisors: Ann Reinthal, Debbie Espy, and Beth Ekelman

Abstract

Introduction and Purpose Individuals post-stroke frequently have impairments in balance and mobility. This study aims to increase mobility through high intensity balance training in a multi-directional harness system using video gaming to add environmental and tsk complexity. We hypothesize the training will improve balance, mobility, and decrease falls.

Methods In this case series, two adults post-stroke completed seven sessions of balance training using four adapted commercial video games from the X-Box Kinect™ (20,000 Leaks (L), Reflex Ridge (R), Table Tennis (T), and Target Kick (K)) on varied types of floor surfaces. These games were chosen to challenge various aspects of balance. They played the games while wearing a fall-preventing harness in a supporting framework that allowed them to move freely in a 7' by 8' area. A progression algorithm was used to advance to game difficulty, thereby maintaining high intensity, challenging training. Motion capture and clinical measures (Berg Balance Scale, Timed Up and Go (TUG), Activities-Specific Balance Confidence Scale (ABC)) were used to assess changes from the training. Motion capture data were processed using Cortex (Motion Analysis Corp™) to find the distance traveled as well as the maximum velocity of critical body segments for each game (center of mass for L and R, racket hand for T, and hemiplegic foot for K). Pre- to post-test scores were compared descriptively.

Result With a few exceptions, the participants improved in maximum velocity and distance travelled of the selected markers as well as for the TUG and Berg. ABC scores remained at similar levels and Participant 2 moved less and with a lower maximum velocity in R, while Participant 1 did not increase maximum hand speed in T.

Discussion and Conclusion Overall, balance measures improved after the training sessions with the exceptions noted above. The ABC, which represents the participant's balance confidence, did not improve. Nevertheless, both participant reported that they were moving better at home. Also, in R, Participant 2's velocity and movement distance decreased; however this may have been a reflection of more efficient movement patterns rather than poorer performance. Subject 1's numbers increased in this game as he began jumping during the game about half way through the sessions.

The T.E.A.M Approach to Interprofessional Education for Pre-Professional and Professional Health Students

College of Sciences and Health Professions

Student Researchers: Mary C. Sammon and Hayden A. Parente

Faculty Advisors: Joanna L. DeMarco, Suzanne Giuffre, and Madalynn T. Wendland

Abstract

Interprofessional education (IPE) is defined as "students from two or more professions learning about, from and with each other to enable effective collaboration and improve health outcomes" (World Health Organization, 2010). When used effectively, IPE programs aid in preparing pre-professional undergraduate and graduate health professional students to enter the healthcare field as effective team members, who are knowledgeable in delivering quality, collaborative care. This project aimed to 1) assess the impact of current IPE programming, 2) create an evidence-based framework to develop IPE programming and 3) determine if current evaluative processes using the T.E.A.M. reporting tool can adequately reflect the ability for IPE programming to be sustainable.

Along with a review of the literature, pre- and post-IPE program surveys were analyzed to create a comprehensive needs assessment using the W.K. Kellogg Foundation Logic Model. From the data compiled, it was determined that initiation of IPE at the foundational level, including exposure of IPE concepts to undergraduate students, would be advantageous. The T.E.A.M. Reporting Tool has the ability to highlight and compare key components to consider prior to implementing IPE events and activities and aligns with the created evidence-based framework to build a sustainable model for IPE.

Reading-related phonological processing interventions for individuals who use augmentative and alternative communication (AAC): A systematic review of the research

College of Sciences and Health Professions

Student Researchers: Christina K. Grecol, Emily A. Sternad, Vonesa Demiri*, Nina G. Pukys, Amy Roth, Katherine Kasunick, and Kaili Smith

Faculty Advisor: April M. Yorke

Abstract

The purpose of this investigation was to conduct a systematic review to determine the effectiveness of reading-related phonological processing interventions designed to meet the needs of individuals with complex communication needs (CCN) who require augmentative and alternative communication (AAC). An extensive review of the literature published from 1980 to June of 2018 that included intervention on reading-related phonological processing skills including phonological awareness (e.g., rhyming, segmentation, blending), letter-sound correspondences, and single-word decoding was conducted using a variety of electronic and table of contents searches. A total of 22 intervention studies (24 experiments) involving 93 individuals met criteria for inclusion and were advanced to the full coding and analysis phase of the investigation. Descriptive analysis and effect size estimations using Tau-U (Parker, Vannest, Davis, & Sauber, 2011) were conducted. Results reveal that individuals who use AAC across a wide range of disabilities and ages can learn phonological processing skills for reading. Studies utilized interventions that were modeled after the Accessible Literacy Learning (ALL) curriculum (Light & McNaughton, 2009), the Early Reading Skills Builder (ERSB; Ahlgrim-Delzell et al., 2016), the Nonverbal Reading Approach (NRA; Swinehart-Jones & Heller, 2009), storybook reading with focus on reading-related phonological processing skills, combinations of storybook reading with other approaches, and other approaches.

**Supported by the McNair Scholars Program*

Environmental Certification Program ISO 14001: A Study of Membership Motivation and Effectiveness

Maxine Goodman Levin College of Urban Affairs

Student Researcher: Lauren Egensperger

Faculty Advisors: Meghan Rubado and Sanda Kaufman

Abstract

ISO 14001 is an environmental management standard developed by the International Organization of Standardization in 1996. The standard was designed to assist companies with improving environmental performance, enhancing efficiency, and advancing business relations. However, studies suggest that ISO 14001 has experienced varying degrees of success. For this research project, academic literature from environmental journals along with ISO data and annual reports were reviewed. Initially, resources were encountered which propose that the extent to which ISO 14001 improves environmental outcomes remains uncertain due to the presence of symbolic adoption and external motives in some certified organizations. These findings indicate that data, including names of certified companies and certification dates, would need to be analyzed so that changes experienced following ISO 14001 adoption could be evaluated. The process of obtaining this material proved unsuccessful as comprehensive information is not publicly available or compiled by ISO. Further setbacks were encountered when accessible data was not standardized in a way that allowed for accurate comparisons or assessments of the standard in different regions. Still, research did reveal that the standard consistently provides several positive effects as it elevates company reputation, legal requirement realization, marketing opportunities, and employee environmental awareness. Determining other benefits that demonstrate similar consistency would require additional data that has yet to be acquired.

Effectiveness of Anti-Discrimination Policies: An Analysis of Housing Advertisements

Maxine Goodman Levin College of Urban Affairs

Student Researcher: Brad Dowling

Faculty Advisor: J. Rosie Tighe

Abstract

This project investigates the efficacy of a proposed policy intervention related to housing discrimination. The student designed and executed a *python* script to collect information from rental housing advertisements in order to assess them for discriminatory language.

Looking through apartment rental listings, common information includes number of bedrooms and bathrooms, location, rental cost, and whether the landlord allows pets. It is not uncommon to see the phrase "No Section 8" as well. These advertisements are exhibiting source of income (SOI) discrimination, whereby a landlord does not rent to a prospective tenant because of where the tenant receives the money to pay rent, commonly through subsidies such as the Housing Choice Voucher Program (HCVP, colloquially called "Section 8"). This form of discrimination is outlawed in a number of states, counties, and cities throughout the United States.

This project analyzes ten counties across the country – five with and five without SOI protections to answer the following question: (1) Does the enactment of a law change the rate at which landlords explicitly discriminate against HCVP participants?

The Formation of Twitter Networks among U.S. City Mayors

Maxine Goodman Levin College of Urban Affairs

Student Researchers: Sam Motes and Gabrielle Parsson

Faculty Advisor: Clayton Wukich

Abstract

This project (a) explores the extent to which mayors use social media to interact with other mayors, (b) identifies the different types of information shared, and (c) examines the factors that influence whether mayors share information. Focusing on the 100 largest cities in the United States by population, we conduct a network analysis of interactions between mayors, occurring on Twitter from 2016-2018. Findings demonstrate an active information network. Types of information shared address city operations, the favorable presentation of a mayor's city, political positioning, and symbolic acts of congratulations, gratitude, and condolences. Results from a Quadratic Assignment Procedure Logistic Regression analysis reveal that geographic proximity and political party affiliation influenced whether mayors shared information. Furthermore, cities with larger populations were more likely to receive attention within this network. Results contribute to our understanding of both the potential and the limitations of social media for interlocal communication and coordination.

Socioeconomic mobility of local refugees: An analysis of Syrian, Congolese and Ukrainian/Russian refugees

Monte Ahuja College of Business

Student Researcher: Ahna Mullins

Faculty Advisors: Vickie Coleman Gallagher, Tracy Porter, Sorin Valcea, and Benjamin Baran

Abstract

In FY18, the United States has received 18,214 refugees with Ohio receiving 6.69% of that total, which places Ohio second only to Texas. In partnership with one of largest refugee resettlement agencies in Ohio, this study explored the experiences of refugees from Ukraine, Democratic Republic of the Congo (DRC), and Syria. A literature review, interviews, and mini focus group suggest a diverse set of experiences, yet some common themes. Such themes include a can-do attitude, perseverance, and a long-term orientation towards success. In contrast to refugees from Syria and Ukraine, DRC refugees experience additional challenges due to prolonged residence in refugee camps. Some differences in gender dynamics across these three groups were also observed. Interviews with refugee-assistance employees revealed additional themes, including novel responses to managing relationships among employers, refugees, and other staff members.

Surface Functionalization of Pure-Chirality Carbon Nanotubes by Covalent and Noncovalent Chemistry

Washkewicz College of Engineering

Student Researcher: Fjorela Xhyliu

Faculty Advisor: Geyou Ao

Abstract

Single-wall carbon nanotubes (SWCNTs) are one-dimensional cylindrical nanostructures with distinct electronic and optical properties. With all its atoms on the surface, SWCNTs have been widely explored for chemical modification through noncovalent and covalent chemistry, which can provide promising applications in bioimaging and sensing. Here we investigated surface functionalization of pure-chirality SWCNTs with various glycopolymers, surfactants, and RPMI cell culture media with and without fetal bovine serum (FBS). Raman, vis-NIR absorption, and vis-NIR fluorescence spectra of SWCNTs in various solvent environments were monitored over time. While nanotube aggregation was not observed for incubation in FBS containing RPMI for 8 hours, interactions of DNA-SWCNTs with biological media resulted in a PL intensity increase for (7,6) and (8,4), decrease for (10,3), (7,3), (8,3), (11,1), (9,1) and (6,4), and relatively stable for (6,5), and (9,4). Photochemistry with aryl azide chain-end functionalized glycopolymers introduces sp^3 defect sites into the carbon lattice of SWCNTs. This defect-induced E_{11}^- emits light at a lower energy peak than the original E_{11} in the NIR region. Interestingly, an E_{11}^- peak formation was observed for (6,5) SWCNTs upon photo reaction with N-lactosyl, N-mannosyl, and N-Polyacrylamide polymers.

Treatment of non-epithelial vaginal cells from Lysyl Oxidase like one knockout mice (LOXL 1) with nanoparticles (NPs)

Washkewicz College of Engineering

Student Researcher: Priya Patel

Faculty Advisor: Margot Damaser[1]

Abstract

Female pelvic floor dysfunction includes pelvic organ prolapse (POP) due to multiple vaginal births causing elastin strength to be reduced. Several normal functions are compromised including bladder control, fecal continence, and painful urination and many other symptoms. Currently no effective treatment is known and women seek surgical mesh implants to correct these issues which are not entirely safe nor effective. The condition of POP affects women across the world and effective treatment is sought. Varying proteins including lysyl oxidase (LOX), tissue inhibitors of metalloproteinases, and matrix metalloproteinases are involved in elastin homeostasis. In this experiment, non-epithelial vaginal cells (NEVCs) retrieved from lysyl oxidase-like 1 (LOXL1) knockout (KO) mice were treated with a nanoparticle drug delivery technology loaded with pro-elastogenic transforming growth factor beta 1 protein (TGF-β1) and were analyzed for their expression of elastin homeostasis enzymes. It was predicted that treatment of NEVCs with this nanoparticle technology will promote elastin regeneration in these cells representative of vaginal cells in women with POP. Treating NEVCs with elastin generating protein of TGF-β1 is likely to increase recruitment of lysyl oxidase protein, which is responsible for elastin homeostasis.

**Supported by the McNair Scholars Program*

[1]Department of Biomedical Engineering, Cleveland Clinic

Multi-phase Waste Gasification: Reaction Engineering for Sustainable Living Environments

Washkewicz College of Engineering

Student Researchers: Kristen M. Reyes and Mason J. Lang

Faculty Advisor: Jorge E. Gatica

Abstract

Gasification converts carbon-based (organic) materials into gaseous products typically referred to as synthetic gas. This technology is an alternative for reducing carbon footprint of energy generation as well as for waste management. This research examines Catalytic Gasification as a route to Sustainability while converting spaceflight and municipal waste into high-value products. As polyethylene (PE) makes up one of the largest portions of both municipal and space waste, this project centered its attention on the gasification of mid-density PE. We used a slurry containing mid-density PE, water, and solid catalysts (ruthenium on alumina, Ru/Al_2O_3) in a 1:1 PE/Ru ratio. The gasification process was investigated in a high-pressure/high-temperature batch reactor operating under isothermal conditions for reaction temperatures between 310-320 ^oC, and various reaction times. Solid and gas residuals were collected and analyzed in the GC and DSC, respectively. Preliminary kinetic characterization and process assessment are presented.

Investigating Particle Size Manipulation for the Metal Organic Framework Cu-BTCs

Washkewicz College of Engineering

Student Researcher: Jonathan Krisak

Faculty Advisor: Sasidhar Gumma

Abstract

Metal organic frameworks are a class of nanoporous materials with pore sizes ranging from 0.5 to 3 nm and high surface areas (500-6000 m^2/g). These materials have potential applications in industrial catalysis, separation and purification, bio-mimetics, drug delivery, semiconductors, sensors and other electronics. The aim of this study is to understand the role of solvent in control of the particle size of the final MOF product. CuBTC MOF has been used as a model MOF in this study to understand this effect.

Altering the dielectric constant of solvents is a potential method of controlling the particle size. The data obtained in this work depicts a direct correlation between the particle size and the dielectric constant of the solvent mixture. Deviations from this rule can be potentially explained by slow evaporation rate, longer nucleation growth, as found in literature, or instability of the hydroxide ions.

Literature states that the donor number and vapor pressure of the solvents also seem to affect the particle size. We observed that, while there is a direct correlation between particle size and donor number, no clear trend was observed between vapor pressure and particle size in this study.

Characterizing Complexes of DNA and Elastin-like Polypeptides

Washkewicz College of Engineering

Student Researcher: Bryce Noe

Faculty Advisor: Nolan B. Holland

Abstract

Elastin-like polypeptides (ELPs) are a class of environmental responsive materials. When prepared with a protein motif that selectively binds to nucleic acids, a nucleic acid-ELP complex can be formed, conferring the responsive properties of ELP onto the nucleic acid. One possible use for such a complex is in DNA origami, where nano-scaled assemblies of DNA can be transformed into nanomachines by using the ELP as an actuator. Other possible uses include the isolation and extraction of a selected strands of genetic material, or the delivery of genetic material to a cell. Using a bacterial expression system, our lab has prepared ELPs with one such DNA binding motif, TAT, which is associated with immunodeficiency viruses. As the TAT-ELP was purified, we observed that it extracted bacterial genetic material along with it. To characterize these nucleic acid-ELP complexes, temperature dependent properties, full UV absorbance spectra, and particle sizing data were collected. Compared to a solution of pure ELP the nucleic acid ELP complex aggregates at a much lower temperature. The absorbance values of the complex show that the complex has a maximum absorbance at a different value than pure ELP. Particle sizing results showed multiple distinct sizes for the complex, as opposed to a singular size for ELP aggregates.

Methodology Development for the Implementation of Microfluidic Mixers

Washkewicz College of Engineering and College of Sciences and Health Professions

Student Researchers: Tahir Butt and Gautam Mahajan

Faculty Advisors: Chandrasekhar Kothapalli and Petru S. Fodor

Abstract

Microfluidic platforms have been widely regarded as defining technologies for the development of chemical and biological synthesis and analysis systems, due to benefits associated with reduced reactant consumption, increases by orders of magnitude of the surface-to-volume ratios, and greatly enhanced control over reactions variables such as temperature and pressure. However, one of the bottlenecks for their wide application is the difficulty in achieving mixing, given the typical laminar flows in these systems. In this work we implement experimentally, various strategies using geometrical features to control the fluid motion and induce stirring flows. The mixers are fabricated using soft-lithography in PDMS employing replica molding. The flow structures were imaged using fluorescence confocal microscopy. In future work, the fluid flow patterns from confocal microscopy imaging, at various locations in the mixer, will be compared to theoretical predictions from computational fluid dynamics modeling.

Implementation of a Reverse Staggered-Herringbone Microfluidic Mixer for High-Throughput Polymer Nanoparticle Synthesis

Washkewicz College of Engineering and College of Sciences and Health Professions

Student Researcher: Alexa Roberts

Faculty Advisors: Petru Fodor, Kiril Streletzsky, and Chandra Kothapalli

Abstract

The goal of this research is to implement and optimize the operating conditions of a microfluidic mixer to synthesize polymeric nanoparticles (NPs) in a high-throughput fashion. Using a reverse staggered-herringbone microfluidic mixer that we recently designed, the effects of experimental conditions such as flowrate and reactant composition on NP characteristics were investigated and optimized. The device design allowed for physical contact between two streams of fluids – one containing poly(lactic-co-glycolic acid; PLGA) in acetonitrile and the other deionized water, to allow for efficient mixing and NP precipitation to occur. The resulting NPs were characterized using dynamic light scattering (DLS) and field-emission scanning electron microscope (FESEM) to determine the size distribution and shape. Results suggest that 0.1 wt% PLGA solution at 70 μL/min flowrate yielded the smallest diameter range and uniformly spherical particles. These optimized experimental conditions will be used to encapsulate drugs for controlled release studies and cell delivery *in vitro*. The project outcomes could lead to controlled-synthesis of efficient nanocarriers of drugs for targeted delivery applications.

Prediction of Metabolism-Induced Neurotoxicity on a 384PillarPlate

Washkewicz College of Engineering

Student Researchers: Rushabh Patel, Pranav Joshi, Soo-Yeon Kang, Stephen Hong, and Parnian Bigdelou

Faculty Advisor: Moo-Yeal Lee

Abstract

Metabolism of compounds including neurotoxins primarily occurs in the liver by a variety of drug-metabolizing enzymes (DMEs) followed by a series of downstream responses. Unmodified (or parent) neurotoxins are transported into human hepatocytes through several influx transporters or via passive diffusion and undergo Phase I and Phase II biotransformation by DMEs before they are cleared. Neurotoxins and their metabolites generated from human hepatocytes could potentially lead to the toxic effects on neural stem cells (NSCs) as the reactive metabolites have potential for producing reactive oxygen species (ROS), which can lead to irreversible oxidative damage to NSCs via lipid peroxidation, DNA, mitochondrial and protein damage, and endoplasmic reticulum (ER) stress. Our goal is to evaluate molecular actions of compounds and their metabolites within NSCs and their cellular consequences by a suite of high-content toxicology assays**.** A 3D NSC culture on a 384PillarPlate will be combined with human liver cell aggregates expressing cytochrome P450s in an ultralow attachment (ULA) 384-well plate to demonstrate metabolism-induced neurotoxicity. Model compounds will be added in the 384-well plate containing liver cells and sandwiched with 3D NSCs on the 384PillarPlate. High-content imaging assays will be performed to evaluate the effect of compounds and their metabolites in NSCs to analyze the metabolism-induced neurotoxicity.

A 3D Cancer Cell Migration Assay on a 384-Pillar Plate with Sidewalls

Washkewicz College of Engineering

Student Researchers: Nicholas Lesh, Alexander Roth, Stephen Hong, [1]Oju Jeon, and Eben Alsberg[1]

Faculty Advisor: Moo-Yeal Lee

Abstract

Hepatocellular carcinoma (HCC) is an aggressive liver cancer where prognosis is heavily tied to metastasis progression. Researchers look to determine the triggers for metastasis to control its spread. The goal of this project is to determine these triggers by quantifying Hep3B cell migration on a high-throughput platform. We infected Hep3B cells with lentiviruses containing mCherry to produce stable fluorescent cells. Next, we determined the stability of growth factors in oxidized, methacrylated alginate (OMA) hydrogel by binding growth factors with methacrylated heparin sulfate (MHS) before encapsulating in OMA, printing onto the 384-pillar plate with sidewalls, and quantifying growth factor release via ELISA. Finally, we printed layer-by-layer migration assays, in which bottom layers of fluorescent cells would migrate in response to top layers of growth factors and quantified migration and proliferation using previously developed macros. Initially, there was a strong release of growth factor, but the release rate was retarded by binding to MHS, meaning growth factors were stable. Cells proliferated in response to growth factors that encourage proliferation, while migration occurred towards growth factors that upregulate angiogenesis. These results show that we have successfully developed a 3D-cancer cell migration assay which has implications in the characterization of other cancers.

[1]Biomedical Engineering Department, Case Western Reserve University

Dendrite Morphology of Pb-5.8 wt. Sb Alloy after Gradient Freeze with Cross-Section Area Change

Washkewicz College of Engineering

Student Researcher: Michael Shannon

Faculty Advisor: Surendra Tewari

Abstract

Directional solidification (DS) is the process of solidifying a metal alloy from one end to another resulting in aligned primary dendrites which are branched tree like features. Alignment of primary dendrites along [100] direction and their uniformity and distribution along the DS length determines the mechanical properties. These properties are especially important for single crystal turbine blade applications in modern gas turbine engines. Convection during solidification plays an important role in formation of detrimental defects, such as, misaligned grains, non-uniformity of dendrites and composition inhomogeneity. In this study the microstructural evolution during "Gradient Freeze DS process", involving an abrupt cross-section decrease has been examined on cylindrical Pb-5.8% Sb alloy samples. Pb-5.8Sb was selected for this study because of its ease of processing and availability of its well-characterized physical property data. Two furnace cooling rates, 0.5 and 4 ^{o}C/min, have been examined during gradient-freeze DS.

Morphology of primary dendrites has been observed to change from being branch-less (cellular), to onset of side-branching, to being well-branched having tertiary and higher level branching as a function of increasing solidification distance. "Freckles" caused by "severe plume-type" convection are seen in the slower cooling rate sample, but not in the faster cooling rate sample. Positive macrosegregation of Sb occurs along the DS length at both cooling rates, but is more severe at the slower cooling rate. A solute buildup, just before the section decrease, and solute depletion, just after the area decrease is seen, especially at the higher cooling rate. Trunk diameter of primary dendrites decreases, and their spacing (mean minimum spanning tree branch length) increases as the liquid-solid interface advances from the cold end of the sample to its hot end.

This ground based research is in support of a future microgravity experiment in the convection free environment of Space Station. The research was supported by grants from NASA and from the Undergraduate Summer Research Program at Cleveland State University.

Boundary effects on the locomotion of active Janus particles

Washkewicz College of Engineering and College of Sciences and Health Professions

Student Researchers: Marola W. Issa and Nicky R. Baumgartner

Faculty Advisors: Shawn D. Ryan and Christopher L. Wirth

Abstract

Self-propelled or "active" micrometer scale particles are capable of supplying local mechanical work, necessary for microscale cargo delivery and useful in other applications within bioimaging and sensing. Research in the last decade has focused on developing, measuring, and manipulating the locomotion mechanisms of active particles in simple environments. However, many applications will be in complex environments with nearby boundaries or variations in physiochemical cues. This poster reports the directed motion of platinum coated polystyrene particles at infinite dilution in the presence of H_2O_2, which acts as a fuel to drive motion. A transport mechanism called "diffusiophoresis" drives motion of the particle as a consequence of the local gradient in chemical species following the breakdown of hydrogen peroxide into oxygen and water on the platinum cap. The apparent swimming speed of the particle increased from 0 μm/s to approximately 2 μm/s with fuel concentrations between 0% and 10% near a boundary. Complementary simulation work showed clustering as a consequence of the balance between swimming speed and random Brownian diffusion. Finally, the poster will summarize efforts to tune swimming speed by adjusting the physiochemical environment of the particle via the addition of salt and non-adsorbing nanoparticles. Results from this work demonstrate how the local environment will alter the dynamic behavior of active Janus particles.

Civil Engineering Surrounds You

Washkewicz College of Engineering

Student Researcher: Claire Anderer-Armstrong

Faculty Advisor: Jacqueline Jenkins

Abstract

Academic engineering departments are regularly asked to conduct tours of their laboratories to prospective CSU students. For the Civil & Environmental Engineering department, the tours typically take place in the Driving Simulation laboratory, which houses an RS-600 driving simulator. The purpose of this project was to develop a driving scenario that highlights various aspects of civil engineering. The programmed scenario will be used to conduct future tours.

Virtual Reality Based Serious Games for STNA Training

Washkewicz College of Engineering

Student Researcher: Ryan Thomas Kall

Faculty Advisor: Wenbing Zhao

Abstract

In this project, exploratory steps have been taken towards the development of a set of serious games for state tested nursing assistants (STNAs) education and training, which promises to make the training more engaging and effective. Tasks include getting familiar with developing 3D scenes with Unity, human activity recognition with Microsoft Kinect, creating holograms with Microsoft HoloLens, and help implement a gaze-based mechanism for performance assessment in patient transfer skills.

Spark Plasma Sintering of Soft magnetic Materials

Washkewicz College of Engineering

Student Researchers: Harnavdeep Kaur, Taban Larimian, and Javier Esquivel[1]

Faculty Advisors: Rajeev Gupta[1] and Tushar Borkar

Abstract

Over the past 3 decades, iron-based soft magnetic alloys such as Finemet ($Fe_{73.5}Si_{13.5}B_9Nb_3Cu_1$ (at%)) have attracted great interest due to their exceptional magnetic properties like high magnetization, low coercivity, and high curie temperature. However, the production of amorphous precursor requires very high cooling rates, and thus only wires, powders, and thin ribbons are achievable, yet these are not suitable in industrial applications where large volume of bulk magnetic components is required. Mechanical alloying (MA) 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 amorphous-nanocrystalline alloys with homogenous microstructure. The iron-based soft magnetic alloys have been fabricated by spark plasma sintering (SPS) process coupled with high energy ball milling. All the alloys have been processed from a mechanically alloyed blend of elemental powders, and their microstructures, microhardness, and phase formation are discussed. In addition, influence of ball milling parameters on microstructure and phase formation of these alloys have been investigated. This study will open new avenues for the development of soft magnetic materials, with complex shapes and excellent soft magnetic properties.

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Comparative Study of the Microstructure and Mechanical Properties of Mechanically Alloyed and Spark Plasma Sintered AlxCoCrFeNi (0≤x≤2)High Entropy Alloys

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Abstract

High entropy alloys are a new class of material systems that have promising potential in high temperature structural applications. Mechanical alloying (MA) 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. This research paper discusses novel mechanically alloyed followed by spark plasma sintering approach for assessing composition-microstructure-microhardness relationship in AlxCoCrFeNi (0≤x≤2) high entropy alloy as a candidate system. With increasing Al content, there was a gradual change from a fcc-based microstructure to a bcc-based microstructure (including the ordered B2 phase), accompanied with an increase in microhardness. Such graded alloys are highly attractive candidates for investigating the influence of systematic compositional changes on microstructural evolution and concurrent physical and mechanical properties in complex concentrated alloys or high entropy alloys.

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