2021 UNDERGRADUATE RESEARCH POSTER SESSION

Student Center Atrium

September 23, 2021

12 PM - 3 PM

ABSTRACTS

ENGAGED LEARNING

Office of Research

2021 Undergraduate Summer Research Award Poster Session

Poster Number	Title of Poster
College of Education and Human Services	
1	Youth-Led Research Goes Online: Building a Digital Hub for School-Based YPAR Resources
2	Making Sense of Youth Sense-making: An Inquiry into How Youth Perspectives are Centered in Youth-led Research
3	An exploratory study of technological tools for teaching learner-centered mathematics
4	Revised Parenting Style and Practices Scale (R-PSPS): Examining Parenting Practices of Resettled Refugees and Immigrants
College of Liberal Arts and Social Sciences	
5	Heritage Spanish in Cleveland: Language Evolution in the Cleveland Hispanic Community
6	Streaming Video Content in the Time of COVID-19*
7	Documentary Storytelling: Production & Post Production
8	The Use of Preferred Music to Improve the Sleep Quality of a High School Athlete with Post-Concussion Syndrome
College of Sciences and Health Professions	
9	Orientation to visual stimuli by the African clawed frog (Xenopus laevis): Size preference, adjustment for motion, and age effects
10	Optimizing cardiomyocyte differentiation for use in atrial fibrillation-associated functional and genetic studies
11	Identifying factors interacting with TbRAP1 in Trypansoma brucei using yeast two hybrid screen
12	Expression and Purification of Recombinant TbTERT for antibody production
13	Characterization of functions of Apollo in Trypanosoma brucei
14	Expressing T. brucei SNAP26 in E. coli cells for antibody production
15	The Addition of Highland Park Cemetery into Existing Studies on Urban Tree Growth
16	Myzocytosis and nutrient uptake in Colpodella sp. (ATCC 50594) investigated using Actin distribution, FluoSpheres and E. coli BioParticles
17	ARLNC1 noncoding RNA mediated Regulation of androgen receptor expression in Prostate Cancer
18	Novel approach to study the cell cycle regulation of molecules controlling the coordinated processes of skeletal myoblast differentiation and apoptosis (cell death)
19	The Role of BATF2 in Experimental Autoimmune Encephalomyelitis and Multiple Sclerosis*
20	Nanostructured alginate-NOS hydrogel with sustained release of nitric oxide: a platform to study of NO-driven modulation of carcinogenesis
21	Detection and quantification and nitric oxide in cell line models of Cystic Fibrosis disease
22	Identification of Anti Glioblastoma Agents With Western Blot Assays in T98G Cells
23	Pharmacokinetic study of an anti-trypanosome agent with different formulations and administration routes in mice by HPLC-MS/MS
24	Identification of Anti-glioma Agents with MTT Assays in Multiple Types of Glioblastoma Cells
25	Synthesis and Characterization of Sialidase Inhibitors
26	RNase L in Renal Function and Repair
27	The Impact Balance Training has on Kinematic Measurements
28	Optimization of cerebrospinal fluid extraction from anesthetized mice via the cisterna magna using pulled glass pipettes and a stereotaxic device
29	Effects of angular momentum on stability during quadrupedal locomotion
30	Prevention of Mild Cognitive Decline in Aging Senior Citizens*
31	Phonological Interventions for Children with Speech Sound Disorders*
32	Jet Graphs
33	Determining Numerical Solutions for Quasi-Birth-Death Processes with Time Varying Transition Rates

2021 Undergraduate Summer Research Award Poster Session

Poster Number	Title of Poster
34	Investigating Strength and Stability of the Louche in Absinthe
35	High-Speed Video Acquisition and Analysis of Taekwondo Kicks*
36	Finding the true molecular weight of the polymeric microgels of varying crosslinking density
37	Observations of cross-shelf nitrate fluxes over the Oregon continental shelf
38	Imaging of the Soft Matter Particulate Systems by Scanning Electron Microscopy
39	Kinetic analysis of Recombinant Dihydroorotase from Methanococcus jannaschii
40	Do Adverse Childhood Experiences Affect Rates of Depression?*
41	MBTI and personality's Academic Preferences*
42	The Effects of Interrupting One's Partner at Work
43	Development of Childhood Friendships in Children Ages Four to Five*
44	The Impact Emotions Have on Recall*
45	Programming with Labvanced for Remote Collection of Cognitive Psychology Data
46	I'm concerned, but hesitant: A test of psychiatric status effects on Coronavirus safety behaviors and vaccine perceptions
47	Not all created equal: A test of psychotropic medication class effects on autonomic and subjective reactivity to dysphoric and hedonic stimuli in a mixed clinical-community sample

Monte Ahuja College of Business

48	How Can We Reduce Consumer Resistance to Sustainability Interventions in Retail Stores? Moderating Roles of Culture, Personality, Customer Loyalty, and Marketing Efforts.*

Washkewicz College of Engineering

49	Non-covalent complexation of boron nitride nanotubes with pectin
50	DNA-Complexed Hexagonal Boron Nitride Nanosheets as Emulsion Stabilizers
51	Effects of Solvent on Creating Fluorescent Quantum Defects in Carbon Nanotubes by Diazonium Reaction
52	Catalytic Gasification of Household Recyclables: Simulating Reactor Performance
53	The Design, Biosynthesis, Purification, and Characterization of Polypeptide Bio-Inks
54	Fabrication of Nylon-6/Multi-Walled Carbon Nanotube Composite for Sodium Ion Quantification*
55	Molecular sieving separation with zeolite membranes
56	Effect of Graphene Oxide on the Properties of Normal Strength Concrete
57	Towards optimization of biomedical bone staples: Numerical Simulations
58	Exploring IoT Jamming Attack on Satellite Communications
59	Identification of Cancerous Tissue from Histopathological Images Using Unsupervised Learning
60	Learn to Control an Autonomous Vehicle Through a Driving Simulator
61	Line-constrained L∞ One-Median and One-Center of Uncertain Points in the Plane
62	Develop a Mobile App Towards Stronger Sense of Belonging for College Students during the COVID-19 Pandemic
63	Object Detection using Computer Vision
64	Microstructure, Mechanical, and Tribological Behavior of Spark Plasma Sintered Titanium Carbide (TiC)-Titanium Nitride (TiN) based Composite Coatings
65	Solar Thermal Dish Storage System Project: A Novel Receiver Experiment Model*

*McNair Projects

Youth-Led Research Goes Online: Building a Digital Hub for School-Based YPAR Resources

College of Education and Human Services

Student Researchers: Lisa Carrick and Alla Karapunarly

Faculty Advisor: Molly Buckley-Marudas

Abstract

In the last decade, a growing number of schools have integrated YPAR into the everyday school curriculum. Teachers of different content areas and grade levels have created space for students to engage in all steps of the action research cycle as part of their work in school. This project focused on building an online hub of resources, aimed at supporting teachers and young people with school-based YPAR. This project included several phases, including: the documentation of the YPAR project at one Cleveland high school; web-site design; collection, the curation and revision of new and existing lesson plans; the creation of student-facing checklists; and publishing the materials.

Making Sense of Youth Sense-making: An Inquiry into How Youth Perspectives are Centered in Youth-led Research

College of Education and Human Services

Student Researchers: Nicolette Hoon and Alla Karapunarly

Faculty Advisor: Molly Buckley-Marudas

Abstract

At this moment, as the Covid-19 pandemic and protests for racial justice lay bare the racial and economic disparities in the United States, it is more urgent than ever to foster youth civic engagement and support students to confront inequities as part of school learning. Recognizing youth as change agents and knowledge generators, this paper shares results from an inquiry that examined what happened when Youth Participatory Action Research was integrated as part of the everyday learning for all enrolled 9th graders in an urban public high school. Attention is paid to the sense-making processes and how youth experiences and perspectives are leveraged (or not) in this phase of the action research process.

An exploratory study of technological tools for teaching learner-centered mathematics

College of Education and Human Services

Student Researcher: Katherine Sammon

Faculty Advisor: Patrick Wachira

Abstract

When used strategically, technology has the potential to develop and advance students' mathematical sense making, reasoning, problem solving and communication. This study investigated how existing and emerging technological tools can be used to support effective learner-centered pedagogical practices in mathematics teaching.

Revised Parenting Style and Practices Scale (R-PSPS): Examining Parenting Practices of Resettled Refugees and Immigrants

College of Education and Human Services

Student Researchers: Katelyn Zeitz and Amanda Mohan

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

Abstract

In 2019, there are 25.9 million refugees worldwide. The United States resettled 30,000 refugees, the top countries of origin for refugees resettled to the U.S. includes Democratic Republic of Congo, Myanmar, and Ukraine. Based on region of origin, 54% of whom came from African, seventeen percent from Asia, seventeen percent from Europe. Of the 49 states admitting refugees, the top three states in the number of resettled refugees include Texas, Washington, and Ohio. Relocated to a new country with a different language and culture than that of their own, resettled refugees and immigrants face several challenges. One of the biggest obstacles parents face is raising their children in a new culture that comprises of different values and beliefs. The purpose of this study was to investigate parenting practices of resettled refugee and immigrant families in the United States. Participants (N = 670) of this study were refugees and immigrants who resided in the Mid-Western region of the United States. The Revised Parenting Style and Practices Scale (R-PSPS) was administered online using SurveyMonkey. Exploratory factor analysis (EFA) was used to assess the factor structure of the R-PSPS. One-way ANOVA was utilized to examine mean differences of the demographic variables. Results of the EFA supported the four-factor structure of the R-PSPS: Expectations (7 items), Autonomy (9 items), Discipline (8 items), and Parental Involvement (5 items). These four factors explained 42.83% of the total variance, and their Cronbach's alpha coefficients are .862, .862, .779, and .768, respectively. Results of the one-way ANOVA showed no significant (p > .05) difference between male and female participants in those four factors of R-PSPS. However, there was a significant difference in Expectations (F = 5.439, p = .020) between immigrants (mean = 5.48 ±0.96) and refugees (mean = 5.18 ±1.18). Likewise, there were significant differences in Expectations (F = 2.843, p = .015), Autonomy (F = 4.649, p < .001), Discipline (F = 6.453, p < .001), and Parental Involvement (F = 6.419, p < .001) among participants with different education levels. The findings indicated that the participants' education level have an impact on their parenting style and practice in the United States. Implications will be provided to inform professional practices and future research.

Heritage Spanish in Cleveland: Language Evolution in the Cleveland Hispanic Community

College of Liberal Arts and Social Sciences

Student Researcher: Melanie Thompson

Faculty Advisor: Lydia Grebenyova

Abstract

In this qualitative study, we investigated the dominant language transfer from English in adult Spanish heritage speakers within the Cleveland Hispanic Community. Two adult Spanish heritage speakers and one adult native Spanish speaker completed linguistic proficiency questionnaires, judging their overall abilities across the two languages. Two oral production tests were used to judge the heritage speakers' actual competence of tense and mood in Spanish. The results of these tests measured the effects of the overall integration of the two languages as well as the incomplete acquisition of Spanish, comparing the overall competence of the subjunctive mood as well as the multiple verb tenses used to describe actions and states of being in the past. The use of the oral production tests, focusing on the spontaneous production of proper tense and mood in Spanish, lead to multiple conclusions on heritage speakers' overall bilingual capabilities. Heritages speakers do struggle with the overall competence of the subjunctive mood in Spanish, at times altogether avoiding the mood in order to best communicate their idea. However, the overall competence and proper usage of multiple tenses describing the past was much higher for both participants. This evidence aligns with the idea that certain language features acquired later in adolescence are more difficult for heritage speakers to master than others, in this case being the subjunctive mood for both participants.

Streaming Video Content in the Time of COVID-19

College of Liberal Arts and Social Sciences

Student Researcher: Thyra Chaney

Faculty Advisor: Evan Lieberman

Abstract

When the COVID-19 pandemic led to quarantine, isolation, and distancing protocols in the U.S., audiences turned to Subscription Video On Demand (SVOD) platforms to cope. While the use of SVOD platforms increased during the pandemic, the pandemic also challenged the entertainment industry's ability to satisfy increased demand for content. A mixed methods approach was used to investigate the motivations that led to widespread use of SVOD platforms by U.S. audiences during the pandemic and the methods used by media companies to adapt to audience demand for streamable content during the same period. A literature review was used to understand the development of the SVOD industry, its role within the entertainment industry as a whole, and its influence in everyday life prior to the COVID-19 outbreak. A secondary literature review was conducted on media uses and audience motivations. A timeline analysis was used to compare the developments of the COVID-19 pandemic to the effects on production and distribution strategies in the entertainment industry. Pre-existing SVOD companies were uniquely advantaged at the start of the pandemic period when theatrical release and broadcast television production schedules were disrupted by pandemic related shutdowns. Overall, the effects of the pandemic catalyzed the entertainment industry's transition from traditional release formats to digital based subscription and streaming models. The widespread use of SVOD platforms during the pandemic is indicative of the value of media in modern life as well as the value of new technologies and distribution models.

**Supported by the McNair Scholars Program*

Documentary Storytelling: Production & Post Production

College of Liberal Arts and Social Sciences

Student Researcher: Spencer DeVeau

Faculty Advisor: Cigdem Slankard

Abstract

This dual research project is comprised of a short documentary and a virtual reality experience. The short documentary tentatively titled *Beyond Survival* explores stories of Congolese refugees who were resettled in Cleveland, and who completed the Survivors of Torture program. The virtual reality experience is an immersive documentary, which focuses on the Wolstein Center Mass Vaccination Clinic with the objective to capture this historic moment.

The Use of Preferred Music to Improve the Sleep Quality of a High School Athlete with Post-Concussion Syndrome

College of Liberal Arts and Social Sciences

Student Researcher: Rebekah Smith

Faculty Advisor: Deborah Layman

Abstract

Difficulty sleeping is a common long-term complaint for those who have experienced head trauma and brain injury, including concussions (Hvingelby, 2020). Sleep issues may result in decreased satisfaction in life, anxiety, and depression (Lim & Baumann, 2021). Music therapy can promote sleep quality and may be an effective, safe, and affordable treatment (Kavurmaci, Dayapoglu, & Tan, 2020). Research has shown that listening to preferred music can reduce stress and anxiety while promoting relaxation and sleep (Bartlett et al., 1993; Davis & Thaut, 1989; Iwaki, Tanaka, & Hori, 2003; Walworth, 2003).

The purpose of this study is to examine the use of preferred music to improve the self-reported sleep quality, pain, and mood of an 18-year-old high school athlete with post-concussion syndrome. A single-subject, quasi-experimental design was used to examine the use of a preferred music playlist to promote relaxation and sleep. Eleven individual music therapy sessions were held weekly via Zoom. During the first four sessions, the student music therapist and the participant created an individualized therapeutic playlist for daily home use. The remaining seven sessions focused on specific music and relaxation techniques.

The results of this study demonstrated that the participant's sleep quality improved when comparing pre-intervention to post-intervention. Daily self-reported sleep quality also increased. Participant's self-reported perception of pain decreased pre- to post-intervention. In addition, the participant's self-reported mood increased throughout the intervention.

The results of this study indicate that music therapy may be helpful in addressing pain, mood, and sleep quality in individuals with concussion histories. This single-subject study and its promising results are just a first step towards examining the utility of music therapy as a non-pharmacological intervention to treat individuals who have experienced concussions.

Orientation to visual stimuli by the African clawed frog (Xenopus laevis): Size preference, adjustment for motion, and age effects

College of Sciences and Health Professions

Student Researcher: Jacob Sherman

Faculty Advisor: Jeffrey Dean

Abstract

Aside from utilizing their lateral line systems to locate prey, African clawed frogs (*Xenopus laevis*) often respond to visual stimuli. To better understand their visual acuity, we used an apparatus that rotated two transparent strips with visual targets opposite one another outside a cylindrical aquarium. The targets were black circles of different diameters, rotating back and forth for roughly three minutes; the diameter of the control circle was always 1 cm, while that of the other target ranged from 0.125 cm to 16 cm. Based on preliminary results, frogs were less likely to turn towards very small and very large targets. In most cases, frogs appeared to turn toward the current location of the target, and rarely deflected their turns in anticipation of target motion.

Optimizing cardiomyocyte differentiation for use in atrial fibrillation-associated functional and genetic studies

College of Sciences and Health Professions

Student Researchers: Jasline Rosario and Samira Xhafer

Faculty Advisor: Shamone Gore Panter

Abstract

Atrial fibrillation (AF), the most common type of sustained cardiac arrhythmia, is an irregular and often rapid heart rate that makes you more susceptible to strokes, heart failure and other heart-related complications. There is a large body of research investigating the genetic factors of AF, but causative gene(s) have not been identified. This summer we worked in the cell and tissue laboratory, under the supervision of Dr. Shamone Gore Panter. Although the initial purpose was to screen several siRNAs for knockdown of an atrial specific gene thought to play a role in AF, there were issues with cardiomyocyte differentiation efficiency which modified our focus to optimizing differentiation of human induced pluripotent stem cells (IPSCs) to beating cardiomyocytes. It has been shown that modifying the concentration of CHIR99021-HCL (CHIR), a GSK-3α/$\beta\beta$ inhibitor, and/or Wnt-C59, a Wnt inhibitor, may affect differentiation and must be examined for each line of iPSCs. For the studies presented here, we focused only on CHIR concentration modifications. Using two genetically identical female lines that were purchased many years apart we plated the cells on Matrigel-coated 6- cell culture plates at a density that will permit near confluency in 4 days. At day zero, the different concentrations of CHIR are added to replicate wells. On day 6-8 of the protocol, eight of the 24 wells showed variable degrees of beating. All beating wells and representative non-beating wells were harvested. RNA was extracted and cDNA prepared. qPCR will be run using several genes that will measure expression of several genes that are cardiac-specific, non-myocyte specific, and pluripotent specific as a negative control. Based on prior data we expect that the beating cells will have much higher expression of cardiac-specific genes than those that did not beat. Additionally, we expect the wells with more robust beating will have higher levels of the cardiac-specific genes when compared to wells with lower levels. Our future plans include modifying Wnt signaling to further optimize beating and adding retinoic acid during differentiation to drive the cardiomyocytes to a more atrial-like phenotype for further downstream AF studies.

Identifying factors interacting with TbRAP1 in Trypansoma brucei using yeast two hybrid screen

College of Sciences and Health Professions

Student Researcher: Umida Burkhanova

Faculty Advisor: Bibo Li

Abstract

The focus of our lab is on studying Trypanosoma brucei, a parasitic protozoan and a causative ageing of African Trypanosomiasis (also known as: African sleeping sickness). It was found previously that telomeric proteins play an important role in VSG switching that allows T. brucei to evade the human immune response. The members of the Li lab determined that specifically the TbRAP1 telomeric protein is essential for VSG silencing. In this project we aimed to identify protein binding partners of TbRAP1 using the yeast two hybrid screen. Yeast two hybrid analysis has been used to screen cDNA library of T. brucei against a protein of interest - TbRAP1, thus identifying candidate genes encoding proteins which bind to the target protein. TbRAP1 has multiple conserved protein-protein interaction domains. In this project we focused on analyzing TbRAP1 interacting partners in Myb-like-RCT (aa 742-855) domain. In our yeast two hybrid screen, we used the L41 yeast strain, which used two reporter genes LacZ and HIS3 to detect the interaction between proteins. The bait and the prey plasmids were designed, one expressing TbRAP1 and the other one expressing the normalized T. brucei cDNA library. The yeast cells were transformed with these plasmids and a total of 5.5 million primary transformants were plated to the synthetic drop-out plates. As a result, a total of 1642 clones were obtained. After performing filter-lift assay, it was found that a total of 580 candidates expressed the reporter LacZ gene. Ultimately, 33 interacting candidates were identified.

Expression and Purification of Recombinant TbTERT for antibody production

College of Sciences and Health Professions

Student Researcher: Nick Gehrke

Faculty Advisor: Bibo Li

Abstract

Trypanosoma brucei is a unicellular parasite known for causing African trypanosomiasis (African sleeping sickness). If left untreated, this can result in insomnia, seizures, paralysis, and death. *T. brucei* is difficult for the human immune system to eliminate as it regularly switches its variant surface glycoprotein (VSG). By switching this protein, which makes up a thick coat on the parasite, *T. brucei* is able to avoid detection and destruction by the host immune system. Telomere proteins have been shown to play a critical role in VSG expression and switching (2-4). Telomeres are known to shorten overtime and depend on telomerase for maintenance. Telomerase consists of telomerase reverse transcriptase (TERT) and an RNA component that provides a template. In order to further study the role of TERT in *T. brucei*, we decided to develop a *Tb*TERT antibody by cloning a C-terminal fragment of *Tb*TERT into a plasmid. Using this plasmid, we produced bacteria that could be induced to express the C-terminus of *Tb*TERT. This protein can be purified for antibody production.

Characterization of functions of Apollo in Trypanosoma brucei

College of Sciences and Health Professions

Student Researcher: Hebah Aladaileh

Faculty Advisor: Bibo Li

Abstract

The stability of linear chromosomes is maintained by nucleoprotein structures known as telomeres. Telomeres, located on chromosome ends, are protected by the protein complex shelterin. This protein complex which is comprised of six proteins; TRF1, TRF2, Rap1, TPP1, TIN2 and Pot, prevents DNA damage repair mechanisms from affecting telomeres. One accessory factor that interacts with the shelterin complex is the exonuclease protein Apollo. In mammalian cells the Apollo protein is recruited by TRF2, a telomere binding protein, to resect the telomere 5' end, allowing a proper telomere G-rich 3' overhang to form at the very end of the telomere. This structure plays a critical role in telomere stability. *T. brucei* is a unicellular protozoan parasite that causes African trypanosomiasis, which can infect humans and livestock. Its infections could be fatal and economically damaging. *T. brucei* can frequently escape the host's immune response by changing its major surface antigen protein, variant surface glycoproteins (VSGs). The expression of VSGs comes exclusively from loci immediately upstream of the telomere. To our knowledge, no studies have been done on *T. brucei* to understand the processing of G rich 3' overhang. Understanding the functional relevance of Apollo would shed light on G rich 3' overhang processing. This study would help in understanding the role of Apollo in telomere stability and pathogenesis in *T. brucei.* We have generated various constructs to characterize the functions of Apollo in T. brucei, including a FLAG-HA-HA (F2H) tagging construct, an RNAi construct, and a single knock out construct.

Expressing T. brucei SNAP26 in E. coli cells for antibody production

College of Sciences and Health Professions

Student Researcher: Maria Rivera Paz

Faculty Advisor: Bibo Li

Abstract

Trypanosoma brucei is a kinetoplastid parasite that causes African trypanosomiasis. As infection can lead to adverse health effects and even death, efficient pharmaceutical therapies are crucial for the treatment and elimination of the parasite from its human host.

T. brucei undergoes antigenic variation. Antigenic variation is used by many parasitic organisms as a defense mechanism against the host's immune system. The major surface antigen that is regularly switched in antigenic variation in *T. brucei* is variant surface glycoprotein (*VSG*).

Studying the regulation of *VSG* genes, all found on subtelomeric regions of its genome, is important since the regulatory proteins found in Trypanosomes differ from their human orthologs significantly. Since *VSG* genes are all found at subtelomeric regions, studying the telomere proteins is also crucial because they not only regulate *VSG* expression but are essential for *T. brucei* proliferation.

Both SL-RNA and snRNAs are important for trans-splicing of mRNA transcripts in *T. brucei*. SL-RNA transcription units are activated by an snRNA activating protein complex, or SNAPc. As such, the SNAPc protein expression can be detected at the *VSG* splicing centers. *VSG*'s are expressed at a considerably high rate, and trans-spliced constantly. Therefore, the *VSG* transcription site is juxtaposing one of the splicing centers in the cell.

In this project, the SNAP26 gene was isolated from *T. brucei* genomic DNA, ligated to a pET15b vector, then the complete plasmid construct was transformed into BL21 cells for expression of the desired protein. After induction of the desired protein, it was purified so that the protein samples could be sent out for antibody production. Once the antibodies have been made and received, they will be confirmed through Western blot analysis. SNAP26 antibodies will aid with visualization of the *VSG* expression site in future experiments.

The Addition of Highland Park Cemetery into Existing Studies on Urban Tree Growth

College of Sciences and Health Professions

Student Researcher: Madelyn Jablonski

Faculty Advisor: Kevin Mueller

Abstract

Greenspaces in cities provide substantial ecosystem services, and the trees in those greenspaces are responsible for most of those ecosystem services. But, the 'forest' in many urban greenspaces is declining, and there is a growing need to monitor and improve urban forests. The purpose for this research was to understand the species diversity, size, and health of the trees that are in Hyland Park Cemetery in Cleveland, Ohio. Candidate trees were selected using several criteria including canopy cover, overall health condition, and within a range of 5-50 centimeters in diameter at breast height (DBH). The average DBH of candidate trees was 38.1cm, with a minimum measurement of 17.1cm and a maximum of 48.6cm. The species composition was primarily maples, particularly Freeman's maple (Acer x Freemanii). The lack of small trees in optimal planting sites and the low species diversity make this greenspace susceptible to disturbances, and a prime candidate for future tree plantings. In the future, the research at Hyland Park can be expanded by monitoring tree growth or other ecosystem services.

Myzocytosis and nutrient uptake in Colpodella sp. (ATCC 50594) investigated using Actin distribution, FluoSpheres and E. coli BioParticles

College of Sciences and Health Professions

Student Researchers: Mary Asraf, Mignon Moore, Siddhi Panchal, Pranav Sivaram, and Angad Dhillon

Faculty Advisor: Tobili Sam-Yellowe

Abstract

Colpodella species are free-living predatory protists phylogenetically closely related to the apicomplexans, which includes important human pathogens causing malaria, toxoplasmosis and cryptosporidiosis. Two cases of human *Colpodella* sp. infections were reported in the literature and apicomplexan related lineages (ARLs) have been isolated from environmental samples. In previous studies, cytochalasin D treatment of cells in diprotist culture resulted in distortions of the tubular tethers connecting predator to prey during myzocytosis, suggesting actin involvement in tether formation. The mechanism of myzocytosis, formation of the tubular "feeding" tether and mechanism of nutrient uptake is not well understood in *Colpodella* species. In this study, *Colpodella* sp. (ATCC 50594) were maintained in *Enterobacter aerogenes* bacterized Hay medium at 24ºC with the prey protist *Parabodo caudatus.* The distribution of actin in the tubular tether formed during myzocytosis, and the size of nutrients taken up by predator and prey were investigated using FluoSpheres and *E. coli* BioParticles. FluoSpheres of 4 µm and 2 µm and *E. coli* BioParticles were added to diprotist cultures immediately after subculture and 27 hours post subculture, respectively. Following 5% formalin fixation, particle uptake was analyzed using confocal microscopy. Fixed cells without particle uptake were also analyzed by fluorescent actin-green 488 staining and by immunofluorescence assay (IFA) using antibodies specific for apical complex proteins. Actin staining was distributed over the cell bodies of predator and prey and along the tubular tethers in some attachments. Preliminary data obtained showed that *Parabodo caudatus* did not take up FluoSpheres of 4 µm and 2 µm but took up *E. coli* BioParticles. Due to low cell density of *Colpodella* sp. in culture, particle uptake was not observed. The uptake data shows that the mechanisms of endocytosis and myzocytosis can be investigated using fluorescent BioParticles. *Parabodo caudatus* may discriminate between inert particles and BioParticles such as bacteria during nutrient uptake.

ARLNC1 noncoding RNA mediated Regulation of androgen receptor expression in Prostate Cancer

College of Sciences and Health Professions

Student Researchers: Samantha Gargasz, Lindsey Tout, and Eve Likos

Faculty Advisor: Girish C. Shukla

Abstract

The androgen receptor (AR), a ligand-dependent transcription factor, plays a significant role in prostate cancer (PCa) development and progression. PCa treatment commonly involves androgen deprivation therapy (ADT), but the disease can still progress to castration-resistant prostate cancer (CRPC). CRPC no longer responds to ADT, and the second line of therapeutics is known as androgen signaling inhibitors (ASI), including Enzalutamide and Abiraterone Acetate. Therefore, the novel treatment of CRPC relies on understanding the molecular mechanisms mediated by AR. Our lab is looking into the cellular factors that can influence AR at the post-transcriptional level. ARLNC1 is a long noncoding RNA expresses almost exclusively in CRPC tumors and appears to provide a positive feedback loop for AR expression and AR signaling. ARLNC1 binds to the 3' untranslated region (UTR) of the AR messenger RNA and appears to stabilize the AR transcript through the RNA-RNA interactions. Our research looks into the molecular effects of ARLNC1 on the expression of varying lengths of the AR 3'UTR. Our results show that the coexpression of ARLNC1 with varying lengths of AR 3'UTR increases the expression of the AR. These results appear to points towards an unsolved conundrum of the regain of AR functions after ADT leading to the development of CRPC.

Novel approach to study the cell cycle regulation of molecules controlling the coordinated processes of skeletal myoblast differentiation and apoptosis (cell death)

College of Sciences and Health Professions

Student Researchers: Paige Suhadolnik and Ara Mendes

Faculty Advisor: Crystal M. Weyman

Abstract

Skeletal muscle development repair is controlled by two mutually exclusive biological endpoints: programmed cell death (apoptosis) or differentiation of myoblast stem cells. While it is well established that the transcription factor MyoD regulates differentiation, the Weyman lab discovered that MyoD additionally regulates apoptosis. Understanding the mechanism whereby MyoD controls both differentiation and apoptosis could identify therapeutic targets to minimize apoptosis and maximize differentiation, thus improving regeneration and treatments for muscular dystrophies utilizing myoblast transfer. The Weyman lab has already linked apoptosis with S-phase of the cell cycle and differentiation with G1 phase of the cell cycle. Moreover, using MyoD-converted fibroblasts, a specific phosphorylation of MyoD is similarly linked with cell cycle phase. These discoveries relied on the accepted practice of synchronizing a typically asynchronous population of cells. However, in vivo, cells are not, and cannot be, synchronized. Herein, we optimize the protocol to create cell lines that will allow us to identify cells in a particular phase of the cell cycle within the context of an asynchronous population. Future experiments will simultaneously assess cell cycle phase and the release of cytochrome c from the mitochondria (apoptosis) or myogenin expression (differentiation) in an asynchronous population of myoblasts or MyoD-converted fibroblasts.

The Role of BATF2 in Experimental Autoimmune Encephalomyelitis and Multiple Sclerosis

College of Sciences and Health Professions

Student Researchers: Maria Habean and Rachel Tinkey

Faculty Advisor: Jessica Williams[1]

Abstract

Astrocytes play an active role in lesion formation in multiple sclerosis (MS) and the murine model, experimental autoimmune encephalomyelitis (EAE). In EAE and MS, activated astrocytes release cytokines and chemokines that lead to an upregulation in BATF2 expression, a transcription factor previously shown to be upregulated during acute MS and EAE. BATF2 regulates infiltrating immune cells in the central nervous system; therefore, the increased expression of BATF2 by astrocytes may lead to more secure lesions and exacerbated clinical outcomes. Immunohistochemistry was used to characterize lesion size, total BATF2 expression, and the types of infiltrating cells found in the lesion. BATF2 expression was upregulated during acute EAE compared to chronic EAE. The highest proportion of cells expressing BATF2 during acute and chronic EAE was astrocytes, with myeloid lineage cells being the second largest in acute and the fewest cells expressing BATF2 were T cells and B cells in both acute and chronic. These data suggest that BATF2 expression plays a role in astrocyte response to lesion formation in EAE and that BATF2 may represent a liable therapeutic target in MS.

**Supported by the McNair Scholars Program*

[1] *Department of Neuroscience, Lerner Research Institute, Cleveland Clinic, Cleveland, Ohio*

Nanostructured alginate-NOS hydrogel with sustained release of nitric oxide: a platform to study of NO-driven modulation of carcinogenesis

College of Sciences and Health Professions

Student Researchers: Noor Al-Mahmoud, Yasmin Nasreldin, Shaimaa Maher, and Khalid Sossey

Faculty Advisor: Mekki Bayachou

Abstract

Nitric oxide (NO) is a ubiquitous biological signaling molecule. NO has been suggested to modulate a number of physiologic processes including cancer-related events such as angiogenesis and metastasis. We have developed functional polyethyleneimine films with embedded NOS enzymes (PEI-NOS) that generate NO on demand. The goal of this project is to build a nanostructured alginate-PEI-NOS hydrogel and used it as a platform to study NO-modulation of cellular events involved in carcinogenesis.

Detection and quantification and nitric oxide in cell line models of Cystic Fibrosis disease

College of Sciences and Health Professions

Student Researchers: William Curtis, Magdy Ibrahim, Haitham Kalil, and Tiyash Bose

Faculty Advisor: Mekki Bayachou

Abstract

Cystic fibrosis (CF) is a disease caused by a gene mutation. It is estimated that over 1,000 new cases are diagnosed each year. Lowered exhaled nitric oxide (NO) levels in CF patients has been identified as one of the manifestations of the disease unlike other lung inflammatory diseases. This project aims at quantifying NO concentration at the level of live normal and CF cells to shed light on the role and source of NO in CF cells.

Identification of Anti-Glioblastoma Agents with Western Blot Assays in T98G Cells

College of Sciences and Health Professions

Student Researcher: Melanie Erickson

Faculty Advisor: Bin Su

Abstract

Glioblastoma is the most aggressive brain cancer with a high mortality rate. In this study, the lead compound was found to exhibit anti-cancer effects on glioblastoma cells during in vitro and in vivo studies. Thirty-two analogs of the lead compound were synthesized for this study in order to attempt lead optimization. Western Blot Assays were performed to determine the AR down regulation effects of the compounds in T98G cells. Compound 4,5,13,15 and 26 indicated significant AR down regulation effect based on the comparison of the lead compound. AR down regulation effects of the compounds will be further determined in other glioblastoma cell lines.

Pharmacokinetic study of an anti-trypanosome agent with different formulations and administration routes in mice by HPLC-MS/MS

College of Sciences and Health Professions

Student Researcher: Raina Dano

Faculty Advisor: Bin Su

Abstract

Previously compound **12** showed great anti-trypanosome activity without toxicity in an in-vivo study. In the current study, a sensitive and rapid high-performance liquid chromatography-tandem mass spectrometry (HPLC-MS/MS) method was developed and validated to investigate its pharmacokinetics in mouse plasma. A protein precipitation method was applied to extract the compound, and it was then separated using a Kinetex C_{18} column with a mobile phase consisting of acetonitrile-0.1% formic acid water (50:50, v/v) at a flow rate of 300 μL/min. The analytes were detected with the multiple reaction monitoring in negative electrospray ionization source for quantitative response of the compounds. Compound **12** was detected at *m/z* 477.0 → 367.2, while the internal standard compound 14 was detected at *m/z* 499.2 → 268.2. Inter- and intra-day precision was <5.22 and 2.79% respectively, while the accuracy range was within ±9.65%. The method was successfully applied to evaluate the pharmacokinetics of compound **12** in mouse plasma with two formulations (20% Cremophor EL or sesame oil) and drug administration routes (oral and intraperitoneal injection). We observed a better drug serum concentration with the Cremophor formulation, and the two different drug administration routes did not show significant differences from the drug distribution.

Identification of Anti-glioma Agents with MTT Assays in Multiple Types of Glioblastoma Cells

College of Sciences and Health Professions

Student Researcher: Shannon Urmetz

Faculty Advisor: Bin Su

Abstract

Glioblastoma is considered the most aggressive human cancer, often resulting in a poor patient prognosis. In this project, MTT assay techniques were utilized to determine the IC50 values for 32 analogues of the lead compound, C1. Viable cells convert MTT into a purple formazan product, which is resolubilized in DMSO. The NADPH-mediated conversion to formazan product precipitates near the cell's surface and allows for spectrophotometer detection. Four glioblastoma cell lines - A172, U87, T98G, and U373 - were used for the assays. Compounds 4, 8, 19, and 26 were determined to have the lowest IC50 values, and thus displayed the most potent drug effects.

Synthesis and Characterization of Sialidase Inhibitors

College of Sciences and Health Professions

Student Researchers: Garrett Rafn and Isaac Turan

Faculty Advisor: Xue-Long Sun

Abstract

Sialic acids (Sias) are a family of 9-carbon containing acidic monosaccharides that often present at the outmost end of glycans of both glycoproteins and glycolipids (sialylation) and are involved in various biological processes. Sialidases (also known as neuraminidases, NAs) are glycosidases responsible for the removal of Sia residues (desialylation) from glycan portions of either glycoproteins or glycolipids. Through removal of Sia moieties, reducing a negative charge and changing conformation and accessibility of the glycoconjugates, sialidases are able to modulate the function of Sia-containing molecules. Sialidase inhibitors are useful tools for studying sialidase function and serve as drugs for sialidase-related diseases, such as viral infection. The sialidase transition-state analogue, 2,3-dehydro-2-deoxy-*N*-acetylneuraminic acid (Neu5Ac2en) has been used as an important probe for structural and mechanistic studies of sialidases. It was also a lead compound for rational design of clinical anti-influenza virus drugs Relenza (Zanamivir or 4-deoxy-4-guanidino-Neu5Ac2en) and Tamiflu (Oseltamivir). Traditionally sialidase inhibitors have worked extracellularly, inhibiting viral neuraminidase by interrupting viral replication and thus prevent the release of viruses from the host cell. This research, rather, looks at sialidase inhibition within the cell. Eight Neu5Ac2en analogues as sialidase inhibitors were synthesized to develop a trend to show that the more hydrophobic the inhibitors are, the more inhibitors gain entry into the cell and thus the better the activity. These Neu5Ac2en analogues can be used as lead compounds for anti-coronavirus infection agent development and functional studies of sialidases and the biological pathways with sialidases as well.

RNase L in Renal Function and Repair

College of Sciences and Health Professions

Student Researchers: Sarah Castle and Guanmin Chen

Faculty Advisor: Aimin Zhou

Abstract

Acute kidney injury (AKI) is a commonly encountered clinical disorder. It is estimated to affect 2–3 people per 1,000 individuals, and accounts for 20% of hospital admissions and 50% of ICU patients in the USA. AKI can undergo a self-healing process, which may substantially affect its long-term endpoints. The activation of the epidermal growth factor receptor (EGFR) has been reported to contribute to the recovery of renal structure and function by promoting renal tubular cell proliferation after AKI. RNase L is a key enzyme in interferon function against viral infection and cellular proliferation. However, the biological role of RNase L is largely unknown. Interestingly, we found that RNase L deficient mice exclusively blocked the excretion of urinary EGF, suggesting that RNase L may be an important regulator in renal function by regulating the EGF/EGFR pathway. In this study, we knocked out RNase L in H293 cells, a fetal kidney cell line, and used an animal model to investigate the role of RNase L in kidney recovery after folic acid (FA)-induced AKI.

The Impact Balance Training has on Kinematic Measurements

College of Sciences and Health Professions

Student Researchers: Abigail Tolstyka and Sydney Bajusz

Faculty Advisors: Ann Reinthal and Deborah Espy

Abstract

Stroke is a neurological disease that causes disability in adults and increases the risk of falling. The integration of technology and rehabilitation strategies are systematically used in physical therapy to target muscle activity, motor control, and balance in post-stroke patients. This research study investigates whether playing motion-sensing video games while attached to a harness system would improve balance. Participants consisted of older adults who experienced a stroke at least six months prior to enrollment in the study. The study consisted of three groups. This data analysis specifically looks at an individual in the gaming group. Gaming sessions utilize motion-sensing video game software to induce certain balance motions. Additionally, CORTEX motion capture and MATLAB software were used to obtain kinematic balance data. Target kick stimulates a one-leg stance with a simulation of kicking a soccer ball into a goal. Time spent on one leg was evaluated pre to post to represent balance. 20,000 Leaks displays an aquarium box with holes to encourage participant stepping and reaching as they plug the leaks. For this game, pre to post session step length was used as an indicator of balance skills. On average, the post-session results displayed longer step lengths per millimeter on the XYZ plane than the pre-session results for this participant. The same participant showed improvements in Target Kick in one-leg stance on his hemipelagic right-side. During the pre-session, the average time in one-leg stance was longer for his non-hemipelagic left-side than his hemipelagic right-side. However, during the post-session the average time in one-leg stance was relatively the same on both sides, with the left-side remaining constant and the right-side showing improvement. Overall, this participant showed notable improvement with balance related activities, particularly with regards to one-leg balance and stride length.

Optimization of cerebrospinal fluid extraction from anesthetized mice via the cisterna magna using pulled glass pipettes and a stereotaxic device

College of Sciences and Health Professions

Student Researchers: Francis Figueiredo, Danielle Joseph, Halle Krisinski, and Alec Stanley

Faculty Advisors: Michael D. Hammonds and Tony L. Sahley

Abstract

Cerebrospinal fluid (CSF) was collected from c57BL/6 and CD-1 mice via puncture of the exposed cisterna magna in urethane anesthetized mice (1000mg/kg). Borosilicate pipettes were pulled from 1.0mm O.D. glass to a fine point and scored at the 54 to 72O.D. micron level, thus creating a sharp fine capillary tube. The sharp pipettes were attached to a 10 cc syringe while puncturing the dura mater over the cisterna magna (a sub arachnoid space located in the dorsal vertebral column). Following a 1 cm incision exposing the dorsal neck region of each mouse, a rodent stereotaxic device and micromanipulator (Kopf Instruments) were used to direct the pipette assembly to the medial region of the cisterna magna. Following puncture of dura mater, very slight retraction of the syringe plunger created adequate amounts of negative pressure to fill the capillary tube with CSF. The pipette contents were then ejected into 0.6mL microcentrifuge tubes. Enzymatic degradation of the CSF was reduced by the addition of a 50% acetic acid 1/100 solution, followed by vortexing and freezing. Due to variability in pipette tip size, angle of approach, mouse weight and researcher experience, extraction durations ranged from 1 to 25 minutes to complete. The procedure was optimized for consistent extraction of 5 to 15 microliters per mouse after a lengthy learning curve using the first 10 to 12 mice. Those optimized volumes of CSF should be large enough to enable our colleagues in Chemistry to assay specific peptides of interest, employing high sensitivity mass spectrophotometry.

Effects of angular momentum on stability during quadrupedal locomotion

College of Sciences and Health Professions

Student Researcher: Grace L. Schepelmann

Faculty Advisor: Andrew R. Lammers

Abstract

This study investigates the effect of angular momentum on the stability of rats during locomotion on narrow supports. To emulate a rat's natural environment of running along a tree trunk, the experiments used a powered rope and pulley system that allowed the rats to run in place (a "rope-mill"), while the velocity of the rope was set to three different conditions. The limbs, swinging forward and then pushing backward during each step, generate angular momentum. This angular momentum can be increased by either (1) increasing the mass of the limb, (2) increasing the angular velocity, and/or (3) changing the length of the limb (i.e., the radius of the roughly circular movement pathway of the limb). We modified angular momentum in two ways, either increasing the speed of the "rope-mill", or by attaching 1.8 g weights to the wrists and ankle joints via bracelets. Data processing and analysis is currently ongoing. We intend to apply a Lyapunov exponent to the three dimensional coordinates of parts of the animals' body and limbs during locomotion as a way to measure stability over time. Essentially this exponent measures whether stability is being maintained, or if the stability is decaying and will eventually result in a fall or a cessation of movement. Since mass and speed are directly proportional to angular momentum, we anticipate the results will show that adding weights to the rats' limbs or increasing the speed of locomotion will increase angular momentum, and that this angular momentum increase will augment stability.

Prevention of Mild Cognitive Decline in Aging Senior Citizens

College of Sciences and Health Professions

Student Researcher: McIntosh, Marissa

Faculty Advisor: Myrita Wilhite

Abstract

Mild cognitive impairment (MCI) is a condition that is very common among the elderly and is characterized by difficulty remembering, deterioration with attention skills, and sometimes making decisions. MCI will not initially interfere with activities of daily living, but it is considered to be a first step towards evolving dementia. This study sought to explore the perceptions of older adults' experiences as they participated in a community book club, specifically, exploring how these participants perceive their cognitive memory skills before and after participating in the book club. A survey was developed to collect the data and interpret the results. Five responses were anonymously collected and participation in the survey was completely optional. The results of the survey show that 50% of respondents perceived that their ability to remember and concentrate has improved after participating in the book club. The other 50% of the respondents reported having no difficulty remembering or concentrating, therefore reporting no improvement from before and after participating in the book club. The results of this study suggest that participation in a community book club may contribute to improved cognitive abilities, such as remembering and concentrating.

**Supported by the McNair Scholars Program*

Phonological Interventions for Children with Speech Sound Disorders

College of Sciences and Health Professions

Student Researcher: Kylie Armstead

Faculty Advisor: April Yorke

Abstract

Speech sound disorders refer to the different types of difficulties which affect the intelligibility of a child's speech. There are five types of speech sound disorders which include: phonological disorder, inconsistent speech disorder, articulation disorder, childhood apraxia of speech, and childhood dysarthria. Phonological treatments which focus intervention on hearing the distinction between speech sounds and creating phonological representations for speech sounds have been proven effective for children speech sound disorders. The purpose of the current paper is to summarize evidence-based interventions that are beneficial to children with speech sound disorders. The results provide a wide range of effective interventions to meet the needs of children with speech sound disorders.

**Supported by the McNair Scholars Program*

Jet graphs

College of Sciences and Health Professions

Student Researchers: Elisabeth Helmick and Molly Walsh

Faculty Advisor: Federico Galetto

Abstract

We define an operation of jets on graphs inspired by the corresponding notion in commutative algebra and algebraic geometry. We examine a few graph theoretic properties and invariants of this construction, including chromatic numbers, co-chordality, and vertex covers.

Determining Numerical Solutions for Quasi-Birth-Death Processes with Time Varying Transition Rates

College of Sciences and Health Professions

Student Researcher: Benjamin Kovacic

Faculty Advisor: Barbara Margolius

Abstract

Quasi Birth Death Processes have such an important relationship to an immense number of topics. They can be described as the two dimensional state space in which the states have levels and phases. This study focuses on solving continuous time Markov chains since QBD systems can be represented as a Markov chain. Markov chains use the data/information present to determine future outcomes. Examples of such include: networking, traffic flow, and even genetics.

Investigating Strength and Stability of the Louche in Absinthe

College of Sciences and Health Professions

Student Researcher: Alyssa Vandecaveye

Faculty Advisors: Jessica E. Bickel and Andrew Resnic

Abstract

Absinthe is a green colored alcohol containing wormwood oil that, with the addition of cold water, forms a cloudy green louche. This louche is termed the "ouzo effect" and is seen in other alcohols including limoncello, absinthe, ouzo, and patis. It is a microemulsion formed due to the competing interactions in this oil-water-alcohol system. The louche can be analyzed by looking at the optical transmission of a laser beam through the system to determine the cloudiness (or turbidity). Previous work with absinthe [1] examined the temperature dependence of the louche formation and showed that turbidity increases with decreasing temperature. This was due to an increase in the number of droplets formed at lower temperatures. In this work we take this a step further to determine the role that oil plays in the strength of the louche. We demonstrate that while the droplets in the microemulsion can be spread apart from one another by increasing the water content (reducing the turbidity), the microemulsion can also be destroyed (turbidity is minimized) through the addition of alcohol. The system of the oil-water-alcohol in absinthe is dependent on if the wormwood flavor is oil or extract. Ethanol additions after water dilution cleared the louche completely. If the fraction of alcohol is increased, therefore decreasing the fraction of oil, the louche will not reach its strongest point. The louche at maximum turbidity at 15 degrees Celsius is stable for more than 15 hours and reaches a point where it does not clear up any further.

High-Speed Video Acquisition and Analysis of Taekwondo Kicks

College of Sciences and Health Professions

Student Researcher: Alexis Merk

Faculty Advisor: Andrew Resnick

Abstract

Taekwondo is a form of martial arts that is characterized by techniques such as: kicks, spins, and strikes. We hypothesize that through these movements, angular momentum acts as an essential characteristic of the motions used in Taekwondo. In order to study the movements, we constructed a large "Lazy Susan," that a martial artist stands on and performs several kicking motions. High-speed videos of the performance are collected and the footage is analyzed. The analysis results in calculations determining rotation rate(s) and the integration of angular momentum in Taekwondo. A further understanding of angular momentum in a Taekwondo system would allow us to better comprehend how energy and forces are associated in martial arts, as well as, create improved kinematic models of Taekwondo forms.

**Partially supported by the McNair Scholars Program*

Finding the true molecular weight of the polymeric microgels of varying crosslinking density

College of Sciences and Health Professions

Student Researchers: Patrick Herron, Andrew Scherer, and Samantha Tiejen

Faculty Advisor: Kiril A. Streletzky

Abstract

Microgels are spherical particles comprised from crosslinked polymer chains suspended in solution. Due to the properties of the parent polymer, microgels undergo temperature dependent de-swelling and have a potential use in drug delivery. These microgels are synthesized using hydroxypropyl cellulose (HPC) and divinyl sulfone (DVS) cross-linker, as well as dodecyltrimethylammonium bromide (DTAB) surfactant to promote particle monodispersity. Static light scattering (SLS) was used to determine the molecular weight, Mw, the radius of gyration, Rg, and second virial coefficient, A2, of synthesized microgels at varying cross-linker density. However, absolute SLS measurements require determination of the specific refractive index increment (dn/dc), the change in index of refraction with concentration for the samples of interest. This project focused on dn/dc measurement for samples with DVS:HPC concentrations of 0.5-41. The dn/dc values found show a temperature dependence at higher DVS concentrations. Here we present how measured dn/dc values affect the obtained Mw of the microgels and show the importance of in lab testing of dn/dc values to dependably obtain thermodynamic information of microgels.

Observations of cross-shelf nitrate fluxes over the Oregon continental shelf

College of Sciences and Health Professions

Student Researcher: Andrew Scherer[1]

Faculty Advisor: Thomas Connolly[2]

Abstract

The US Pacific Northwest coastal ecosystems are primarily limited in growth from nitrate supply. The nitrate supply that drives the highly productive marine growth in this region is primarily a result of wind driven coastal upwelling, a process by which southward wind forces nutrient-depleted water offshore and nutrient-rich water from deeper in the water column replenishes the coastal nutrients and drives primary production. This work seeks to investigate cross-shelf nitrate fluxes over the continental shelf off the coast of Oregon following the installation of new nitrate and Acoustic Doppler current profilers (ADCPs) in the Ocean Observatories Initiative (OOI) Endurance Array. The primary onshore flow of nitrate-rich water over the continental shelf is found to originate at the middle depths, consistent with previous research in the region. However, the upwelling and cross-shelf nitrate fluxes on the continental shelf are found to be in poor agreement with common upwelling indices, e.g., coastal upwelling transport index (CUTI) and biologically effective upwelling transport index (BEUTI). Several factors for this disagreement are proposed, including the focus of the indices on dynamics farther offshore of the continental shelf. Observed coastal wind stress, calculated on a weekly rolling average, is found to be a potential alternative for predicting nearshore nitrate concentrations. Farther offshore at the mid-shelf, only a weak correlation between observed wind stress and observed surface transport is found, suggesting the need for additional dynamics to fully explain the observed surface transport and nitrate fluxes. Correctly modelling the nitrate supply for coastal ecosystems is essential for predicting phytoplankton blooms that are vital to the production of fisheries on the coast. Thus, understanding these limitations is of great importance for ocean-driven coastal economies.

[1]Student supported by Dr. Kiril Streletzky's FRD Grant

[2]Faculty, Moss Landing Marine Labs, San Jose State University

Imaging of the Soft Matter Particulate Systems by Scanning Electron Microscopy

College of Sciences and Health Professions

Student Researcher: Richard Sent

Faculty Advisors: Petru Fodor and Kiril Streletzky

Abstract

Polymeric microgels suspended in water exhibit a reversible volume transition phase upon heating which leads to nanoparticles deswelling by as much as a factor of 15 in volume. Microgels are typically characterized by noninvasive techniques of dynamic light scattering (DLS), which probe particle structure/dynamics. More direct methods such as scanning electron microscopy (SEM) are useful for visualizing polydisperse microgel samples. As SEM typically uses high vacuum to characterize dried samples it is problematic as the dehydrated microgels collapse under vacuum. This project explores wet particle imaging in an ionic liquid stable under high vacuum. Particles were suspended in a thin ionic liquid film on a copper grid and were studied for both size distribution and dynamics. The experiment was tried on separate suspensions of silica particles and polymeric microgels. The silica particles exhibited Brownian motion proving the concept of the approach. While the average SEM sizes of microgels generally agreed with sizes obtained by DLS in ionic liquid at room temperature, the initial attempts at diffusion analysis using SEM particle tracking yielded mixed results. The microgels were often observed to drift significantly, clustering with nearby particles and drifting towards the grid edges.

Kinetic analysis of Recombinant Dihydroorotase from Methanococcus jannaschii

College of Sciences and Health Professions

Student Researcher: Seth Ayotte

Faculty Advisor: Jacqueline Vitali

Abstract

Dihydroorotase (DHOase) is an enzyme which catalyzes the reversible cyclization of N-carbamoyl-L-aspartate (CA) to L-dihydroorotate (DHO) in the *de novo* biosynthesis of pyrimidines. At lower pH values, the biosynthetic reaction is favored (CA → DHO) while at higher pH values the hydrolysis of dihydroorotate dominates (DHO → CA). We are working with the enzyme from the hyperthermophilic archaeon *M. jannaschii*. We are interested how the structure and function of this enzyme adapt to high temperatures that are the normal environment of *M. jannaschii* and how these differ from other DHOases. In addition, *M. jannaschii* serves as model organism for research purposes. During this award we analyzed kinetic data on this protein in both directions using the program Graphpad PRISM. The enzyme follows Michaelis Menten kinetics in both directions. Specific activities and Km values were computed at 25C, 45C, 80C for the degradative reaction and 25C, 45C for the biosynthetic direction. The specific activity is higher in the degradative direction. In addition, both specific activity and Km values increase with temperature. The dependence of both reactions with pH was studied at high substrate concentrations. At low pH the biosynthetic reaction dominates and at high pH the degradative reaction dominates. It would be of interest to compare these curves with crystallographic studies of complexes of the enzyme with the two substrates in future studies.

Do Adverse Childhood Experiences Affect Rates of Depression?

College of Sciences and Health Professions

Student Researcher: Donna R. Erwin

Faculty Advisor: Elizabeth Goncy

Abstract

Adverse childhood experiences (ACEs) classified as traumatic events that occur during the first eighteen years of life and range emotional neglect to sexual abuse. A bulk of literature addresses that gender differences can attribute to higher rates of depression/anxiety in adolescent females. However, the current literature lacks information about how identifying as a minority affects exposure to ACEs and how it contributes to rates of depression/anxiety in comparison to White participants. The present study investigated whether experiencing ACEs during adolescence affect rates of depression/anxiety, and whether gender differences increase the chances of depression/anxiety as well as examine whether race can be a moderator between ACEs and depression/anxiety. It is hypothesized that experiencing ACEs heightens one's chance of developing depression/anxiety as opposed to experiencing none. We also hypothesize that identifying as a minority will increase an individual's chances of developing depression/anxiety during adolescence. To investigate this, secondary data was analyzed based on responses to an online survey given to United States adolescents aged 14-18 (N=103), which assessed ACE exposure and symptoms of anxiety/depression. Analysis indicated that the mean score for anxiety was higher for those who experienced ACEs (M =28.60, SD = 7.47) in comparison to those who did not (M= 25.33, SD = 7.16). Similarly, the mean score for depression was higher for those who experienced ACEs (M =10.53, SD = 3.56) than those who did not experience ACEs (M= 8.40, SD= 2.45). Additionally, 70% of or non-white sample experienced ACEs, while the other 30% dd not. As for the white sample 58% experienced ACEs, while the remaining 42% did not. Within this sample there were no differences between white & ethnic minority youth who experienced ACEs and who had not experienced ACEs. The implications for the research are to see if the rates of depression/anxiety can be reduced in adolescents.

Keywords: Adolescents. Adverse Childhood Experiences (ACEs), Minority

**Supported by the McNair Scholars Program*

MBTI and personality's Academic Preferences

College of Sciences and Health Professions

Student Researcher: Jessica M. Disla

Faculty Advisor: Elizabeth Goncy

Abstract

The Myers Brigg typology inventory (MBTI) has been a popular tool used for identifying individuals' preferences, general decision making, and career trajectories selection. Scholars have suggested knowing one's own preference, values and abilities are crucial for college major and career path selection. Several articles have analyzed the relationship between distinct MBTI's personalities and their choice for academic and career paths. This systematic literature review shows patterns of the relationship of distinct orientations and personality types across trajectories. Results suggest that Extroverts (E) were linked to business, education, and music careers, whereas Introverts (I) were prevalent among technology and computing. Intuitive (N) were found in the faculty of arts, music, architecture, and some computer and technology trajectories, whereas most Sensors (S) were found in business, education, science, computing, and civil engineering. Feelers (F) were found in music therapy and Thinkers (T) and Judgers (J) were linked to business, education, computing, engineering, and science. Perceivers (P) were found in the fine arts and in some engineering programs. In relation to a significant pattern between personality type and trajectory, types such as ESTJ, ENTJ, ISTJ, ESFJ, and ESTP were linked to business; ISTJ and INTJ to technology, computers programs, and engineering programs. These previous studies provide insight on using the MBTI as a tool of guidance for undecided students to choose an academic major and professionals to use the type of work that best matches their preference and abilities.

Key Words: Myers Brigg Typology inventory, MBTI, individual preferences, career trajectories selection, Preferences, Academic Major, personalities type, Orientation

**Supported by the McNair Scholars Program*

The Effects of Interrupting One's Partner at Work

College of Sciences and Health Professions

Student Researchers: Jennifer A. Blair and Dawn R. Diamond

Faculty Advisor: Michael Horvath

Abstract

Innovations such as technology allow for an increased blending of work and family roles (e.g., working from home at night, answering texts from family during work hours). Consequently, individuals may engage in different styles of boundary management – some allowing and encouraging the domains to mix and others keeping work and family as separate as possible. In our study we examined how individuals react to their partner interrupting them while at work. We surveyed individuals with employed partners whom they recently interrupted while working, assessing factors such as features of the interruption, preferences for boundary management, and perceived partner reaction to the interruption. We found that more positive reactions occurred for less severe interruptions.

Development of Childhood Friendships in Children Ages Four to Five

College of Sciences and Health Professions

Student Researcher: Hannah Tackett

Faculty Advisor: Shereen Naser

Abstract

Work with older elementary students reveals that children often identify friendship qualities based on what they see from their parent's relationships, but close friendships amongst peers are developed in children in preadolescence years (ages eight to ten years old). However, little is known about friendship building in four to five year olds. Therefore, the purpose of this study is to describe how children ages four to five define and think about the process of making friendships. Researchers conducted interviews with twenty-two children ages four to five years old from a suburban child care center. Survey questions asked students how they think about friendship and their process of finding and making friends. Systematic content analysis of interview transcripts indicate that friendship development for children ages four to five is most times related to convenience and self-initiated conversation amongst peers. Moreover, the children in this study reported engaging in play with peers they have already established a relationship with before engaging in social play with unfamiliar peers around them. Results of this study can inform how adults support friendship building at such a young age.

**Supported by the McNair Scholars Program*

The Impact Emotions Have on Recall

College of Sciences and Health Professions

Student Researcher: Sadie-Marie Wright

Faculty Advisor: Maria Rowlett

Abstract

The relationship of how emotions impact the way a person remembers events has helped improve fields outside of psychology, such as criminal justice and biology. Most studies that explore emotions and recall have had inconclusive results due to factors such as participants being tasked with free recall in response to stimuli such as the study done by Gorlin et al. (2018). With that knowledge, the current study focused on a task of recall from a short list of words along with a direct stimulus in the form of an emotional or non-emotional passage with hopes that it would affect the short-term memory enough to result in lesser recollection amongst the group of participants who received the emotional stimuli passage. Sixty-four participants were recruited through email and social media, they received either the non-emotional passage or the emotional passage. An independent t-test was conducted to test whether participants that read the emotional passage recalled fewer words than those who read the non-emotional passage. The results, however, were found to be not significant. A limitation to this study was the sample size, and a larger number of participants is needed. Due to the study being conducted online over the summer months, finding an adequate number of participants proved to be very challenging. Future research should host a larger sample size to have a better chance for a significant finding.

Keywords: emotion, recall, short-term memory, memory processes, recollection

**Supported by the McNair Scholars Program*

Programming with Labvanced for Remote Collection of Cognitive Psychology Data

College of Sciences and Health Professions

Student Researcher: Ramandeep Arora

Faculty Advisor: Albert F. Smith

Abstract

The COVID-19 pandemic has necessitated that collection of data for cognitive psychology experiments be transitioned from laboratories to web-based platforms that permit remote data collection. Rather than coming to a laboratory and receiving instructions from an experimenter, with remote data collection, participants are sent a link to an experiment and complete participation without intervention of an experimenter. We describe several of the challenges that we encountered (and overcame) using Labvanced, a platform to build online experiments, to construct a program to collect data for an experiment on color-word contingency learning. These challenges included properly placing a fixation cross; placing labels for response keys that appeared to be continuously available; and controlling program flow according to the correctness of a response. We intend to use the completed program for data collection during the fall semester and as a base for other experiments.

I'm concerned, but hesitant: A test of psychiatric status effects on Coronavirus safety behaviors and vaccine perceptions

College of Sciences and Health Professions

Student Researchers: Taylor Stergar and Caitlin Tytler

Faculty Advisor: Ilya Yaroslavsky

Abstract

Problem. The Coronavirus pandemic has polarized US climate concerning vaccinations (i.e., intent to get vaccinated) and public health-oriented behavior (i.e., social distancing & masking) along geopolitical and racial divides. Less is known, however, concerning the roles of depression and anxiety, which rates have increased amid the pandemic, to follow current medical recommendations concerning mask wearing, participating in social distancing, and willingness to get the Covid-19 vaccine. We hypothesize that depression severity will predict reduced public- health oriented behavior and intent to vaccinate, while anxiety would have an inverse effect.

Methods. Fifty-six (*M*=32.82, *SD*=11.90, 70% female, 70% Caucasian) participants completed measures of depression (CES-D) and anxiety (Penn State Worry Questionnaire) at 4-month intervals (Waves 1-2; vaccination intentions measured at 2nd Wave), and 7-day Ecological Momentary Assessments (EMA) following each Wave during which public health-oriented behaviors were assessed (N=1,674 observations).

Results/Conclusion. Masking and social-distancing was reported during 32%-34% of EMAs, which use was solely related to age: older participants were less likely to social distance or wear masks (ORs=1.03-1.04, *ps*<.05). In contrast to expectation, anxiety was unrelated to public- health oriented behavior, and evidenced a negative relationship with vaccination intentions (OR=1.10, *p*=02); depression's effects were non-significant across outcomes. African Americans reported greater intent to get vaccinated than Caucasians (OR=3.28, *p*=.05). Public health implications will be discussed.

Not all created equal: A test of psychotropic medication class effects on autonomic and subjective reactivity to dysphoric and hedonic stimuli in a mixed clinical-community sample

College of Sciences and Health Professions

Student Researcher: Taylor Stergar

Faculty Advisor: Ilya Yaroslavsky

Abstract

Introduction. Pharmaceuticals are frontline treatments of internalizing and externalizing disorders that affect physiological processes linked to emotional well-being. In particular, selective serotonin reuptake inhibitors (SSRIs), serotonin and norepinephrine reuptake inhibitors (SNRIs), anxiolytic, and stimulant medications reduce Parasympathetic Nervous System (PNS) activity, which levels are associated with effective emotion regulation and a reduced risk for psychopathology. Yet, these medications elevate mood or reduce distress, thereby suggesting a PNS-independent pathway for their effect; the common use of poly-pharmaceuticals further muddies the waters for their therapeutic effects. We test the unique effects of SSRIs, SNRIs, anxiolytic, and stimulant medication on PNS and affective reactivity to sad and happy mood induction procedures via well-validated film clips among 302 adults.

Results/Conclusion. Stimulant and SNRI use predicted reduced PNS levels at baseline (indexed via Respiratory Sinus Arrhythmia, RSA). Anxiolytic use *blunted* sadness but *enhanced* RSA withdrawal to the sad film and *increased* RSA to the happy film. SNRI use enhanced happiness after the happy film, but not the RSA response. Conversely, SSRI use blunted the RSA response to the happy film, and was unrelated to subjective affects. The distinct physio-affective response profiles between anxiolytics, SSRIs, and SNRIs may suggest diverging mechanisms of these drugs' therapeutic effects.

How Can We Reduce Consumer Resistance to Sustainability Interventions in Retail Stores? Moderating Roles of Culture, Personality, Customer Loyalty, and Marketing Efforts.

Monte Ahuja College of Business

Student Researcher: Janell Craig

Faculty Advisor: Jieun Park

Abstract

Consumer resistance in the retail industry has had a major impact on the success rate of sustainability interventions. Consumer resistance can be described as consumers opposition or unwillingness to change due to a shift in the product or service (Gonzalez-Arcos & Joubert, 2021). Limited research on consumer resistance to sustainability interventions creates a research gap that we are attempting to fill. We propose that marketers can reduce consumer resistance to sustainability interventions in the retail industry by implementing the following moderators which suggest that the relationship between consumer resistance and sustainability will differ based upon the type of store, marketing efforts, personality traits, cultural identity, and customer loyalty. A structural equation model will be estimated in "analysis of a moment structure" to assess the proposed model. The analysis will provide evidence or no evidence for the hypothesized relationships among all the variables of interest. With this research, our goal or main purpose is to understand how to reduce the negative effects or outcomes from consumer resistance when implementing a sustainable intervention in the retail grocery industry.

**Supported by the McNair Scholars Program*

Non-covalent complexation of boron nitride nanotubes with pectin

Washkewicz College of Engineering

Student Researcher: Tanner L. Larson

Faculty Advisor: Geyou Ao

Abstract

Creating stable dispersion of boron nitride nanotubes (BNNTs) is vital to effectively translate their superior thermal, chemical, and mechanical properties to macroscopic assemblies. These properties are desirable for a variety of applications, including fabricating robust films and fibers for effective heat management. However, BNNTs do not readily disperse in almost all solvents, including water, due to strong van der Waals interactions. This presents a major challenge to fully exploiting their favorable qualities. In this study, we demonstrate that pectin, a polysaccharide naturally found within the cell walls of plants, is effective in stabilizing BNNTs in water. This is achieved through the hydrophobic and π-π interactions and a possible hydrogen bonding between hydroxyl groups of pectin and BNNTs. Particularly, we determined an optimum mass ratio of BNNTs:pectin = 1:2 in creating stable aqueous dispersions of BNNTs. We characterized the dispersion quality and yield of BNNTs through UV-vis absorbance measurements. Additionally, the colloidal stability of BNNT dispersions was evidenced by the laser scattering effects as defined by the Tyndall effect. This project lays the foundation for our future work in manufacturing thermally conductive films and fibers through liquid phase processing for a variety of situations where thermal management is essential, such as electronics, protective coatings, and fabrics.

DNA-Complexed Hexagonal Boron Nitride Nanosheets as Emulsion Stabilizers

Washkewicz College of Engineering

Student Researchers: Sara R. Groetsch and Tanner L. Larson

Faculty Advisor: Geyou Ao

Abstract

Hexagonal-boron nitride nanosheets (BNNSs) are 2D materials with superior mechanical strength, thermal conductivity, electrical insulation, and chemical and thermal stability. Additionally, the micron scale lateral size and nanoscale thickness of BNNSs provide improved interfacial activity at the liquid-liquid interface. These properties make them an ideal candidate as chemically inert emulsifying agents. In this study, we show that BNNSs acts an effective emulsion stabilizer in lotion formulation, eliminating the use of unwanted emulsifying wax. Specifically, we prepared aqueous dispersions of cosmetic grade hexagonal boron nitride (hBN):DNA = 1:2 mass ratio in pH 7.4 PBS buffer solution. DNA stabilizes BNNSs in water due to π-π stacking. The dispersion quality and yield of DNA-BNNSs were examined by UV-vis absorbance measurements. Stable dispersions of DNA-BNNSs were then utilized for lotion formulation, where the BNNSs are used as emulsion stabilizers. At a final concentration of 1 mass% BNNSs, we found that emulsions with oil:water ratio of 1:2.5 (v/v) displayed improved stability than that at 1:1 (v/v). Future studies will focus on creating cosmetic lotion products utilizing BNNSs as a safe and effective ingredient.

Effects of Solvent on Creating Fluorescent Quantum Defects in Carbon Nanotubes by Diazonium Reaction

Washkewicz College of Engineering

Student Researcher: Brandon J. Heppe

Faculty Advisor: Geyou Ao

Abstract

Pure-chirality single-wall carbon nanotubes (SWCNTs) possess well-defined optical and electronic properties for applications, such as biochemical sensing and imaging. Fluorescent quantum defects can be created on semiconducting SWCNTs covalently at molecular precision, enabling the creation of single photon sources *via* exciton trapping. Diazonium (Dz) reaction of (6,5) SWCNT is known to create an optimal doping in deuterium oxide (D_2O) at a molar concentration ratio of [Dz]:[carbon 12] = 1:400. In this work, we demonstrate that the solvent environment affects the doping reaction of SWCNTs with diazonium salts, leading to significantly different molar concentrations of reactants needed for optimal doping to occur. We utilized deionized (DI) water and D_2O to demonstrate the solvent effects on diazonium reaction utilizing surfactant-coated (6,5) SWCNTs. Particularly, a significantly higher concentration of diazonium salt is needed to create fluorescent quantum defects on SWCNTs in water than in D_2O. Additional reaction conditions including temperature and surfactant concentration were evaluated for their effects on the diazonium reaction efficiency. Future studies will focus on understanding the mechanisms of diazonium reaction of pure-chirality SWCNTs in DI water vs. D_2O.

Catalytic Gasification of Household Recyclables: Simulating Reactor Performance

Washkewicz College of Engineering

Student Researcher: Rebecca L. Ellis

Faculty Advisor: Jorge E. Gatica

Abstract

Waste buildup is quickly becoming a serious global problem, one that negatively impacts quality of life and damages ecosystems. While a variety of methods of reducing waste exist, their environmental impact is rapidly becoming an issue. Thus, developing waste management methods that do not further harm the environment is a necessary next step in pollution control and sustainability. Via the process of gasification, recyclable plastics can be converted (gasified) into syngas, which in turn can be converted into fuel. The low-temperature catalytic gasification of Polyethylene Terephthalate (PET) is the focus of this project. Research was centered on comparison of thermal properties of PET recovered from household recyclables and laboratory-grade PET. Thermal analysis completed in a research-grade Differential Scanning Calorimeter (DSC) yielded heat of formation values of 24.99 J/g and 27.33 J/g for pure PET and household-recovered PET, respectively. Mixing patterns of a multi-phase reacting media in a laboratory-scale stirred tank reactor were predicted using a finite-element method (FEM) based computational fluid dynamics (CFD) platform. The results suggested satisfactory mixing within the reactor and flow patterns were recovered to study simultaneous mass transport and reaction phenomena in a particulate (catalyst and polymeric particles in a fluid media) system.

The Design, Biosynthesis, Purification, and Characterization of Polypeptide Bio-Inks

Washkewicz College of Engineering

Student Researchers: Daniel Röhrer, Adil Mistry, and Isha Kowey

Faculty Advisors: Edward Turk[1], Kiril Streletzky, and Nolan Holland

Abstract

Elastin-Like Proteins (ELPs) are synthetic biopolymers that mimic elastin through repeating GxGyP amino acid monomers, with x being any amino acid and y being any but proline. An ELP 3D-scaffold has the advantage of being biocompatible and biodegradable, ideal for making bio-inks with embedded cells. Linear tri-block ELP polypeptides have been designed to assemble into a 3D-hydrogel matrix in a reversible process when temperature is increased. While this transition is not unique, what makes ELPs interesting is how the temperature at which the transition spontaneously occurs changes with environmental factors. Changes in ELP concentration and salt concentration will affect the transition temperature, making ELPs relevant for bioprinting applications. In order to characterize these properties, ELPs need to be synthesized. This entails designing a custom ELP genetic sequence and transforming it into bacterial cells. Once protein production is induced in these cells, the ELPs must then be purified. After sufficient amounts of purified ELP are obtained, its transition temperature is finally characterized. Here, we describe the design and assembly of $(GVGVP)_n$ ELP plasmids for transformation into *E. coli*, as well as the purification and characterization of a different ELP ($nRGDS_{n0}$) previously prepared in our lab.

[1]*External Advisor, Gilmour Academy*

Fabrication of Nylon-6/Multi-Walled Carbon Nanotube Composite for Sodium Ion Quantification

Washkewicz College of Engineering

Student Researcher: Orlando Lopez

Faculty Advisor: Chelsea N. Monty-Bromer

Abstract

Multi-walled carbon nanotubes (MWCNT) are a material being integrated into a wide variety of fields due to their high tensile strength and high electrical and thermal conductivity. Implementing MWCNT into an electrochemical sensing platform has allowed for improved electrical performance by increasing sensor sensitivity. Through this work, fabrication of a nanocomposite used in a sensor that is able to measure the sodium ion concentrations found in sweat in real-time was studied to analyze the effects of incorporating MWCNT in the solution used in the production of the sensor. 0.5, 1, 2, and 5 weight percentages of MWCNT were incorporated into the solution. The solutions were then electrospun into a mat and cut into 1.2 cm by 1.2 cm sensor samples. The samples were then analyzed electrochemically using a potentiostat, to run direct current through two micro-alligator clips placed on the edges of the nanocomposite to ultimately measure the resistance at known concentrations of sodium solutions. The average resistance was then plotted against the sodium solutions to then observe the R^2 value of the best fit line to evaluate the performance of the sensors. Electrochemical analysis indicates that the sensor performance was optimized at 1 weight percent. The performance of these sensors at 1 weight percent also had the least variability in the regression model parameters considered. Future work that includes at least two more runs to be tested in a triplicate would determine if incorporating MWCNT into solution is a viable option to reduce the fabrication time.

**Supported by the McNair Scholars Program*

Molecular sieving separation with zeolite membranes

Washkewicz College of Engineering

Student Researchers: Benjamini F. Mollel and Ninad D. Anjikar

Faculty Advisor: Shaowei Yang

Abstract

Dehydration of acetic acid is important for chemical industry. Millions of tons are produced every year, mostly through carbonylation of methanol. Water is used to catalyze the reaction. Water removal is necessary to get pure acetic acid. Membrane pervaporation is energy-efficient and promising for the dehydration process. However, most commercially available membranes either does not have high performance or will not survive the acidic and high-temperature operating environment. Among all the membrane materials, zeolites have the advantage of good chemical and thermal stability, and uniform pore size defined by the pore structure, which could achieve high selectivity by molecular sieving effect. In this work, we studied the synthesis of CHA zeolite crystals and membranes. The membrane is intended for the pervaporative dehydration of acetic acid. The zeolite crystal and membrane synthesis will be discussed. The long-term stability of the zeolite membrane is equally important and will also be discussed.

Effect of Graphene Oxide on the Properties of Normal Strength Concrete

Washkewicz College of Engineering

Student Researchers: Erica L Roelke and Tawsif Mohammad Hasan

Faculty Advisor: Srinivas Allena

Abstract

Concrete made from ordinary Portland cement is one of the most widely used construction materials. However, concrete lacks ductility resulting in low tensile and flexural strengths, and poor resistance to crack formation. Studies have demonstrated that the addition of graphene oxide (GO) can effectively enhance mechanical strength of normal strength concrete, confirming GO as an excellent candidate for using as nano-reinforcement in cement-based composites. The primary objective of the present study was to investigate the effects of GO on workability, compressive and flexural strengths, and drying shrinkage of concrete at different concentrations. Six different concrete mixtures were proportioned by varying GO content ranging from 0% to 0.05% by mass of cement with a water to binder ratio of 0.38. Experimental results showed that the mechanical strength of normal strength concrete was improved with 0.02% GO content.

Towards optimization of biomedical bone staples: Numerical Simulations

Washkewicz College of Engineering

Student Researcher: Safal Sinnya

Faculty Advisor: Josiah Owusu-Danquah

Abstract

The unique superelastic, mechanical, and biocompatible properties of Nickel-Titanium (NiTinol) memory alloys make them preferred materials for designing bone fracture fixation staples. However, the cost of NiTinol staples in comparison to traditional steel or titanium is significantly higher. The *main objective* of this research was to assess the avenues by which NiTinol staples can be optimized geometrically or materially to reduce NiTinol volume (hence, reduce the cost) without detrimental effect on staple performance. For this purpose, a commercially available finite element software was used to simulate the bone fracture fixation process and the contact forces were measured for several different 3D CAD models of the staples. The results indicated that the compression forces generated to hold fractured bone parts together were predominantly produced by only a portion (i.e., about one-half to two-thirds) of the NiTinol staple volume. In particular, staples with a larger arch or bridge radius produced higher contact forces; tapering the staple legs at a ratio of 2:1 from the top thickness to the bottom thickness produced compressive force almost equal to that of the original full NiTinol. Also, replacing 1/3 to 1/2 of the staple leg volume with either steel or titanium generates almost the same contact forces as that obtained from the full NiTinol, however, the current manufacturing techniques lack the ability to manufacture bimetallic bone staples.

Exploring IoT Jamming Attack on Satellite Communications

Washkewicz College of Engineering

Student Researchers: Gopal Shukla and Chad Fortenbaugh

Faculty Advisor: Zicheng Chi

Abstract

With the numerous services provided by satellites, satellite jamming is not only drawing attention from the military, but also many civilian sectors as well, with how relevant it is to our daily life (e.g., navigation, climate monitoring, firefighting, television, telephones, space science). [1] There are many satellites which do not encrypt wireless communications, especially, satellites which operate on the Industrial Scientific and Medical (ISM) radio band. These satellites are vulnerable to being interfered with and jammed as the ISM band is unlicensed and "free" to use. [2, 3] Internet-of-Thing (IoT) devices also share the ISM band. These cheap devices are used to support smart homes, smart health devices, and smart cities applications. However, they are also used by several malicious attackers, including criminal and state-sponsored hackers. [4]
In our research, we investigate the potentiality of using IoT devices to conduct jamming attacks on satellite communications. We use a readily accessible antenna that can be bought from the web, and a software-defined radio SDR to receive signal beacons transmitted by several satellites and then analyzed them to find how vulnerable communications were. Our results show that these satellites do in fact transmit unencrypted data that can be received by anyone without inside knowledge of the subsystems of these satellites. They can use IoT devices to take satellite signals and are able to, with sufficient equipment and knowledge, transmit fake data to ground station receivers at a low cost.

Identification of Cancerous Tissue from Histopathological Images Using Unsupervised Learning

Washkewicz College of Engineering

Student Researchers: Harsh Shah, Alexander Clemente, and Beryl Joylin Asir

Faculty Advisor: Sathish Kumar

Abstract

The purpose of this research was to find the nucleus within a patch using unsupervised region of interest extraction methods. To achieve this, we make use of two different clustering algorithms, k-means and mean shift clustering. K-means clustering is a method of vector quantization, originally from signal processing, that aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean (cluster centers or cluster centroid), serving as a prototype of the cluster. Mean shift is a non-parametric feature-space analysis technique for locating the maxima of a density function. It is used in cluster analysis and image processing. It is concluded that the k-means clustering algorithm derives better results in terms of the intersection over union. This work is done on whole slide images, and could be used in the future to implement more clustering algorithms to compare which one is the best to get the most accurate regions of interests.

Learn to Control an Autonomous Vehicle Through a Driving Simulator

Washkewicz College of Engineering

Student Researcher: Quang N. Nguyen

Faculty Advisors: Zhiqiang Gao and Hongkai Yu

Abstract

In this project, we designed a driving simulator to control an intelligent vehicle via the input human pose. The driving simulator only takes one regular camera as the hardware connected to a computer. It could control the motion of an intelligent vehicle in a virtual computer game-like environment by different human poses. It is implemented by the CARLA simulation software for the vehicle motion control and a deep learning model for human pose classification. The deep learning model includes two parts: 2D human pose estimation and human pose classification. We trained a deep neural network to recognize six different human poses (forward, backward, brake, left, right, speedup) by using PyTorch and ResNet18. For each pose, we used OpenPose to capture skeletal images for training. After training, the deep learning model for pose classification is connected with the CARLA Python API to control the motion of the intelligent vehicle in the simulation environment.

Line-constrained L ∞ One-Median and One-Center of Uncertain Points in the Plane

Washkewicz College of Engineering

Student Researcher: Quan D. Nguyen

Faculty Advisor: Jingru Zhang

Abstract

Problems on uncertain data have attracted significant attention due to the imprecise nature of the measurement. In this project, we consider the (weighted) one-median and one-center problems on uncertain data with the additional constraint that requires the sought facility to be on a line. We are given a set of n (weighted) uncertain points and a line L. Each uncertain point has m possible locations in the plane associated with probabilities. The one-median aims to compute a point q* (i.e., the median) on L to minimize the sum of the expected L∞ distance from q* to all uncertain points, and the one-center is to find the center p* to minimize their maximum expected L∞ distance. We design the prune-and-search algorithms and solve the one-median and one-center respectively in O(mn) time. Since the input is O(mn), our algorithms are optimal.

Develop a Mobile App Towards Stronger Sense of Belonging for College Students during the COVID-19 Pandemic

Washkewicz College of Engineering

Student Researcher: LinCheng Ou

Faculty Advisor: Wenbing Zhao

Abstract

Success in college can be defined in many ways, whether it is achieving A's in your classes, securing an internship at your dream company, or finding a partner. What all these things have in common is the need for social interactions and networking. Unfortunately, the COVID-19 Pandemic has made college social interactions very difficult. This project seeks to design a mobile application to solve this problem by providing an application with social media-like features. These features include posting pictures, commenting/liking a post, sending chats to peer members, and scheduling events with other peers. One thing that makes this different from other social applications is that this app revolves around the user itself. The app will recommend people in the college institution that have similar interests with the user. Based on the user's daily interaction, the app will learn the user's behavior and interests, and recommend peers accordingly.

Object Detection using Computer Vision

Washkewicz College of Engineering

Student Researcher: Nadia Cannon

Faculty Advisor: Ye Zhu

Abstract

Object detection is used in an abundance of areas such as surveillance, modeling, or even video game design. In this project, I research methods to detect an object and apply these methods to gesture creation. One of the most important tools for object detection is the OpenCV library. This is an open-source computer vision library with real-time functions and algorithms designed for real-time applications. The research for this project includes learning about the applications of OpenCV and how to integrate it into applications for object detection.

Microstructure, Mechanical, and Tribological Behavior of Spark Plasma Sintered Titanium Carbide (TiC)-Titanium Nitride (TiN) based Composite Coatings

Washkewicz College of Engineering

Student Researchers: Omar Kolt, Anthony Bearden, and Ganesh Walunj

Faculty Advisor: Tushar Borkar

Abstract

Titanium alloys are attractive candidates for structural, marine, aerospace, biomedical (such as in dental and orthopedic as bone implants) and other industrial applications due to their excellent strength to weight ratio, ductility and formability, corrosion resistance and biocompatible properties. However, titanium alloys suffer from rather poor surface hardness and wear resistance properties. One way of improving the hardness as well as tribological properties of titanium alloys is by reinforcing the soft matrix with hard precipitates, such as titanium nitrides, carbides, and borides. In the present investigation, various ceramic (e.g. TiN, TiC, Ti_2CN, NbN) coatings have been applied on titanium substrate via spark plasma sintering (SPS) technique. Different coatings have a different wear behavior; titanium nitride and niobium nitride have the lowest coefficient of friction compared to pure titanium plate and all other coatings and exhibit excellent tribological behavior. The microhardness for the titanium plate shows an improvement after the SPS process, and the coating of titanium carbide's highest microhardness is 1817 HV. All ceramic coatings exhibited excellent microhardness and tribological behavior as compared to pure titanium plate.

Solar Thermal Dish Storage System Project: A Novel Receiver Experiment Model

Washkewicz College of Engineering

Student Researcher: Forrest Osborn

Faculty Advisors: Chris Hunke and Yongxin Tao

Abstract

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

**Supported by the McNair Scholars Program*