10th Annual Student Center for Science Engagement Research Symposium

In Partnership with NIH MARC U-STAR

September 21, 2018

NEIU El Centro Campus

8:30 AM to 4:00 PM

3390 N. Avondale Ave, Chicago, Illinois 60618

Northeastern ILLINOIS UNIVERSITY

Student Center for Science Engagement

The Student Center for Science Engagement
Tenth Annual Research Symposium

Friday, September 21, 2018
Northeastern Illinois University
El Centro Campus
Chicago, Illinois

Student Center for Science Engagement

Sudha Srinivas, Ph.D., Associate Dean
College of Arts and Sciences

Kenneth Voglesonger, Ph.D., SCSE Director
Professor, Earth Science

Rey Ayon, Academic Success STEM Coach

Shreya Patel, Ph.D., Physical Sciences Advisor

Laura West, Student Academic Services Specialist in STEM

Cynthia Roth-Garfield, Office Manager

Executive Board Members (2016 - 2017)

Gregory Anderson, Ph.D., Professor, Physics

Samantha Brown-Xu, Ph.D., Assistant Professor, Chemistry

Ruth B. Church, Ph.D., Professor, Psychology

Lidia Filus, Ph.D., Professor,
Department Chair of Mathematics

Elisabet Head, Ph.D. Assistant Professor,
Department Coordinator of Earth Science

Francisco Iacobelli, Ph.D. Associate Professor,
Department Chair of Computer Science

Cindy Voisine, Ph.D. Assistant Professor,
Biology

Tenth Annual Student Center for Science Engagement Research Symposium

Table of Contents

Student Center for Science Engagement (SCSE)
MISSION AND GOALS

The mission of the SCSE is to significantly improve recruitment, retention and graduation rates for students in STEM disciplines, with an emphasis on minority, low-income, and first generation students. The goals of the SCSE are being achieved by enhancing academic support and mentoring through advising, faculty-student research projects, and peer mentoring. We provide professional development opportunities to students through internships, networking opportunities, connections with leaders in STEM industries and academic institutions. We also foster career exploration in STEM fields and the development of programming focused on reaching minority, low-income and first generation students. The SCSE is proud to serve NEIU and support future student success in the sciences.

Tenth Annual Student Center for Science Engagement Research Symposium

Message from the College of Arts and Sciences

This tenth annual student research symposium reflects the hard work of motivated teams of students, working alongside their faculty mentors, on studying fundamental questions in the STEM fields. Today, these students, in the spirit of all true explorers, report back on the work they have done all summer.

As you head into your presentations, I ask that you view this symposium not as a culmination of your summer research, but as the initial steps in the process of becoming engaged scientists and researchers. It is the nature of science, that the questions we answer lead us towards further questions. I invite you to take that spirit of scientific discovery far beyond this summer research experience – bring it to the classes you will take, to the papers you will read, to the future projects you will work on!

As you enjoy your presentations and those of your peers today, reflect on how much you have learned this summer, and nurture the curiosity that led you to seek this research experience in the first place, along with the enthusiasm that has allowed you to come this far. These will serve you well in all that you do – in your studies and in your professional work, no matter the field.

Congratulations to the students, the faculty mentors and to the staff at the Student Center for Science Engagement for your work this summer and fall!

Sudha Srinivas
Professor of Physics and Acting Associate Dean
College of Arts and Sciences

Tenth Annual Student Center for Science Engagement Research Symposium

SCSE Director's Message

Welcome everyone to the 10th Annual Research Symposium of the Student Center for Science Engagement (SCSE), co-sponsored with the NIH MARC NU-STAR Program! All of us in the SCSE are excited about the research and collaborations that were part of the summer program, both at NEIU and at other institutions. The SCSE Summer Research Program has continued to flourish, with 44 students and 26 faculty involved in 19 different research groups. These projects represented all of the STEM disciplines, with many interdisciplinary collaborations. These partnerships extended outside of the NEIU campus with students working with the scientists at the Field Museum, Lafayette College, Northern Illinois University, the University of Chicago, Michigan State University, the USDA National Soil Erosion Research Laboratory, the University of California at Berkeley, the University of Iowa, Ithaca College, Centro de Investigación Científica de Yucatán, and the Pennsylvania State University.

Whether projects were done at NEIU or elsewhere, they are only possible with the support and efforts of faculty mentors and students working together to form strong and authentic research communities. Vital support also came from the College of Arts and Sciences, Academic Affairs, the SCSE Executive Board, and the contributions from grant programs secured by the NEIU community, including the NSF Louis Stokes Alliance for Minority Participation, the U.S. Department of Education Hispanic Serving Institutions Title III program, the U.S. Department of Agriculture, the NIH MARC U-STAR Program, and the NIH Chicago-CHEC program. It is also important to recognize the work of the SCSE staff in supporting all of the work that went into supporting students and faculty, as well as this Symposium. Since I am relatively new in the position of Director, I also need to recognize the extensive efforts of Dr. Joel Olfelt, who was in the position of Director prior to my start in August of this year.

Finally, I want to emphasize not just the excellent work that was done over the summer, but also the building of a culture and community at NEIU that values and emphasizes these research experiences for our students, faculty, and staff. This is the result of all those involved, especially the talents, abilities, dedication, enthusiasm, and determination of our students.

Congratulations to everyone! I hope that you all enjoy the day!

Ken Voglesonger, Ph.D.
Associate Professor of Earth Science and Director, Student Center for Science Engagement
College of Arts and Sciences

Tenth Annual Student Center for Science Engagement Research Symposium

KEYNOTE SPEAKER BIOGRAPHICAL SKETCH

Laura Sanchez, Ph.D.
Assistant Professor of Medicinal Chemistry and Pharmacognosy,
University of Illinois at Chicago

*** Keynote speaker sponsored by the NIH Maximizing Access to Research Careers (MARC) U-STAR Program**

Dr. Sanchez was born and raised in Northern California. She attended Whitman College in Walla Walla, WA where she obtained a Bachelor of Arts degree in Chemistry (2007) and was three times a dodgeball champion. Dr. Sanchez decided to pursue a Ph.D. in Chemistry at the University of California, Santa Cruz after an amazing NSF Summer Undergraduate Research Fellowship (2006) in Prof. Phil Crews lab. In the Fall of 2007, she returned to UCSC to work for Prof. Roger Linington where her graduate studies encompassed two main projects including: (1) using the natural product almiramide C as a basis for structure activity relationship and mechanism of action studies; and (2) exploring the fish microbiome as a niche environment for isolating microbes.

In the Fall of 2012, Dr. Sanchez continued to move south to join Prof. Pieter Dorrestein's lab at UC San Diego as an NIH IRACDA Fellow. Her postdoctoral research focused on establishing methods for probing and characterizing metabolic exchanges in polymicrobial communities, specifically those associated with cheese rinds. Additionally, she was also involved with beta testing, documentation, creation of in-house natural product libraries donated by the NIH for Global Natural Products Social Molecular Networking. As an IRACDA fellow, Dr. Sanchez was able to gain experience teaching and developing her pedagogy.

The Sanchez lab utilizes cutting edge mass spectrometry techniques to study the chemical language microbes use to communicate with one another and their surroundings. The aim of the lab is to exploit this chemical communication to understand how microbes function in and affects a host in different health and disease states. Overall, this research will lead to the rapid identification of harmful bacteria based on the chemicals they produce, permitting clinicians and researchers to design more effective courses of treatment.

* The National Institutes of Health MARC U-STAR (Maximizing Access to Research Careers Undergraduate Student Training in Academic Research) Program at Northeastern Illinois University is a comprehensive educational program for college juniors and seniors. It comprises innovative curriculum developments that integrate quantitative sciences into the program of study of the STEM disciplines, diverse research experiences that include research training in research-intensive universities, and structured mentoring and advising. In addition, the MARC Program provides a stipend for two years and covers 60-100% of tuition. **Deadline for student applications is March 11, 2019. For more information, please visit MARC website: cs.neiu.edu/marc**

Tenth Annual Student Center for Science Engagement Research Symposium

SYMPOSIUM SCHEDULE

8:30-9:00 A.M.
Breakfast, Registration(1st Floor Lobby) and Poster Set-up (3rd Floor Atrium)

9:00-9:10 A.M.
Welcome, Opening Remarks (1st Floor Lobby)

9:15 A.M.-10:45 A.M.
Podium Presentations (Rooms 320 & 325)

11:00-12:30 P.M.
Keynote Speaker (1st Floor Lobby)

12:30 P.M.-1:00 P.M.
Lunch Break (1st Floor Lobby)

1:00-2:00 P.M.
MARC NU-STAR & SCSE Awards (1st Floor Lobby)

2:00-4:00 P.M.
Poster Presentations (3rd Floor Atrium)

ABSTRACTS OF PODIUM PRESENTATIONS

RESPONSES TO HEADBAND MOUNTED ERM HAPTIC ACTUATORS DRIVEN BY THE DRV2605 INTEGRATED CIRCUIT LIBRARY

Caroline López-Martinez, Frederick R. Prete Ph.D.
Department of Biology, Northeastern Illinois University, Chicago, IL 60625

Haptics is the application of tactile stimulation by small vibrating (ERM) actuators. Haptic-based prosthetics is a cutting-edge field of research with various therapeutic applications. We are interested in haptic-based mobility aids for visually impaired children. Some studies suggest that head-mounted haptic devices are useful as guides for sighted users but stimulus types and patterning have been simple ON/OFF pulses that convey limited information. Hence, we assessed the perceptibility and pleasantness of 55 complex stimulus patterns programmed into the Texas instruments DRV2605 integrated circuit. All stimuli were generated by each two types of ERMs mounted in a headband, one disc shaped (10mm diameter) and one tube shaped (7x24 mm). Stimuli were classified into nine categories: alert, fuzz, ramp, pulsing, buzz, click, hum, bump, and tick. Our criterion for individual stimulus reliability was 90% detectability. Within categories, all but one of the tube-generated-stimuli met this criterion. For disc-generated stimuli, hums, bumps and ticks were too unreliable to be considered. Among the clicks, only the six strongest, most complex or repeating patterns met the criterion. All alert, fuzz, ramp, pulsing, and the strongest two buzzes met criterion. Subjects rated stimulus pleasantness on a 1-7 Likert scale. Subjects rated the clicks and hums that met criterion as most pleasant for both disc- and tube-generated stimuli. However, they rated only the most perceptible disc-generated ramp stimuli as pleasant. These data indicate that stimulus complexity and actuator type influence stimulus perceptibility and pleasantness ratings, and can guide the choice of stimuli in head mounted haptic devices.

RELATIVE SURVIVAL OF SOD^{X39} AND CAT^{n1} MUTANT *DROSOPHILA MELANOGASTER* EXPOSED TO ACETAMINOPHEN DURING LARVAL DEVELOPMENT

Stefanie Premarathna, Lindsey Walker, Mary Kimble, Ph.D.,
Department of Biology, Northeastern Illinois, Chicago, IL 60625

Acetaminophen (APAP) is a common ingredient used in over the counter analgesics, and effects of APAP on adults have been thoroughly investigated but not for developing fetuses and children. APAP causes the formation of reactive oxygen species (ROS) that damage cells' proteins, lipids, and DNA. Depletion of GSH, an antioxidant molecule, and changes in antioxidant enzymes are seen in APAP overdose. This study examined the relative survival of *Drosophila melanogaster* larvae when exposed to APAP throughout larval stages. The long-term goal of the current study is to assess the effects of APAP during larval development to investigate potential implications on developing human fetuses and children. The fly strains used in this experiment were Oregon R, SOD^{X39}/TM3 and CAT^{n1}/TM3. These mutations were chosen since they possess active cellular enzymes that reduce ROS. The fly larvae were fed food containing APAP and allowed to mature. Adults that survived were scored by sex and genotype, and we found SOD^{X39}/+ and CAT^{n1}/+ larvae survived at higher rates than their TM3/+ siblings, and better than wildtype controls. Our previous studies have also shown that larvae raised on APAP have increased levels of GSH/GSSG. In mammals, GSH is directly involved in detoxification of APAP by-products but is also used in other antioxidant pathways. Assuming similar roles in *Drosophila*, the improved survival of the SOD^{X39}/+ and CAT^{n1}/+ larvae may result from an increased GSH production, allowing more to be directed to detoxifying APAP by-products.

UNCOVERING THE REGULATION OF PROGENITOR CELL DIFFERENTIATION IN THE ZEBRAFISH ENTERIC NERVOUS SYSTEM

Josue Franco[1], Julia Ganz, Ph.D.[2,3]
[1]Psychology Department, Northeastern Illinois University, Chicago, IL 60625, [2]Neuroscience Program, [3]Department of Integrative Biology, Michigan State University, East Lansing, MI 48223

The enteric nervous system (ENS) is the largest division of the peripheral nervous system. It innervates the gut and regulates all gut functions. While we know what functions the ENS carries out, there is still a significant gap in knowledge as to how the development of the ENS is regulated. During development, ENS progenitor cells differentiate into neuronal and glial cells, but which factors determine the cellular fate of each progenitor cell remains unknown. Improper ENS development can lead to ENS diseases, such as Hirschsprung's disease, a congenital disease characterized by lack of ENS neurons in terminal regions of the gut. The focus of this study was to address the following question; 'How are differentiation processes in the ENS regulated?' The CRISPR/Cas9 genome editing technology was used to create deleterious mutations in a specific region of each candidate gene using zebrafish as a model organism. CRISPR/Cas9 components were injected into one-cell stage embryos. At five days post fertilization, the number of ENS neurons and neuronal subtypes were compared between injected larvae and uninjected controls. Changes in ENS neuron number will indicate that the tested gene may have an effect on progenitor cell differentiation. The results of these studies will contribute to a better understanding of how ENS differentiation is regulated during development.

RECONSOLIDATION OF COCAINE ASSOCIATED MEMORIES ON PERK LEVELS WITHIN THE DORSAL AND VENTRAL HIPPOCAMPUS

André Herrera Charpentier[1] and Amy Arguello, Ph.D.[2]
[1]Department of Psychology, Northeastern Illinois University, Chicago, IL 60625
[2]Department Psychology, Michigan State University, East Lansing, MI 48223

Drug-associated environments have the ability to trigger relapse, which can impede subsequent rehabilitation. To create better treatment methods, it is important to understand the neurobiological mechanisms by which these cocaine-context memories potentiate future relapse. By using a rodent model of drug relapse, previous studies have shown that extracellular signal-related kinase (ERK) within the basolateral amygdala contributes to the reconsolidation of cocaine-context memories that promote subsequent drug-seeking behavior. The role of ERK within the dorsal and ventral hippocampus (DH and VH) in this phenomenon is unclear; therefore we aim to determine whether ERK protein levels within the DH or VH are altered following re-exposure to a previously cocaine-paired context. Male Sprague-Dawley rats underwent jugular catheterization surgery, followed by a recovery period. Rats were then placed in a distinctive context and trained to press a lever to administer a cocaine infusion (self-administration (SA) training). Next, rats underwent extinction training in a separate and distinct context in which lever presses resulted in no infusions. After extinction, rats were placed back into the cocaine-paired context for a 15-minute memory-reactivation (MR) session. Rats were then sacrificed, brains extracted and tissue punches obtained. We aim to quantify protein levels of ERK via western blotting between MR and no MR groups. The DH plays an important role in maintaining contextual memories that potentiate drug relapse and the VH in motivational and emotional behavior. We expect that ERK will be increased in both hippocampal regions, following cocaine-context memory retrieval.

AN INVESTIGATION OF THE AMELIORATIVE EFFECT OF STEROIDS ON MULTIPLE SCLEROSIS

Sergio Escobar[1], Cody Pinger[2], Dana Spence, Ph.D.[2,3,4]
[1]Department of Chemistry, Northeastern Illinois University, Chicago, IL 60625
[2]Department of Chemistry, [3]Department of Biomedical Engineering, and [4]Institute for Quantitative Health Science and Engineering, Michigan State University, East Lansing, MI 48824

Multiple sclerosis (MS) affects 2.5 million individuals worldwide and yet current treatments are often ineffective and accompanied by serious side effects. Steroids such as prednisolone have therapeutic potential and are believed to disrupt the cascade pathway responsible for proper secretion of nitric oxide, leading to the myelin depletion and blood-brain barrier deterioration associated with MS. The first step in this pathway is the binding between albumin and C-peptide. Two 3D-printed centrifuge filtration devices were filled with solutions of albumin and C-peptide buffered at physiological pH. A competitive-binding assay was performed to measure the impact of prednisolone on the binding of C-peptide to albumin. Prednisolone was added to the first sample, with a concentration in excess of the albumin, while the control sample did not contain prednisolone. After centrifugation, the concentration of C-peptide which passed through the membrane onto the reservoir tip was assessed using an ELISA assay. The concentration of C-peptide that travels through the membrane allows us to measure the effect of prednisolone on the amount of formed complex present. The concentrations from both samples were found to be within close range of one another. A double tail ANOVA test with a P value of 0.466 confirmed that prednisolone does not significantly affect the binding between albumin and C-peptide. Future research should evaluate if the albumin and C-peptide complex is being inhibited from binding red blood cells.

DATA ANALYSIS USING SPSS: RISK FACTORS ANALYSIS OF PROGRESSIVE SPINAL DEFORMITY AND INTRAMEDULLARY CERVICAL TUMOR

Jose Hernandez Lopez[1], Walter Rodriguez[2], Shan Wang Ph.D.[1]
[1]Department of Mathematics, [2]Department of Computer Science, Northeastern Illinois University, Chicago IL 60625

Laminoplasty has been used as an alternative approach over laminectomy for preventing of spinal deformity after intramedullary spinal cord tumor (IMSCT) resection in recent years. However, controversies exist regarding its real role in maintaining postoperative spinal alignment. The purpose of this study was to investigate the incidence of progressive spinal deformity in individuals who had undergone laminoplasty for IMSCTs resection and to identify the risk factors of IMSCTs and progressive spinal deformity. We retrospectively reviewed the records of 105 consecutive patients who underwent laminoplasty for IMSCTs resection, and 43 patients with the representing intramedullary cervical tumor at a single institution. The associations of all clinical, radiographic, and operative variables to subsequent progressive spinal deformity and present of IMSCTs were assessed using chi-square test and multivariate logistic regression analysis. The analysis was carried out by IBM SPSS Statistics. We concluded that progressive spinal deformity occurred in 25.7% patients undergoing laminoplasty for IMSCT resection and was associated with a decreased functional status. Younger age ($\leq$ 25 years) and preoperative spinal deformity increased the risk of progressive spinal deformity. In light of this risk for postoperative deformity, serious consideration must be given to undertaking concurrent fusion at the time of IMSCT resection or close follow-up postoperatively. Age and Cobb's angle C2-7 also had significant effects on the present of IMSCTs.

USING MICROSATELLITES TO IDENTIFY A POTENTIAL INVASIVE POPULATION OF THE GRACEFUL CATTAIL (*Typha laxmannii*) IN THE MIDWEST

Jacob Ballasch[1], Allison Kish[1], Pamela Geddes, Ph.D.[1,2],
[1]Department of Biology, [2]Environmental Sciences Program, Northeastern Illinois University, Chicago, Illinois, 60625

The Graceful Cattail, *Typha laxmannii*, has recently been observed as a potential invasive species in a U.S. Midwestern wetland where three cattail species already co-occur: *Typha latifolia* (native), *Typha angustifolia* (exotic), and their hybrid, *Typha x glauca*. Cattail species (about 30 worldwide) are morphologically very similar to one another and many hybridize readily which causes issues in their morphological identification. Therefore, a molecular approach is needed to accurately identify all cattail species and to determine if hybridization has occurred. Our objective was to determine if microsatellites that were successful in distinguishing Midwestern cattail species would be useful in correctly identifying the newly invasive *T. laxmannii*. We hypothesized that primers derived from *T. minima* would be compatible with *T. laxmannii* samples since they are thought to be synonymous species. Thirteen samples of suspected *T. laxmannii* were collected from Milwaukee County in Wisconsin and identified morphologically. Seventeen primers derived from two different cattails, *T. angustifolia* and *T. minima*, were tested on the presumed *T. laxmannii* samples. Ten of the 17 primers we tested supported the identification of presumed *T. laxmannii* as a different species from the Midwestern cattails, where many of the diagnostic primers were derived from *T. minima.* Our results show that we can successfully identify *Typha* species. The invasion of further cattail species into the Midwest is likely to continue due to climate change and globalization. Additionally, we recommend the current *Typha* taxonomy be revised to incorporate emerging information from more recent molecular analyses of the *Typha* genus.

AIR BIOMONITORING USING MOSS BAGS: A PILOT STUDY

Glenn Simpson, Jr.[1], Estefania Long[1], Nkosi Evans[1], Matt von Konrat Ph.D.[2], and Thomas Campbell Ph.D.[1],
[1]Department of Biology, Northeastern Illinois University, Chicago, IL 60625, [2]The Field Museum of Natural History, Chicago, IL 60605

Air pollution causes approximately 3.3 million premature deaths yearly worldwide. Potential sources of air pollution include motorized vehicles and power generation stations. Unfortunately, people tend to aggregate in the same areas where many pollutants are released and circulating perhaps without awareness to their presence. The high cost and unsightliness of traditional air monitoring practices led to the exploration of using living organisms (moss) as environmental monitors. We measured relative accumulation of pollutants in moss biobags distributed throughout the Chicagoland area and compared them with historical moss samples available to us from the collection at The Field Museum. *Brachythecium, Fissidens,* and *Mnium* bryophyte sample mats were collected from a pristine area in the Minnesota Driftless Area and placed into mesh biobags with a sphagnum base for moisture retention. Biobags were then distributed to 20 outdoor locations based on EPA pollution maps and recalled after 25 days. Elemental analysis of 45 elements / compounds was then conducted using a portable x-ray fluorescence instrument. Surprisingly, no significant differences in lead, mercury, or cadmium were detected between placed samples, but significant levels of sulfur contamination were found in some sites. Previous studies have linked bio accumulated sulfur levels to sulfur dioxide air pollution, thus we believe our study may indicate increased, and potentially dangerous air pollution levels at some Chicago sites.

EFFECTS OF PHOTOPOLLUTION ON CIRCADIAN ACTIVITY RHYTHMS

Gabriela Naveda[1], Tetyana Perchyk[1], Elyse Bolterstein, Ph.D.[1], Elisabeth DiNello[1], Humerah Ahmed[1], Caleb Gallemore Ph.D.[2], Ting Liu Ph.D.[3], Aaron Schirmer Ph.D.[1]
[1]Department of Biology, Northeastern Illinois University, Chicago, IL, 60625
[2]Oechsle Center for Global Education, Lafayette College, Easton, PA 18042
[3]Department of Geography and Environmental Studies, Northeastern Illinois University, Chicago, IL, 60625

As the Earth cycles through 24-hour light dark-cycles, organisms synchronize their internal circadian clocks to the surrounding environment. This synchronization ensures that oscillations in an organism's behavior and physiology occur at optimal times. The increase of artificial light (or photopollution) in our modern world potentially alters this critical synchronization. Photopollution has been found to impact numerous biological and ecological processes, but the impact on urban wildlife is still unclear. To further explore these impacts, we utilized two model organisms: *Drosophila melanogaster* and *Mus musculus (*house mice). Activity patterns were analyzed using TriKinetics activity monitors and running wheels with Clocklab data collection software, respectively. For both species locomotor activity was collected continuously for the duration of the experiments and levels of nighttime light were manipulated to replicate levels of photopollution found in the Chicagoland area (0 to 36 lux). Significant activity pattern differences were found for both species. Specifically, nighttime light changed total activity, the length of the active phase, and the amplitude of the activity rhythm in both species. In addition, a cover variable was added to the mouse experiments to better replicate field conditions. Preliminary data suggests both the active phases and the amplitude of the activity rhythm decreased more quickly in mice with shelter. These data demonstrate that the effects of photopollution are far reaching and can impact a variety of organisms. By using both *Drosophila* and mice as model systems, we hope to better understanding the varying impacts of photopollution on circadian clocks, behavior, and the environment.

CHARACTERIZING THE ROLE OF *GLAIKIT* IN OXIDATIVE STRESS IN *DROSOPHILA MELANOGASTER*

Deborah Onofrei, Vada Becker, Elyse Bolterstein, Ph.D.,
Biology Department, Northeastern Illinois University, Chicago, Illinois 60625

Oxidative stress is caused by excess free radicals that are introduced to the human body through endogenous metabolism and exogenous carcinogens. DNA self-repair mechanisms are critical for repairing oxidative stress damage. The human repair protein TDP1 is a DNA end-processing factor that combats this type of damage by cleaving protein-DNA covalent bonds that inadvertently form between topoisomerase proteins and the DNA backbone during replication and repair. *Glaikit* is the *Drosophila* homolog of TDP1. *Glaikit* mutants have been shown to have decreased lifespan and motility in females, with sensitivity to mutagenic chemotherapeutics. We hypothesized that *glaikit* responds to oxidative stress. We first confirmed the *glaikit* mutation using PCR. We also confirmed larval sensitivity to chemotherapeutics including rough eye phenotypes, indicating significant cellular damage during development. Eggs laid by *glaikit* females had a low hatching frequency, suggesting that maternally loaded *glaikit* is critical for development. Fertility of young and old *glaikit* males was normal. *Glaikit* larvae were not sensitive to oxidative stress inducers paraquat and hydrogen peroxide, indicating that *glaikit* does not play a role in repairing oxidative damage at the larval stage. Interestingly, our climbing assays have shown increased motility in both young and old *glaikit* females compared to wildtype flies, which contradicts published results. Further characterization of *glaikit* will explore embryonic and adult toxicity and the expression of antioxidants in *glaikit* mutant as well as flies that are mutant in additional DNA repair genes to exacerbate the effect.

A COMPUTATIONAL ANALYSIS OF SPIRAL WAVES

Vincent Vangelista, Karl Amjad-Ali, Minhyeok Kwon, Paulo Acioli, Ph.D.,
Physics Department, Northeastern Illinois University, Chicago, IL 60625

Spiral waves are self-propagating waves that can exist for long periods of time, rotating around some central point. This property allows a single spiral wave to repeatedly send signals across the medium it exists in. In neural and muscle tissue, the presence of spiral waves are potentially dangerous events, and have been attributed to serious medical conditions such as heart fibrillation and seizures. This project seeks to understand more about the nature of how spiral waves can occur, and how various properties about the medium they exist in can change their characteristics, hopefully identifying conditions for both their production and termination. For this project, we have built a simulation using python, where we model nodes in a discrete grid, which can be in one of three states: excited, refractory, or unexcited. With simple rules to determine which nodes interact with each other, what conditions are needed to excite nodes, and how long each state lasts, we can study wave propagation in various mediums. Results seen thus far for systems with properties that can fluctuated on the fly, suggest that many systems would often fall into disorder, with the centers of the spiral waves drifting around. The period between excitations of a point inside the medium were also seen taking on an erratic nature to varying degrees. The use of a simple set of rules to simulate discrete excitable mediums appears to capture many phenomena that occur within similarly setup systems, offering a good alternative to continuous solutions.

A SELECTIVE CAPTURE/RELEASE APPROACH TO SIMPLIFY METABOLIC STUDY OF DRUGS

Gabriela Martinez-Ramirez, Anna Kratowicz, Brenna Dooley, Jing Su, Ph.D.
Department of Chemistry, Northeastern Illinois University, Chicago, IL, 60625

Drug metabolism is defined as the biochemical modification of drug structures by enzymatic systems in living organisms. Understanding of drug metabolism can provide guidelines for optimization of drug structures and properties. Isolating drug metabolites from complex mixtures is often labor-intensive and time-consuming. Our work aims to develop a straightforward method for separating drug metabolites from complex biological samples, allowing metabolites to be analyzed by mass spectrometry. A drug molecule is attached to a biotin group through a disulfide bond, which can selectively bind to a streptavidin-coated solid surface and be separated from the initial biological complex through rinsing the surface. Incubation of the surface-bound drug-disulfide-biotin conjugates with a free thiol solution cleave the disulfide bond and release the conjugates from the surface, enabling the drug and its modified forms to be studied by MS. This approach avoids the tedious separation process in conventional drug metabolism studies. As proof of concept, a model synthetic peptide Cys(SS-Cys-biotin)-Ala-Arg-Gly-Ala-NH_2 and its enzymatic cleavage by trypsin is being studied to demonstrate this selective capture /release approach *in vitro*. Trypsin cleaved the model peptide to give Cys(SS-Cys-biotin)-Ala-Arg-OH, which bound to the streptavidin-coated surface, and was then broken down at the disulfide bonds by DL-dithiothreitol (DTT) and released Cys-Ala-Arg-OH into the solution, as revealed by electrospray ionization mass spectrometry. The spectrum showed a signal corresponding to the unmodified peptide Cys-Ala-Arg-Gly-Ala-NH_2 as well, indicating incomplete enzymatic cleavage. This selective capture/release method enables clean recovery of peptide metabolite and may find application in the metabolic study of various drugs.

ABSTRACTS OF POSTER PRESENTATIONS

DEVELOPING EARTHQUAKE-RELATED LEARNING MODULES USING A PNEUMATIC SHAKE TABLE

Abdulkader Abbas[1], Gisel Lopez[1], Nathalie Martinez[1], Elisabet Head, Ph. D. [1], John Papiewski [2],
[1]Department of Earth Science, [2] Department of Physics, Northeastern Illinois University, Chicago, IL 60625

A newly developed pneumatic shake table at Northeastern Illinois University provides precise control of its amplitude and frequency. This development has introduced the need for new pedagogical material to aid the understanding of earthquake-related phenomena such as resonant frequency and liquefaction, and to provide exposure to engineering methods for damage mitigation. In particular, we wanted to address the behavior of saturated sediments during liquefaction, investigate resonant frequencies of different size structures, and the effects of using various tuned liquid dampers on buildings. The liquefaction model demonstrates that the strength and stiffness of soil is reduced by earthquake vibrations. Using the new shake table, students will be able to recreate a series of experiments that would help them to understand the role of sediment size and shape during liquefaction. The resonant frequency module uses a small actuator with metal strip attachments and a Building Oscillation Seismic Simulation (BOSS) model to highlight the effects of resonant frequency. The engineering module focuses on two techniques to minimize building damage during an earthquake. One technique is base isolation, where the building is separated from its foundation, and the other involves a tuned liquid damper to offset the sway of the structure. All of these laboratory modules aim to stimulate critical thinking regarding the mechanics behind resonant frequency, liquefaction, and engineering for earthquakes. They are designed to usher curiosity towards other earthquake-related phenomena, as well as foster students' interest towards earthquakes so they can develop their own experiments and ideas using the pneumatic shake table.

THE ROLE OF GESTURES IN MATH INSTRUCTION FOR ENGLISH LANGUAGE LEARNERS

Yadira Alonzo[1], Jelena Pantelic[1], Jennifer Sansone[1], Suleima Tank[1], Yeo Eun (Grace) Yun[1], Theodora Koumoutsakis[2], Lisa Hollis-Sawyer, Ph.D.[1], Linda Rueckert, Ph.D.[1], R.B. Church Ph.D.[1]
[1]Northeastern Illinois University, Chicago, IL, 60625; [2]School of Social Service Administration, University of Chicago, Chicago, IL 60637

Co-speech gesture, as a second channel of communication to speech, improves memory and comprehension of speech for both child and adult listeners. Children start gesturing at an early age, before they can speak and their gestures precede early spoken words. Gesturing during math instruction has been shown to be significantly beneficial for learning. However, the impact of gesture during instruction has only been examined in monolingual English-speaking children. Given that gesture conveys universal images related to the speech it accompanies, we asked whether gesture during math instruction could help English Learners (EL) who have just entered the U.S. We examined the effect of gestures in math instruction on learning for 157 EL children and 115 monolingual English-speaking children, 7-9 years old, from 24 Chicago public classrooms. Classrooms participated in a pretest-instruction-posttest experiment designed to teach pre-algebra math problems (i.e., 3 + 4 + 2 = ____ + 3). Classrooms were randomly assigned to watch ***speech only*** or ***speech+gesture*** math instruction. Children benefited significantly more from speech***+gesture*** than ***speech only*** instruction. However, ELs did not benefit from instruction that included gesture while English Speakers did benefit. ELs learned more from Speech+Gesture instruction in English than in Spanish. The poor rate of learning for ELs may be explained by increased cognitive load and a focus on learning English while learning math. These results suggest that gestured instruction should be carefully considered when teaching math to children whose native language is not English.

COMPUTATIONAL MODELING AND ANALYSIS OF SPIRAL WAVE BEHAVIOR

Karl Amjad-Ali, Minhyeok Kwon, Vincent Vangelista, Paulo Acioli, Ph.D.
Department of Physics, Northeastern Illinois University, Chicago, IL, 60625

Spiral waves are self-repeating waves that can form in excitable media, propagating outward from their center in a spiral pattern. In previous work, spiral waves have been linked to medical conditions such as epilepsy and atrial fibrillation. To better understand spiral wave behavior we built custom modeling software using Python. Our focus was ensuring easy to use, efficient, and modular code, allowing for further experimentation both by ourselves and interested parties in the larger community. Our model involves a grid of individually excitable nodes and an interface that allows us to set initial nodal conditions and to observe as the wave propagates throughout the grid. We are able to use this program to study the effect of changing node properties, such as those relating to their excitation and de-excitation, as well as allowing for these values to be randomized during the course of wave propagation. We have run simulations of spiral waves with differing node properties and determined the basic conditions necessary to reliably create spiral waves and related phenomena We have also determined how changing various node properties during wave propagation can cause early termination. Another key aspect was collecting data from our simulation, such as the frequency of the wave, wave edge and center detection, and factors related to randomization, such as the number of waves present in the grid. Moving forward, we intend to thoroughly study different conditions for formation and termination of spiral waves, providing a greater understanding of the behavior of spiral waves on different systems.

VISUALIZING AND ANALYZING VOLCANIC SULFUR DIOXIDE EMISSIONS

Daniela Arriaga, Tamanna Sultana, Andrea Valenzuela, Purushotham Valathur, Elisabet Head, Ph.D.[1], Rachel Trana, Ph.D.[2], [1]Department of Earth Science, [2] Department of Computer Science, Northeastern Illinois University, Chicago, IL 60625

Volcanic eruptions release large amounts of sulfur dioxide (SO_2) emissions, along with other gasses, which can ultimately lead to many environmental issues, such as crop destruction, acid rain, water contamination, and human respiratory conditions. It is important for researchers and Earth Science students to be able to study the effects of volcanic emissions and understand the impacts of volcanic activity on atmospheric chemistry and climate. This research is built on a previous research that created the initial framework for reading OMI data to calculate SO_2 concentrations of volcanic plumes. Within the current research, the existing Python code was updated to work with Python 3 and restructured to be easily maintainable and extendable. With these modifications, users can upload OMI data and visualize and quantify the SO_2 plume for any volcano in the world. Using HySplit, users can identify the portion of the cloud that was emitted within a 24-hour period in order to back-calculate to obtain the amount of original SO_2. Multiple software packages for distributing applications on both MacOS and Windows 10 were tested, resulting in the use of py2app (Mac) and pyinstaller (Windows) for distribution. Future research will focus on re-creating more accurate pixel dimensions, automating the backcalculation of original SO_2, and further editing the application for better user experience.

MAPPING THE MOVEMENT OF THE AMYOTROPHIC LATERAL SCLEROSIS ASSOCIATED PROTEIN TDP-43 FROM CELL TO CELL USING *C. elegans*

Rocio Avila**,** Phoenix Toboz, Cindy Voisine, Ph.D.
Department of Biology, Northeastern Illinois University, Chicago, IL 60625

Motor neuron deterioration in Amyotrophic Lateral Sclerosis (ALS) causes progressive weakness of muscles, possibly triggered by the release of a toxic form of the disease protein TDP-43 from affected neurons into neighboring cells. The toxic fragment, TDP-25, is found in cytoplasmic aggregates in affected tissues of ALS patients. However, the pathway by which the fragment exits the donor cell and enters the receiving cell is unclear. To understand the process of cell to cell transmission, we used the nematode *Caenorhabditis elegans* to monitor movement of toxic fragments from cell to cell. *C. elegans'* cuticle is transparent, allowing visualization of fluorescently tagged proteins within a living organism. Transgenic *C. elegans* lines expressing TDP-25 tagged with a red fluorescent protein (RFP) are crossed to strains that contain green fluorescent protein (GFP) tagged to various proteins localized to specific subcellular compartments. The compartments of interest are the lysosome, autophagosome, and endosome where the GFP-tagged proteins LAAT-1, CTNS-1, and RAB-7 reside, respectively. We used confocal microscopy to determine the location of RFP-tagged TDP-25 in donor cells. Co-localization of RFP with GFP provides evidence that TDP-25 enters these subcellular compartments on its journey out of the cell. Preliminary results suggest the colocalization of the TDP-25 fragment with the lysosome, an organelle responsible for digesting unwanted cellular biomolecules. Our continued studies will provide evidence for the mechanism by which the disease protein escapes one cell to populate other cell types, contributing to the progressive nature of deteriorating neurons in ALS.

GEOMETRY, ART, AND CULTURAL RELEVANCE WITH COMPUTATIONAL THINKING

Lily Radom, Paul Brinkmann, Brittany Pines[1], Joseph Hibdon, Jr., Ph.D.[2], Rachel F. Adler, Ph.D.[3]
[1]Math and Science Concepts Program (MSTQE), [2]Department of Mathematics, and [3] Department of Computer Science, Northeastern Illinois University, Chicago, IL 60625

Teachers need to understand programming to help their students learn basic computer skills so that they can be an engaging part of the 21st century workforce. Our objective is to prepare teachers that are competent in using computational thinking and developing those skills in their students, as well as to make computer science and STEM classes accessible to a diverse population. To this end, this work focuses on developing Scratch modules for an existing geometry course for pre-service teachers. Scratch facilitates non-programmers to learn programming by allowing them to build code from existing blocks of code rather than writing it out. The modules will introduce students to Scratch by drawing geometric shapes and using loops and variables to streamline their code. Not only will coding reinforce the principles in the geometry class, but will also teach problem solving that can be carried over to other subjects. The final project is art-based, further reinforcing the geometry and coding concepts taught during the course, as well as making the lessons culturally relevant to a diverse group of students. Each pre-service teacher will choose a piece of art that speaks to them and build code to produce a geometric interpretation of it. Students will then take it a step further by combining their codes with a partner. Our work showcases the final project that will be conducted in the course, and the modified curriculum that will be used in Fall 2018. We hypothesize that using this approach will help students who have traditionally been marginalized to more fully engage in the geometry class and also allow them to connect with their future K-12 students.

THE EFFECTS OF GLYPHOSATE ON PLANT COMMUNITIES IN INDIAN BOUNDARY PRAIRIES

Chris Comber, Ali Yaseen, Rebekah Fitchett, M.S.[1,2], Karl Gnaedinger[3],
[1]Department of Earth Science and [2]Environmental Science Program, Northeastern Illinois University, Chicago IL, 60625 [3]Indian Boundary Prairies, Markham, IL 60428

Controversial glyphosate-containing-herbicides usage is employed by many Natural Areas Land Managers. Glyphosate targets all plant species indiscriminately making it effective against invasive plants such as Reed Canary Grass, Cattails, and Common Reed. Indian Boundary Prairies (IBP) is one such preserve that uses glyphosate. Even with limited usage there is concern that glyphosate may do more harm than good on the plant community in the surrounding areas of IBP. To determine if there was a correlation between glyphosate use and possible negative impacts on the plant community, three sites were study. All three sites varied in usage of glyphosate. At each site soil was collected at five sub-sites along a 500 foot transect and measured for concentration of glyphosate as well as pH and salinity, both can affect the leaching capability of soil. Glyphosate concentrations were measured using an enzyme-linked immunosorbent assay kit and determined through a calibration curve. Floristic Quality Assessments of each sub-site were conducted to obtain a Floristic Quality Index (FQI) number, which quantifies the density and quality of the plant community. Preliminary results suggest that there was a linear correlation between poor FQI values and high glyphosate concentration in the soils (R^2 = 0.5795). There is little evidence from the results that suggests that the pH and salinity had an effect with leaching of glyphosate. It's concluded that in natural areas, higher glyphosate concentrations in soil will lead to lower plant density and plant quality in areas that were directly treated. But will have little impact on untreated areas.

LEARNING WHEN THE INSTRUCTOR IS BORING: DO GESTURES HELP?

Tony Couturier, Samantha Manno, Jelena Pantelic, Ruth Church, Ph.D., Linda Rueckert, Ph.D., Lisa Hollis-Sawyer, Ph.D., Department of Psychology, Northeastern Illinois University, Chicago, IL, 60625

Previous studies have demonstrated that gestures that occur with speech during math instruction offer visual support to help both children and adults learn math concepts compared to instructions with speech alone. However, no research has examined how an instructor's gestures might influence a learner's perception of the instructor's enthusiasm or how that perception might influence learning. To address this question, we examined college students' understanding of the statistical concept of analysis-of-variance (ANOVA) using a pretest, video instruction, posttest design. Each participant completed a multiple-choice pretest on ANOVA, and then was randomly assigned to view one of two video lessons on ANOVA: (1) an instructor giving a speech only lesson or (2) an instructor giving the same speech lesson but with accompanying co-speech gestures. After the video lesson, the participants took an identical ANOVA posttest and a survey asking them to indicate a number of attributes gauging whether the professor was enthusiastic. Learning was measured by the difference in score between the posttest and pretest. Students who watched the video featuring speech and gesture learned more than those in the speech alone condition. Perception of instructor had no effect on learning overall. There was an interaction between condition and perception of instructor; participants who did not perceive the instructor as enthusiastic learned more when they watched the video with speech and gestures compared to participants who watched the speech only video. This suggests that gestures could help students learn math regardless of instructor enthusiasm, having implications for educators in higher learning.

A STUDY OF TEXT SIMPLIFICATION ON BREAST CANCER INFORMATION TARGETING A LOW HEALTH LITERACY POPULATION

Ginger Dragon, Josefina Guzmán, Francisco Iacobelli, Ph.D., Xiwei Wang, Ph.D.,
Department of Computer Science, Northeastern Illinois University, Chicago, IL, 60625

Adequate health literacy is important for maintaining good health, managing disease and self-advocacy. Internet searching is a popular tool for patients to find health related information, yet the written grade level of medical information is higher than many patients' level of literacy. Consequently, patients with low health literacy are less likely to understand online health information to make better informed decisions. The purpose of this study is to understand what makes a text simple in the domain of breast cancer. With the understanding that most health text simplification relies on readability formulas, e.g., Flesch-Kincaid, as way to determine simplification, and that these formulas are not always reliable, we set out to study which other measures were reliable indicators of simpler text, putting more emphasis on clarification and explanation. In this research, we developed our own coding scheme to simplify text. We then simplified 50 online texts about breast cancer accordingly. A linguistics analysis tool, Coh-Metrix, was used to extract over 100 surface features of text, measuring comprehension, cognition, meaning, discourse of words, etc. We selected multiple surface features that were correlated with simpler text and trained an automatic classifier for simple and complex texts. We report on the classifier's performance and the features selected. Future work should involve testing our findings on low literacy populations to validate our work, as well as designing algorithms to manipulate these surface features by automating the simplification of texts.

WRNEXO'S ROLE IN RESPONDING TO OXIDATIVE STRESS IN *DROSOPHILA MELANOGASTER*

Derek Epiney, Elyse Bolterstein, Ph.D., Department of Biology,
Northeastern Illinois University, Chicago, IL, 60625

DNA replication is an imperfect process that is susceptible to interference from inside as well as outside the cell. One source of interference is oxidative stress, the toxic buildup of free radicals, which can cause mutations possibly leading to cancer. One defense against improper replication is the protein WRN. In humans, WRN facilitates proper DNA repair and replication. Mutations in *WRN* cause Werner syndrome, a disease characterized by accelerated aging and an increased risk of cancer. In *Drosophila melanogaster*, *WRNexo* is homologous to *WRN*. A deletion in *WRNexo* (*WRNexo*$^{\Delta}$) results in incomplete DNA replication during early embryogenesis. We investigated if *WRNexo* protects against oxidative stress by treating *WRNexo*$^{\Delta}$ mutants with paraquat (an herbicide which causes oxidative stress) and determined their viability in eggs, larvae, and adults using fertility, mutagen sensitivity, and hatching frequency assays. Because of the importance of WRNexo during embryogenesis, we expected to see sensitivity of *WRNexo*$^{\Delta}$ to oxidative stress. While fertility was lower in young *WRNexo*$^{\Delta}$ males, there was no effect on fertility in older *WRNexo*$^{\Delta}$ males. There was also no difference in hatching frequencies of *WRNexo*$^{\Delta}$ mutants compared to wild type flies. Surprisingly, *WRNexo*$^{\Delta}$ mutants are also not sensitive to paraquat as the relative survival of *WRNexo*$^{\Delta}$ mutants was the same as wild type flies. Given that the results contradict previous work, we plan to confirm our results using a new stock of *WRNexo*$^{\Delta}$ mutants. Understanding these interactions may allow us to develop better chemotherapy drugs and may also give us further insight on aging.

PROMOTING FUTURE TEACHERS' COMPUTATIONAL THINKING SKILLS USING EARTHQUAKE SIMULATOR ROBOTICS

Adam Erbacher [1], Jacqueline Luna Chavez [2], Maricela N. León [3], Hanna Kim, Ph.D.[3], Rachel Adler, Ph.D.[1],
[1]Department of Computer Science; [2]Math, Science, and Technology for Quality Educators (MSTQE) Program,
and [3]Department of Teacher Education, Northeastern Illinois University, Chicago, IL 60625

The Next Generation of Science Standards (NGSS) values promoting math and computational thinking (CT) - a critical manner of problem solving - for science educators, but many teachers are unsure of what CT is, and how these practices can be incorporated into their teachings. Therefore, we sought to integrate CT in an effective and stimulating manner in order to heighten future teachers' awareness and ability to apply CT skills. We developed an educational robotics module that can simulate earthquakes using the LEGO Mindstorms EV3 kit. Our team members constructed, then programmed the robot to display the impact of an earthquake. We then created an inquiry-based instruction approach by constructing Lego buildings of variable heights and widths. These models are placed on the simulator to determine the structural integrity of each model in the event of increasing earthquake magnitudes. We will test this robotic earthquake simulator for a class of preservice teachers who will focus on elementary and middle school science methods during the fall. The acquisition of the core CT skills (decomposition, algorithmic thinking, identifying patterns, and problem-solving) as well as core science content knowledge (i.e., the cause and effects of earthquakes and structural stability) will be assessed via surveys filled out before and after the activity. The results from these surveys will also reveal if preservice teachers felt that the earthquake simulator would be beneficial in their classrooms, and whether they intend to incorporate robotics into their future classrooms.

STRUCTURAL CHARACTERIZATION OF BACTERIOPHYTOCHROMES BY SCANNING PROBE MICROSCOPY

Annie Fritz[1], Ninorta Dammo[1], Juliet Salivo[2], Rima Rebiai[1], Stefan Tsonchev, Ph.D.[1],
Kenneth T. Nicholson, Ph.D.[1] and, Emina A. Stojković, Ph.D.[2],
[1]Department of Chemistry, [2]Department of Biology
Northeastern Illinois University, Chicago, IL 60625

Bacteriophytochromes (BphPs) are red-light photoreceptors found in various photosynthetic and non-photosynthetic bacteria. BphPs are composed of a photosensory core module (PCM) that consists of three domains termed PAS, GAF, and PHY along with a signal effector domain, usually a histidine kinase (HK). BphPs utilize covalently attached biliverdin chromophore (BV), a linear tetrapyrrole, to detect light. BV enables photoconversion between red (Pr) and far-red (Pfr) light-absorbing states, which results in global structural changes within the protein. We have developed a method of Scanning Probe Microscopy (SPM) to characterize the structure of the PCM and the intact BphP, including HK, in the Pr and Pfr states in a biologically relevant environment; a unique advantage of SPM. Specifically, we have developed a method utilizing atomic force microscopy (AFM) and high speed-AFM to characterize the domain structure of the truncated and intact phytochrome from *S. aurantiaca* (SaBphP2) in its respective Pr and Pfr biologically relevant states. Individual dimers of SaBphP2 reveal extensive conformational changes when compared in the Pr and Pfr states. Close comparison of the truncated SaBphP2 to the intact SaBphP2 shows a clear difference in protein length and size. As expected, the intact protein is longer in shape due to the HK that is missing in the PCM construct. The size, orientation, and structure of SaBphP2 have been further compared to the published cryo-electron microscopy (EM) structures of the related, *Deinococcus radiodurans* BphP, which shows similar conformational changes between the Pr and Pfr states.

ASSESSING ESSENTIAL OILS AND THEIR COMPONENTS AS MUTUAL PRODRUGS AGAINST MULTI-DRUG RESISTANT *PSEUDOMONAS AERUGINOSA*

Alexis L. Hamm, David Alvarado, Emily Booms, Ph.D., Department of Biology,
Northeastern Illinois University, Chicago, IL 60625

Pseudomonas aeruginosa is a gram-negative bacterium and nosocomial pathogen that causes a diverse range of infections. There are multi-drug resistant (MDR) strains of *P. aeruginosa* that have acquired resistance to at least three antibiotics. Prior to 2003, MDR infections were rare and still treatable. Now, MDR infections are more common and sometimes untreatable. This highlights the importance of identifying additional treatment methods outside of antibiotic therapies alone. In our initial study we examined the inhibitory potential of 17 essential oils against two non-MDR strains (33347, 9027) and one MDR strain (2110) using a standard disc diffusion assay. Seven oils showed inhibition against all three strains. To support our findings, we performed a second study where we tested nine new oils using a standard disc diffusion assay at concentrations of 5%, 10% and 20%. In this second study we found that one oil, Ajowan, inhibited *P. aeruginosa* at all concentrations. The 20% concentration had the largest zones of inhibition ranging from 8 – 15mm across all three strains, zones over 9mm are considered significant. We examined the HPLC profiles of these oils and compared the compounds present in the eight inhibitory oils from both studies. Based on the HPLC profiles of these oils, the most prevalent compounds present are eugenol, linalool, γ-terpinene, and β-caryophyllene. We predict that these compounds are responsible for the inhibitory property of these eight oils. Our next steps are to test the individual compounds in these eight oils to identify active components, individually and in combination.

OPTIMIZING METHODS FOR METABOLITE PROFILING OF RIBOSWITCH VARIANTS

Natalie Hernandez[1], Jacob Sieg[2], Philip C. Bevilacqua, Ph.D.[2,3]
[1]Department of Chemistry, Northeastern Illinois University, Chicago, Illinois 60625
[2]Department of Chemistry, [3]Department of Biochemistry and Molecular Biology,
Pennsylvania State University, University Park, PA, 16802

Riboswitches are noncoding portions of bacterial messenger RNA (mRNA) that regulate gene expression in response to changes in the concentration of metabolites. The ligand binding partners of some predicted riboswitches are unknown. The objective of this project is to utilize metabolite profiling of bacterial cell extracts to match orphan riboswitches with their cognate ligands. Herein, we have optimized the procedure for metabolite profiling of riboswitch RNA. In this approach, a biotin-labeled riboswitch RNA pulls down the ligand from cell extracts, using magnetic streptavidin beads. Through our experiments, we have determined that riboswitch RNA is stable for 60 minutes in cell extract that has undergone phenol chloroform extraction and then dialysis. This will enable long ligand-binding incubation times in cell extracts to encourage binding of dilute ligands. Counter to what was expected, riboswitch RNA is stable in the elution condition with ammonium hydroxide buffers of pH 7, 9, 10, and 11 for up to 10 minutes. This may be due to error in pH determination. Future work will utilize metabolite profiling to deorphanize bioinformatically predicted riboswitches.

AUTOPHAGY GENE Ulk1b POTENTIALLY RESPONSIBLE FOR YOLK DIGESTION IN ZEBRAFISH (*DANIO RERIO*) EMBRYOS

Noemi Hernandez, Alivia Heuer, Hannah Nuszen, and Jorge A. Cantú
Northeastern Illinois University, Chicago, IL, 60625

Autophagy or "self-eating" is essential for a cell to maintain energy balance and overturn damaged organelles. The Ulk1b complex is a serine/threonine protein kinase responsible for autophagosome maturation and autophagy initiation. *ulk1b* is activated by starvation in response to glucose deficiency signals. Here, we are investigating if yolk digestion is a form autophagy carried out by the ulk1b complex. Our aim is to understand autophagy in the yolk and establish the zebrafish yolk cell as a novel system to study digestion. Within the yolk, yolk granules are present to provide nutrients needed for embryonic development. Thus, we hypothesize that if yolk digestion is a form of autophagy, knockdown of ulk1b will halt yolk digestion. To knockdown ulk1b, we will use CRISPRi, or CRISPR-mediated inhibition and study the effect on zebrafish yolk digestion. We will use zebrafish embryos at 0-5 days post fertilization as this time is when the yolk is digested and can be easily measured by recording the size of the yolk cell. To better characterize the effect of ulk1b knockdown, we will use immunofluorescence to visualize autophagosome formation in the yolk cell. This will give us a better understanding of the role of ulk1b in yolk digestion. With this, we hope to gain insight on autophagy mechanisms to possibly study hypoglycemia.

RUVBL-1 KNOCKDOWN IN THE ZEBRAFISH YOLK RELATED TO THE mTOR SIGNALING PATHWAY

Alivia Heuer, Noemi Hernandez, Hannah Nuszen, and Jorge A. Cantú, Ph.D.
Northeastern Illinois University, Chicago, IL, 60625

Gene RUVBL-1 is an ATPase that makes up part of the TTT-RUVBL1/2 complex which is necessary for the assembly of numerous multisubunit complexes involved in ATP-dependent cellular remodeling. The TTT-RUVBL1/2 complex is also responsible for assembling a major metabolic sensor, mTORC1, previously associated with various types of cancer. Utilizing Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) with enzyme dead caspase 9 (dCas9) the RUVBL1 gene was knocked down in the model organism *Danio rerio*, commonly known as zebrafish. mRNA for dCas9 and sgRNAs targeting the RUVBL1 gene were injected into the yolk of blastula-stage Zebrafish embryos to repress gene expression autonomously in the yolk cell. In previous studies, treatment with Rapamycin, an inhibitor of the mTORC1 pathway, prevented yolk digestion. This experiment targets a more specific gene within the mTORC1 pathway and examines whether the same phenotypic effect is observed. The phenotypic effects of such repression were examined to better understand the potential function of RUVBL1 in the mTOR signaling pathway. We hypothesize that knockdown of this gene will repress the entire mTOR Complex 1 and provide a more accurate insight into the effects of mTORC1 on yolk digestion. The mTOR pathway is involved in cellular growth and metabolism therefore, it is important to understand what factors affect these pathways when studying various types of cancer.

SEASONAL PATTERNS OF SOCIAL JETLAGS AND ACADEMIC PERFORMANCE BETWEEN DIFFERENT GENDERS

Annick Laure Ishami [1], Michael Vujnovich [1], Benjamin L. Smarr [2], Aaron E. Schirmer, Ph.D. [1]
[1]Department of Biology, Northeastern Illinois University, Chicago, IL 60625
[2]Department of Psychology, University of California, Berkeley, Berkeley, CA 94720

Circadian rhythms are biological processes that show 24 hour oscillations that are synchronized with the environment. Social jetlag (SJL) arises when our internal circadian rhythms are misaligned with the environment due to social impositions such as work or school. Previous studies have shown that increased levels of SJL correlate with decreased academic performance, but data on the impact of season and gender on this phenomenon are limited. In the current study, login data from over 14,000 students were collected from the Northeastern Illinois University learning management system Desire 2 Learn (D2L). These data were analyzed using the R 3.5.0 statistical package and the interactions between season, gender, SJL, and academic performances were explored. Specifically, SJL was calculated by subtracting the median login time of non-class days from the median login time on class days. Students were then sorted depending on gender and season (fall vs. spring) and patterns in SJL and GPA were identified. Preliminary data suggest that, although women have higher GPAs and take fewer courses than men, they both have the same SJL levels. Additionally, SJL was found to be lower and the GPA higher in spring compared to fall students regardless of gender. Understanding these interactions will help individuals more effectively schedule their time to minimize SJL and better synchronize their circadian rhythms. This would serve to maximize academic performance to the benefit of individual students and the universities they attend.

DEVELOPING A MODEL TO SCREEN FOR SMALL MOLECULE TREATMENTS THAT REDUCE ADVANCED GLYCATION END PRODUCTS USING *C. ELEGANS*

Jazmine Jan, Jacob Manlucu, Cindy Voisine, Ph.D.
Department of Biology, Northeastern Illinois University, Chicago, IL 60625

Prostate cancer is the second leading cause of cancer death among men in the United States. Race and ethnicity significantly influence prostate cancer incidence and its level of aggressiveness. Recent studies have found that advanced glycation end products (AGEs) are elevated in the serum of African American compared to European American men. AGEs are harmful compounds that form when glucose covalently attaches to proteins, lipids or nucleic acids in a non-enzymatic reaction. Failure by protective cellular pathways leads to AGE accumulation and this accumulation may serve as a potential biomarker for aggressive forms of prostate cancer. Since the model organism *Caenorhabditis elegans* shares conserved components of AGE detoxification pathways that reduce AGE levels, we are developing a high throughput screen to identify small molecules that reduce AGE accumulation in the nematode. Our first objective was to induce rapid accumulation of AGEs by feeding the animals a high glucose diet and adding exogenous methylglyoxal, a precursor to AGE formation. We then monitored AGE accumulation using a green fluorescent protein (GFP) reporter, where an increase in fluorescence reflects an increase in the level of AGEs. Preliminary results suggest that a 2% glucose diet and an exogenous treatment with a high concentration of methylglyoxal (7mM) for 6 hours increase fluorescence. This breakthrough in our research gives way for high throughput assays to test for drug candidates that reduce AGEs. Our long-term goal is to use *C. elegans* to assist in our understanding of underlying cellular mechanisms that contribute to prostate cancer disparities.

CYTOPLASMIC AGGREGATES OF HUMAN TDP-25 PROTEIN IN *C. elegans* CHALLENGE PROTEOSTASIS

Yuriy Khlopas, Cindy Voisine, Ph.D.
Department of Biology, Northeastern Illinois University, Chicago, IL 60625

Proteostasis, the process by which a cell maintains protein production, folding, and degradation is critical for survival; however, the fidelity of this process declines with age. Disturbance of proteostasis contributes to many age-related neurodegenerative diseases, such as Amyotrophic Lateral Sclerosis (ALS), leading to the accumulation of misfolded proteins. Patients with this disease accumulate an aggregated form of the ALS associated protein TDP-43 in neurons, suggesting a disruption in proteostasis. Here, we are using the nematode *C. elegans* to examine how a toxic fragment of TDP-43, called TDP-25, challenges proteostasis. *C. elegans* is our model of choice because of its short life cycle, its transparent nature, and conservation of genes with human homologues. We have generated multiple transgenic lines expressing fluorescently tagged TDP-25 in the body wall muscles of the animal. Using gel electrophoresis followed by Western Blot Analysis, I will evaluate the steady state level of TDP-25 in each of the three transgenic lines during development and aging. Furthermore, the aggregation state of TDP-25 will be monitored with an expectation that the aggregation level increases with age. The strain with the highest steady state level will be identified and then aggregation will be examined. We anticipate a high level of TDP-25 will lead to an increase in aggregation in aging animals by challenging proteostasis.

CHARACTERIZING SOD1 MUTANTS TO MEASURE OXIDATIVE STRESS IN *DROSOPHILA*

Rolan Milutinovic, Elyse Bolterstein Ph.D., Department of Biology,
Northeastern Illinois University, Chicago, IL, 60625

Free radicals such as reactive oxygen species have the capability to induce structural changes in biological structures such as DNA, lipids, and proteins that directly impact their functionality. The enzyme superoxide dismutase (SOD) mediates free radical damage by catalyzing highly unstable superoxide to hydrogen peroxide. Mutations observed in SOD are hallmarks of familia amyotrophic lateral sclerosis (ALS), a neurodegenerative disorder. *Drosophila melanogaster* contains homologs to the three human SOD genes with a variety of mutant alleles available. This makes *Drosophila* an excellent model to investigate the effects of oxidative stress. Previous research showed that reduced SOD1 expression causes decreased lifespan, delayed and reduced adult emergence, infertility, and sensitivity to paraquat, a herbicide and oxidative stress inducer. Because many SOD1 alleles are lethal, we have created trans homozygous mutants with different SOD1 alleles, $SOD1^{n1}/SOD1^{X\text{-}39}$. $SOD1^{n1}/SOD1^{X\text{-}39}$ displayed a lower hatching frequency compared to wild type and eggs laid by female $SOD1^{n1}/SOD1^{X\text{-}39}$ mated with male wild type have a 29.4% hatching frequency. Male $SOD1^{n1}/SOD1^{X\text{-}39}$ mated with female wild type exhibit 79% hatching, suggesting that maternally loaded SOD1 is critical for early embryonic development. In paraquat sensitivity assays, $SOD1^{n1}/SOD1^{X\text{-}39}$ mutant larvae exhibit 44.59% relative survival to their heterozygous counterparts showing that these trans homozygous flies can serve as a baseline when testing for oxidative stress in other mutants. Future testing with SOD may hold better understanding into the repair of diseases stemming from oxidative stress.

ESTIMATING ATRAZINE REMOVAL AND DEGRADATION BY ACTIVATED CARBON CLOTH

Lynnette Murphy[1], Javier M. Gonzalez, Ph.D.[2], Laura Sanders, Ph.D[3], Jean Hemzacek, M.S.[3] and Kenneth Voglesonger, Ph.D.[1,3], [1]Environmental Sciences Program, Northeastern Illinois University, Chicago, IL 60625
[2]Agricultural Research Services, National Soil Erosion Research Laboratory, West Lafayette, IN 47907
[3]Department of Earth Science, Northeastern Illinois University, Chicago, IL 60625

In the U.S. Midwest, blind inlets composed of various filter media are used as conservation practices to drain closed depressions while losses of sediments, nutrients, and pesticides are reduced, relative to conventional tile risers. Atrazine, a commonly applied herbicide, is highly soluble in water and has been shown to sorb to pyrogenic carbonaceous materials. The objective of this study was to determine atrazine sorption on three activated carbon cloths (ACC), including single weave, double weave, and knit, and a control (geotextile used in blind inlets). Sorption kinetics was performed by shaking each textile at time intervals from 0.01 to 24 hrs. Sorption capacity flow-through was studied using the single weave ACC at retention times 0.75, 5, 10 mins. Finally, atrazine desorption and degradation were studied by incubating for 21 days 1 ppm sorbed single weave ACC in nanopure water, 0.01 M $CaCl_2$, or methanol. All samples were analyzed for atrazine and its metabolites using UPLC MS-MS. The results showed that the three ACCs sorbed at minimum 95% of the atrazine by 1 hr. of shaking, while the control sorbed only 20%. With flow, atrazine was found to sorb greatest (91%) at the 10 min retention time. No atrazine desorption or degradation was detected in both nanopure water and 0.01 M $CaCl_2$, while <8% atrazine desorption, but no degradation, was observed with methanol. In placement of geotextiles in blind inlets, ACC could be utilized to improve the blind inlet to mitigate contaminant loadings that move off fields and into water sources.

THE COMBINATION OF CETUXIMAB AND INTERLEUKIN-1α INCREASES ANTI-TUMOR RESPONSE IN HEAD AND NECK SQUAMOUS CELL CARCINOMA (HNSCC)

Moraima Noda[1], Yinwen Cheng[2,3], Samuel Rodman[2,4], Madelyn Espinosa-Cotton[2,4], Andrean L. Simons Ph.D[2,3,4,5], [1]Department of Biology, Northeastern Illinois University, Chicago, IL 60625
[2]Department of Pathology, [3]Interdisciplinary Human Toxicology Program, [4]Department of Radiation Oncology, Carver College of Medicine, [5]Holden Comprehensive Cancer Center, University of Iowa, Iowa City, IA

The interleukin-1 (IL-1) pathway plays a central role in immune and inflammatory responses by regulating the expression of various inflammatory genes in immune cells. A lesser known role of IL-1 signaling is its involvement in anti-tumor immunity specifically via natural killer (NK) and T cell mediated activity, which is also a major mechanism of action of the monoclonal Epidermal Growth Factor Receptor (EGFR) antibody, cetuximab. We propose that increased IL-1 signaling would enhance anti-tumor immunity resulting in enhanced tumor response to cetuximab. Previous work in the lab revealed that IL-1 alpha (IL-1α) enhances HNSCC tumor response to cetuximab *in vivo* although the anti-tumor mechanism is unclear. The purpose of the current work is to understand how the combination of IL-1α and cetuximab affect anti-tumor immune response. Using *in vitro* co-culture methods we show that IL-1α alone increased number of activated NK cells. Additionally, IL-1 beta (IL-1β) also increased levels of activated NK cells, as well as CD4+ and CD8+ T cells. No additive or synergistic effects were observed with the combination of IL-1α/IL-1β and cetuximab. We further tested if single administration of recombinant IL-1α would suppress or delay SCCVII tumor development in the immunocompetent C3H mice. We found that neither intraperitoneal nor subcutaneous administration of IL-1α 1 week prior to tumor cell challenge suppressed or delayed tumor development. Overall, we show that IL-1 signaling may alter levels of activated NK and cytotoxic T cells however further work is needed to elucidate how IL-1α enhances tumor response to cetuximab.

EXPRESSION PATTERNS OF THE TUMOR SUPPRESSOR GENES, NF2a AND NF2b IN THE CEREBRUM OF ZEBRAFISH

Hannah Nuszen, Noemi Hernandez, Alivia Heuer, and Jorge A. Cantú, Ph.D.,
Department of Biology, Northeastern Illinois University, Chicago, IL 60625

Neurofibromatosis type 2 (NF2) is a rare genetic disorder that is characterized by the growth of benign tumors in the nervous system. One cause of NF2 is mutation in a putative tumor suppressor gene *NF2*. The protein product of *NF2*, MERLIN, is believed to function in regulating cell proliferation and apoptosis. In humans, NF2 condition manifests benign brain tumors in the cranial nerve VIII region, known as the auditory vestibular nerve. Here we seek to understand the function of MERLIN by studying homologous proteins in zebrafish (*D. rerio*) cerebrum through analyzing two paralogs, *NF2a* and *NF2b* that have been duplicated in the zebrafish genome from NF2. Through conducting an qRT-PCR, we analyzed changes in expression levels and the overall patterns of expression of NF2. We next determined patterns of apoptosis within the cerebrum during different embryonic stages through immunostaining of DAPI and Rabbit Anti-active Caspase along with comparing the effects of knocking down NF2.

ACOUSTIC DETECTION OF ALPHA PARTICLES MOVING THROUGH ALCOHOL VAPOR

Adam Provost, Orin Harris, Ph.D., Department of Physics, Northeastern Illinois University, Chicago, IL 60625

As part of its work to discover dark matter in the form of new weakly interacting massive particles, the PICO collaboration analyzes the acoustic profiles of bubbles produced by subatomic particles colliding with the nuclei of superheated fluids. To determine if this technique can be used in supersaturated vapors, a cloud chamber was constructed by using dry ice to produce a supersaturated layer of alcohol and the zirconate piezoelectric acoustic transducers (PZTs) currently used on superheated fluids were used to search for the sounds from ion trails left by alpha particles. Acoustic samples were taken of the empty cloud chamber to generate a background signal which was then compared to samples taken with a Uraninite pebble in the chamber. The resulting acoustic signal was examined using Fourier transform and MATLAB software to visualize the loudness of frequencies between 0 and 1.25MHz. The 102 samples taken with Uraninite in the chamber generated a combined 91.8 seconds of acoustic signal. Based on the average number of alpha particles emitted by the pebble there should have been 348.3 acoustic events detected. None of the 102 samples contained a significant increase in detected acoustic signal relative to background and no frequency profiles were identified as candidates for ion trails. A potential improvement would be using the images of track formation to study the acoustic profile as a function of time.

IDENTIFYING NEW COMPONENTS MEDIATING FIBROBLAST GROWTH FACTOR RECEPTOR SIGNALING IN CAENORHABDITIS ELEGANS

Victoria Puccini de Castro[1], Jessica Palalay[1], Omar Payan Parra[1], Mariya Stefinko[1],
Cindy Voisine, Ph.D.[1], Te-Wen Lo, Ph.D.[2], Michael Stern, Ph.D.[1]
[1]Department of Biology, Northeastern Illinois University, Chicago, IL 60625
[2]Department of Biology, Ithaca College, Ithaca, NY 14850

Fibroblast growth factor receptors (FGFRs) belong to a larger family of receptor tyrosine-kinase (RTK) cell-surface receptors that act by phosphorylating specific tyrosine residues to trigger downstream responses such as cell proliferation, migration, and differentiation. The study of the EGL-15 FGFR in the nematode *Caenorhabditis elegans* has long been used as a paradigm to understand principles of RTK signaling; defects in the processes mediated by EGL-15 result in striking phenotypes that provide powerful genetic tools to discover many of the components mediating RTK signaling. One such process is the regulation of fluid homeostasis. EGL-15 hyperactivation causes excessive accumulation of clear fluid inside the worm's body (the Clear (Clr) phenotype). The isolation of Clr suppressors, termed **S**uppressor **o**f **C**lr (*soc*) mutants, identified many of the core components of EGL-15 signaling. For example, the original set of *soc* mutations identified the Grb2/SEM-5 adaptor protein that links RTK activation to the activation of the RAS/MAPK pathway. Although SEM-5 is required for EGL-15 signaling, a key component that links activated EGL-15 to SEM-5 has yet to be identified, since an *egl-15* mutation, *n1457*, that eliminates the known SEM-5 binding sites on EGL-15 does not confer a Soc phenotype. To identify these missing components, a modified "enhancer" Soc screen was performed in an *egl-15(n1457)* background, resulting in the identification of new *soc* mutations that define at least two new *soc* genes. Genetic analysis and whole-genome sequencing will be used to identify the molecular identities of these new FGFR signaling genes.

COMPUTATIONAL THINKING AND COMPUTER PROGRAMMING AS PART OF THE PHYSICS CURRICULUM FOR PRE-SERVICE STEM TEACHERS

Lauren Rabe[1], Angela McCain[2], and Scott Mayle[3]
[1]Department of Computer Science, [2]Math, Science, and Technology for Quality Education (MSTQE) Program,
[3]Department of Physics, Northeastern Illinois University, Chicago, IL 60625

At NEIU, computational thinking (CT) and computer programming are being integrated into several classes within the Math, Science, and Technology for Quality Education (MSTQE) program, which trains pre-service elementary and middle school math and science teachers. As part of this effort, our team is developing six modules that incorporate CT and coding into the physics curriculum for MSTQE students. For one module, we have created a simulation that allows students to draw vectors on a set of axes by clicking and dragging. Displayed alongside each vector are the vector's components. As part of the module, students will be introduced to the programming concepts of functions and for-loops. Each student will be required to complete a flow chart of a simple function that uses a for-loop, then write a small function that uses a for-loop to calculate the sum, or resultant, of all the vectors that he/she has drawn. After integrating this function into the simulation's existing code, each student will run the simulation again and see that after drawing at least two vectors, the resultant vector will appear automatically. Thus, the students will learn about vector addition while having to use CT skills in order to complete the simulation's code. By using CT to teach physics content to MSTQE students, we will be preparing pre-service teachers to effectively incorporate CT into their future classrooms.

COMPARING THE ACCURACY OF SURFACE ELEVATIONS DERIVED FROM SATELLITES AND UAVS IN THE YUCATÁN PENINSULA

Andrea Saavedra[1], Thomas Pingel, Ph.D. [2], Lily Cobo[2]
[1]Department of Earth Science, Northeastern Illinois University, Chicago, IL 60625
[2]Department of Geographic and Atmospheric Sciences, Northern Illinois University, DeKalb, IL 60115

The Yucatán Peninsula (YP) is considered a groundwater-dependent ecosystem, due to its reliance on aquifers for its supply of freshwater. Increasing populations and use of the underlying aquifers to support the tourism industry in the YP has led to the potential depletion of its natural aquifer systems. Due to the YP's geological characteristics, the area is flat and surface-water runoff and drainage are practically non-existent. One critical component of modeling groundwater effectively is its relation to surface elevations. In the YP, the best source of elevation data is Digital Elevation Models (DEMs) from the Shuttle Radar Topography Mission (SRTM) and Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER). The objective of this study is to test how accurate satellite elevation values in the YP are for groundwater modeling purposes. This study uses Unmanned Aerial Vehicles (UAVs) equipped with cameras and precision Real Time Kinematic (RTK) GPS units to create highly accurate models of the ground surface and cenote water heights, which are then compared to the DEMs from ASTER and the SRTM. The elevation values combined with water-depth values from geophysical surveys will form the basis of groundwater flow models in the YP. Data will also be compared to values in the literature, as drones have been flown in the YP in the past. These comparisons will help to provide estimates of both error in ground surface measurement and change in groundwater levels over time.

EFFECT OF BISPHENOL S ON GAP JUNCTION INTERCELLULAR COMMUNICATION IN THECA CELLS

Juliet Salivo[1], Jeremy Gingrich[2], Almudena Veiga-Lopez, Ph.D.[2]
[1]Department of Biology, Northeastern Illinois University, Chicago, IL 60625
[2]Department of Animal Science, Michigan State University, East Lansing, MI 48824

A wide range of consumer products used today are thought to contain endocrine disrupting chemicals (EDCs). EDCs pose a potential health threat to humans as exposure can occur through food, water, thermal paper receipts, and/or consumer products containing polycarbonate plastic or epoxy resins. The most prevalent EDCs worldwide are bisphenols, specifically bisphenol A (BPA). Regulatory changes impacting the production of BPA has caused an increase in the production of other analogous chemicals with unknown exposure risks, such as bisphenol S (BPS). Ovarian cyclicity is a process that is very tightly regulated by intercellular communication and hormone production, both of which could be affected by exposure to EDCs. Our preliminary findings have shown that BPS can enhance intercellular communication in ovarian theca cells. However, the specific mechanism by which this occurs remains unknown. The current study attempts to better understand the mechanism(s) by which BPS enhances gap junction intercellular communication in ovarian theca cells. We hypothesized that BPS enhances gap junction intercellular communication through the MEK/MAPK pathway. To test our hypothesis, we use ovine ovarian theca cells. Primary ovine theca cells were exposed to either a DMSO vehicle or BPS (at 200 ng/ml), with or without pathway-specific inhibitors. Following exposure, a scrape load/dye transfer assay was employed. This assay used a low-weight fluorescent dye, lucifer yellow, to assess gap junction intercellular communication in live cells. Images were quantified using Fiji-Image J software. Female infertility has recently been correlated with environmental chemical exposure, thus making EDCs a point of research interest.

GESTURE USED IN MATH INSTRUCTION HELPS GIRLS LEARN BUT FRUSTRATION WITH MATH STILL PERSISTS

Jennifer Sansone[1], Jelena Pantelic[1], Yadira Alonzo[1], Yeo Eun (Grace) Yun[1], Suleima Tank[1], Theodora Koumoutsakis, MSW[2], Saba Ayman-Nolley, Ph.D. [1], Linda Rueckert, Ph.D.[1], R.B. Church, Ph.D.[1], Lisa Hollis-Sawyer Ph.D.[1],
[1]Department of Psychology, Northeastern Illinois University, Chicago, IL 60625
[2]School of Social Service Administration, University of Chicago, Chicago, IL 60637

Research shows using visual scaffolding (gesture) in math instruction enhances learning for children, particularly for students with compromised math skills. Although girls' and boys' mathematical abilities are similar, girls' math achievement suffers largely due to math anxiety and stereotype threat (i.e., boys are good at math, girls are good at reading), which leads to frustration when performing math tasks. Therefore, we hypothesized that math instruction with gesture could benefit math learning for girls, and reduce frustration with math performance. Fifty-four 7-9-year-old children from Chicago Public Schools participated in a pretest-instruction-posttest experiment with a survey gauging children's frustration levels with performing the pre- and posttest math activities. The instruction videos taught how to solve pre-algebraic math problems (i.e., 3 + 4 + 5 = __ + 5); one video included gesture to visually support the speech and the other included only speech instruction. Results show that overall, children benefited the most from speech and gesture instruction. However, girls benefited more from gesture scaffolded instruction than boys, even though girls showed significantly more frustration after speech and gesture instruction than boys. Girls were also significantly more frustrated when they did not learn, while boys' frustration did not seem to be affected whether they learned. This implies that boys are more confident in their math abilities, even when they are getting the answers wrong. Future research will examine whether girls interpret their frustration with math as evidence that they are not good at math.

THE MOSQUITO-BORNE ZIKA VIRUS AS A MEANS TO INTRODUCE MODELING TO BIOLOGY STUDENTS

Samah Slim[1], Michael Konecki[2], Stuart Thiel[3], Jennifer Slate Ph.D.[1], and Rachel Adler Ph.D.[4]
[1] Department of Biology, [2] Department of Teacher Education, [3] Department of Mathematics,
[4] Department of Computer Science, Northeastern Illinois University, Chicago, IL 60625

Cases of mosquito-borne illnesses have tripled in the United States and its territories in the last 15 years, according to the Centers for Disease Control. The Zika virus, transmitted by a mosquito vector, can have severe impacts such as microcephaly and brain abnormalities in babies born to infected mothers. We thus created a computer simulation with the modeling platform NetLogo to help introductory biology students analyze how the Zika virus can spread. The simulation expands upon the susceptible, infectious, and recovered (SIR) model commonly taught to introductory students by adding an exposure (E) period. During the exposure period, the pathogen presents in a latent stage, without clinical symptoms or signs of infection in the host. Students manipulate the exposure period and compare its impact to other factors that affect disease spread, such as transmission rate and recovery rate. Students also alter the NetLogo computer code to add other factors to the model, such as mosquito population growth. The computer simulation subsequently tracks the number of people who are susceptible, exposed, infectious, and recovered (SEIR) in real time through a graphical output, allowing students to evaluate the results of their models. By using and modifying our computer simulation of the SEIR model, students not only increase their understanding of the spread of disease but also their modeling skills.

THE ROLE OF TP53i11 IN REGULATING APOPTOSIS OF ROHON-BEARD NEURONS DURING ZEBRAFISH DEVELOPMENT

Amy Sticha, Peter Bleka, Hannah Nuszen, Alivia Heuer, Greg Cox, Jorge Cantu, Ph.D.
Department of Biology, Northeastern Illinois University, Chicago, IL 60625

In zebrafish, Rohon-Beard primary sensory neurons are located in the dorsal spinal cord during the early larval stages. They participate in the embryonic escape response, and help to guide the growth of motor axons and nerves and innervate the trunk and tail of the fish. The RB cells are short-lived, and typically undergo apoptosis by 5 days post fertilization, after the spinal cord and branching tail nerves have begun developing. Recent work has shown that RB cells express the TP53-induced gene, TP53i11, though little is known about this gene's function in any vertebrate system. TP53-Induced Gene 11 Protein likely plays a role in signaling Caspase 9 to commence apoptosis; using Crispr/Cas9-mediated inhibition, we will determine whether TP53i11 is necessary for the developmentally regulated apoptosis of Rohon-Beard cells. In addition, we will use whole mount *in situ* hybridization to determine the spatial and temporal expression pattern of TP53i11's role in nervous system development.

CELL PROLIFERATIVE EFFECT OF INGAP-P AND ITS ANALOGS ON TWO CELL TYPES INVOLVED IN DIABETIC COMPLICATIONS

Astrid Vargas[1], Brenna Dooley[1], Kerald Gonzales[2], Sue Mungre, Ph.D.[1], Jing Su, Ph.D.[2]
[1]Department of Biology, [2]Department of Chemistry[2], Northeastern Illinois University, Chicago, IL 60625

Diabetes mellitus is characterized by hyperglycemia stemming from defects in insulin secretion or function, or both. Insulin, released by β-cells of pancreas maintains normal blood sugar level. A decrease in the number and function of β-cells is seen in both, diabetes type 1 and 2. Thus, the number of functioning β-cells is a good indicator of disease progression and severity. Hyperglycemia also causes damage to nerve cells leading to diabetic neuropathy. Hence, developing therapeutics that increase the proliferation of both β-cells and neuronal cells may have significant impact in disease treatment. A 15-amino acid peptide segment of the islet-neogenesis associated protein (INGAP-P, Ac-IGLHDPSHGTLPNGS-NH_2) has been reported to promote β-cell proliferation in animal models. We studied whether the peptide would also increase the number of viable neuronal cells. A major factor determining the efficacy of the peptide is its stability and half-life in the cells. Towards that end, we designed and synthesized multiple analogues of INGAP-P and observed their effect on the viability of rat β-cells RINm5F, and neuronal PC12 cells. Both cell lines were treated with INGAP-P and its analogs at concentrations ranging from 0.01 μM to 1μM. Cell viability was measured spectrophotometrically using MTT([3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide]) colorimetric assay. Our data shows that all analogs of the peptide increased viable cell count of both RINm5F as well as PC12 cells by 15~30%. We are currently studying the molecular mechanism(s) of peptides' action. These findings will help develop new drugs to alleviate the loss of multiple types of cells under diabetic conditions.

SEASONAL PATTERNS OF LEARNING MANAGEMENT SYSTEM LOGINS INTERACT WITH CHRONOTYPE AND SOCIAL JET LAG TO IMPACT ACADEMIC PERFORMANCE

Michael A. Vujnovich[1], Annick Laure Ishami[1], Benjamin L. Smarr, Ph.D.[2], Aaron E. Schirmer, Ph.D.[1],
[1]Department of Biology, Northeastern Illinois University, Chicago, IL 60625,
[2]Department of Psychology, University of California at Berkeley, Berkeley, CA 94720

Human circadian rhythms are 24-hour oscillations in an individual's behavior and physiology that are synchronized with environmental cues. These individuals develop stable phase relationships between the environment and their internal rhythms giving rise to different chronotypes (morning larks, afternoon finches, and night owls). The imposition of one's social schedule on their internal rhythms, termed social jetlag (SJL), can cause a misalignment between these rhythms and the environment. Such misalignments have been shown to have severe consequences to health and performance. Online records of daily logins from the university learning management system Desire to Learn (D2L) have been used to study the interaction between circadian rhythms, chronotypes, SJL, and academic performance. We mined data from over 3 million D2L login events by Northeastern Illinois University students and analyzed these data in the R 3.5.0 statistical package to identify seasonal patterns across chronotypes in login activity and SJL. Specifically, semesters were broken down into week bins characterized by class and non-class day activity in D2L, and chronotypes were assessed by median non-class day activity per semester. Preliminary results suggest that patterns of login activity vary across chronotypes and between class and non-class days. In addition, changes in logins and SJL were assessed for seasonal patterns in individual students, and significant SJL, chronotypes, and GPA interactions were identified. Data mining across multiple semesters of academic profiles will provide knowledge for students, educators, and universities to create customized schedules that fit individual chronotypes to minimize social jetlag and increase overall academic performance.

ANALYSIS OF THE EFFECTS OF CHRONIC APAP EXPOSURE ON THE DEVELOPMENT OF DROSOPHILA MELANOGASTER

Lindsay Walker, Stefanie Premarathna, Mary Kimble, Ph.D.
Department of Biology, Northeastern Illinois University, Chicago, IL 60625

Acetaminophen (APAP) is one of the most commonly used nonprescription analgesics. While APAP is generally safe at recommended doses, damage to liver and other tissues has been documented at doses that were previously considered non-toxic. APAP effects on adults have been thoroughly tested, but little is known about the effects on children and developing fetuses. Studying the effects of APAP on larval development in *Drosophila melanogaster* will help to understand its' effects on human fetuses and infants, as the larva is analogous to the latter stages of pre- and postnatal development. In previous studies, we observed developmental delay in APAP exposed versus control larvae. In this study, we analyzed the histological effects of APAP in early larval stages that lead to a delayed development to adulthood. Specifically, we compared general tissue morphology, cell damage, and fat body volume between control and APAP exposed first and second instar larvae. Cryosections, 12µm thick, were cut and stained with Hematoxylin & Eosin (H&E), Oil red O (fat body) or TUNEL assay (apoptosis). The APAP treated larvae were significantly smaller in total body size than the control larvae. However, there were no significant differences in structure or relative amount of specific tissue groups. We anticipate that delayed development of APAP larvae is due to disruption of other biochemical pathways. NADPH, used in APAP detoxification, is also needed for various anabolic pathways, thus future experiments will test whether heavy use of NADPH for APAP detoxification siphons off molecules needed for growth and development.

THE INHIBITORY EFFECTS OF SOIL BACTERIA ON *BATRACHOCHYTRIUM DENDROBATIDIS*

Emily T. Yalda, Jason M. Block, Emily A. Booms, Ph.D.,
Department of Biology, Northeastern Illinois University, Chicago, IL 60625

Recent amphibian extinctions and population declines are due to the sudden appearance of chytridiomycosis, an infectious disease in amphibians, caused by the chytrid fungus *Batrachochytrium dendrobatidis*. Zoospores are a reproductive structure of the fungus, which target the skin in larval and adult amphibians after being released from mature zoosporangia. Once zoospores invade the amphibian, they thicken the outer layer of epithelial cells, making it difficult for gas exchange to occur, which is essential for breathing. According to a study in 2010, some species and populations resist the effects of the fungus and we are interested in understanding why. One factor suggested in the literature is that soil composition in the surrounding ecosystem inhibits the effects of the fungus. In our study, we collected soil samples from three aquatic areas in Illinois and isolated bacteria from them. We then exposed zoospores to bacteria-conditioned media and counted live versus dead zoospores using Trypan blue staining over a 1-, 4-, and 7-day period post-exposure. We hypothesize that over time, the survival of the zoospores will decrease if the bacteria-conditioned media contains antifungal peptides secreted into the media by the soil bacteria. Our first trial showed that zoospore survival decreased over time with 4 of 7 bacterial isolates tested, suggesting that if amphibians pick up these soil bacteria, they could be protected from chytrid infection when exposed to certain soil compositions. In future studies, we plan on analyzing the soil bacteria conditioned media to identify what is responsible for the inhibitory effects.

VIDEO INSTRUCTION WITH GESTURE ENHANCES MATH LEARNING BUT CHILDREN'S DIGITAL MEDIA EXPERIENCE MAKES A DIFFERENCE

Yeo Eun (Grace) Yun[1], Jelena Pantelic[1], Jennifer Sansone[1], Suleima Tank[1], Yadira Alonzo[1], Theodora Koumoutsakis[2], Lisa Hollis-Sawyer, Ph.D.[1], Linda Rueckert, Ph.D. [1], R.B. Church, Ph.D.[1]
[1]Department of Psychology, Northeastern Illinois University, Chicago, IL 60625
[2]School of Social Service Administration, University of Chicago, Chicago, IL 60637

Video math instruction with gesture improves learning for elementary school children compared to instruction without gesture. This is because gestural imagery visually scaffolds the learning of abstract math concepts (e.g., manually depicting a balance movement when talking about the equal sign). In addition, research suggests children who play video games do well on complex spatial tasks (such as multiple object tracking). Therefore, we asked how experience with digital media influences the processing of gesture in a digital media venue in math video instruction. Chicago public school children (N=214; ages 7-9) completed a pretest, watched either a speech only or speech+gesture instructional video and completed a posttest on problems reflecting the understanding of the equal sign (i.e., 3+4+5 = __+5). Parents reported how many hours per week their children spent on video games, media, and TV (screen time). Children were classified into two screen time groups: Low (<5 hours/week) and High (≥5 hours/week). We found: (1) Overall, children benefited more from speech+gesture instruction than speech only instruction, (2) screen time did not significantly correlate with learning and (3) low screen time children, but not high screen time children, benefited significantly from speech+gesture instruction compared to instruction without gesture. Video instruction with gesture may not benefit high screen time children because they are more habituated to visual spatial stimuli.

CELLULAR ORGANIZATION OF THE BRAIN AND THORACIC GANGLIA OF THE PRAYING MANTIS

Xhulio Zeka, Frederick R. Prete, Ph.D.
Department of Biology, Northeastern Illinois University, Chicago, IL 60625

The praying mantis is a charismatic, predatory insect that depends on vision for prey identification. Students in our lab have published extensively on the psychophysics and neurophysiology of prey recognition but little is known about the underlying neuroanatomy. We analyzed the brain and thoracic ganglia anatomy of several mantis species using *Gromphadorhina portentosa*, a similarly sized member of the Blattodea (cockroaches, sister taxon to Mantodea) as a benchmark. Preparations were toluidine and horseradish peroxidase stained whole mounts and sections stained for acetylcholine and GABA. Overall mantis brain and ganglia anatomy followed the basic orthopteroid bauplan but with several specializations. The latter included relatively larger optic lobes containing ommatidia with six elongated and two truncated retinula cells, and supporting cells at their distal tips. The next proximal ganglion of densely packed lamina monopolar cells projected through the first optic chiasm to the anterior and posterior medulla. The latter projected to an unusual, multilayered lobula complex. The protocerebrum contained three robust, transverse axon pathways reaching across the entire brain. Mantises had highly complex mushroom bodies with dense concentrations of Kenyon cells atop robust calyces. In addition, there was an elaborated central body complex in the center of the brain with efferents displaying ACh-like immonoreactivity. Large mushroom bodies and central complexes have been associated with complex sensory processing such as that necessary to implement the prey identification algorithms demonstrated in our behavioral research. Understanding this neural architecture will help our research team create more realistic computer models of the mantis' computational visual algorithms.

ABOUT THE STUDENT CENTER FOR SCIENCE ENGAGEMENT (SCSE)

The Student Center for Science Engagement (SCSE) is a resource to help students succeed at NEIU and in their future careers in the sciences. We serve all students interested in the sciences, and we support the following departments and programs: Biology, Chemistry, Physics, Earth Science, Environmental Science, Computer Science, Mathematics, and Psychology.

We offer:

- **One-on-One Professional Advising** – Life science and physical science advisors assist students in exploring majors, internships, graduate school, and other career options. Advisors assist students in advancing their professional training by securing resources that support academic and professional goals.

- **Signature Workshops**-Workshops cover a broad range of topics including study skills, time management, graduate school, branding and networking, career planning and professional development planning. The Center emphasizes building strong professional development skills.

- **Tutoring and GRE Preparation**-The Center provides daily tutoring services in upper-level Biology, Chemistry, Computer Science, Earth Science, Genetics, Mathematics, and Physics courses. Free GRE classes are offered annually.

- **Research Opportunities** – Students are encouraged to gain valuable hands-on experience by helping through summer research opportunities with NEIU faculty and at other institutions.

- **Conference Attendance and Participation**-The SCSE supports students to attend and present their research at conferences locally and nationwide.

- **Invited Speakers**-The SCSE invites individuals representing organizations and industry to inform students on internships and career opportunities in a broad range of fields.



10th Annual Student Center for Science Engagement Research Symposium

ACKNOWLEDGEMENTS

The research presented at the Tenth Annual Research Symposium of the Student Center for Science Engagement has been funded by several internal and external agencies. On behalf of our students and faculty, the SCSE acknowledges financial support from the College of Arts and Sciences, the United States Department of Education Title III, National Institutes of Health, ChicagoCHEC U54 Catalyst, The Field Museum of Chicago, and the National Science Foundation Louis Stokes Alliances for Minority Participation.

Special Thanks to:

NIH MARC U-STAR
US Department of Education
Illinois LS-AMP
Chicago State University
National Institute of Health
The Field Museum of Chicago
National Science Foundation
NIH ChicagoCHEC