URCAD 2014 Student Abstracts

In Alphabetical Order by Presenting Author

How to read the abstracts

Title of Presentation

Name of Student Author, Co-Investigator, Co-Investigator
Name of mentor, rank of mentor, department of mentor

Student presenter names are in bold. Non-presenting co-investigators are not in bold
All investigators are assumed to be from UMBC unless otherwise noted.
Mentor information is shown below author information, in roman type. If the mentor is not from UMBC, an institution name is given.

The body of the abstract provides information about the student's research.

Funding information is provided in italics below the body of the abstract.

Use of Social Marketing Principles to Promote Positive Diabetes Care Practices in Older Hispanics and African Americans

Fadaka Adebayo
Angelica P. Herrera, Assistant Professor, Department of Sociology and Anthropology

Older Hispanics and African Americans are twice as likely as non-Hispanic Whites to have Type II Diabetes (T2DM), which compromises quality of life and leads to unnecessary health care expenditures. Old age and a lack of culturally targeted messages can further complicate the comprehension of diabetes care regimens. Social marketing principles and techniques – product, price, place, and promotion (the 4 Ps) – can be used to generate positive messages that motivate and influence positive behavioral change. The present study draws on a systematic review of literature and qualitative ethnographic interviews with older racial and ethnic minorities with T2DM to identify misaligned perceptions and sociocultural and structural barriers and then to create positive messages using Social Marketing principles. Content analysis of ethnographic interviews and literature review resulted in eight overarching themes, now in our adapted Health Belief Model, which would be amenable to health behavior change. These themes included mistrust in health advice, spirituality, psychological distress, family loss and suffering, functional health and disability, family support, gender identity, and cultural associations with food. Suitable placements included public transportation sites, barber and beauty shops, places of worship, local ethnic grocery stores, and community based social services centers.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Antimicrobial Activity of Fluoroquinolone Antibiotics: Consequences for UV-based Wastewater Treatment

Hollie Adejumo
Lee Blaney, Assistant Professor, Department of Chemical, Biochemical, and Environmental Engineering

Wastewater treatment removes contaminants from sewage and eliminates threats to human and ecological health. Fluoroquinolone antibiotics have been measured in wastewater and may contribute to antimicrobial resistance in bacteria. The goal of this research is to understand the interaction(s) of fluoroquinolone antibiotics and microbial populations. In particular, the antimicrobial activity of fluoroquinolones will be measured against a common environmental indicator organism, *Escherichia coli.* We hypothesized that the antimicrobial potency of fluoroquinolone antibiotics against *E. coli* will be in the same order of magnitude for difloxacin, enrofloxacin, norfloxacin, and pefloxacin. To test this hypothesis, we ran bioassays and generated inhibition profiles using the Hill equation for each fluoroquinolone. The IC_{50} is the concentration that results in 50% inhibition of a microorganism. Our findings indicate that fluoroquinolones with similar chemical structures have similar IC_{50} values. Difloxacin, enrofloxacin, norfloxacin, and pefloxacin demonstrated IC_{50} values of 28.1, 38.2, 154, and 232 µg/L, respectively. The Hill slope, which describes the steepness of the inhibition profile, of difloxacin was the greatest (H = 29.7), whereas the Hill slope for the other three fluoroquinolones was similar (H = 3.1-6.3). These profiles will be used to describe the antimicrobial activity of wastewater treated with UV-based processes.

Improving Brief Constructed Responses (BCRs) in Science Using RACES Strategy

Jeania Afrin
Jonathan Singer, Associate Professor, Department of Education

The purpose of the present study was to examine the ability of RACES to improve seventh grade students' ability to develop BCRs. The RACES intervention provided a sequential framework for students to follow as they developed science BCRs: (1) **R**estate the question or statement, (2) **A**nswer the question or statement, (3) **C**ite information or examples from the text or investigation to support their answers, (4) **E**xplain their information or examples, and (5) **S**ummarize their answers and connect to the overall topic. Baseline data from Maryland's Seventh Grade Standard Science Benchmark Assessment indicated that students struggle to develop brief constructed responses (BCRs): They often fail to fully justify their responses with specific details from a scientific investigation, selected reading, or graphical representation of data. Such justifications are essential to explain scientific phenomenon. The data are being collected on their next Benchmark Assessment to see students' improvement on their BCR responses.

The Cloning and Expression of Whooping Crane Photopigments

Ifeolu Akinnola, *Elelbin Ortiz, Devyani Ujla, Robert McCready, Evan Cameron, Alexandra Kingston, Megan Porter, Thomas Cronin, Phyllis Robinson*
Phyllis Robinson, Professor, Department of Biological Sciences

The whooping crane (*Grus Americana*) is an endangered species of bird native to North America and has yet to have its visual system characterized. Photopigments are a class of G-protein coupled receptors that respond to light. Each photopigment responds to a different wavelength of light. Our goal was to determine the sequences of whooping crane opsins and the spectral properties of the expressed visual pigments. We cloned the avian opsin genes and subcloned the genes into a mammalian expression vector and expressed them in a heterologous expression system. We are now in the process of comparing the whooping crane's visual system to that of other avian creatures. We have also begun research on melanopsin within the whooping crane. Our goal with melanopsin is to discover the number of forms within the whooping crane and characterize each one as we have done with the other photopigments. Melanopsin is known as a non-visual protein that plays a role in regulating circadian rhythm and pupillary light reflex.

*This work was funded, in part, by a grant from the National Eye Institute to P.R.R, a NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC, and by the Howard Hughes Medical Institute's Precollege and Undergraduate Science Education Program.*

Increasing Student Knowledge on How to Identify and Describe Relationships among Inscribed Angles, Radii, and Chords

Kerianne Allen
Jonathan Singer, Associate Professor, Department of Education

This study focuses on student understanding of identifying and describing relationships among inscribed angles, radii, and chords. In order to measure the growth of student knowledge, pre and post assessment measures will be compared and analyzed. This study will run through the course of 6 weeks in a Baltimore city public high school. The test group is 31 tenth grade geometry students. Throughout the study, students participated in student centered learning activities. Students will be encouraged to discuss their reasoning throughout lessons. Lesson plans will include the appropriate use of technology to display new information and student work. AgileMind, an online learning program used in mathematics classrooms in an urban school district, will be incorporated in daily lesson plans. Students will be given a performance assessment task, along with formal and informal formative assessments to gauge progress throughout the study. After the unit is complete, students will be given a summative post assessment which will determine the growth in knowledge. The target result is 80 percent of students will pass the post assessment.

Structure and Variation of the Warble Song in Grasshopper Sparrows (*Ammodramus savannarum*)

Aymen Alqazzaz*, Mary Willard*
Bernard Lohr, Assistant Professor, Department of Biological Sciences

The song repertoire of male Grasshopper Sparrows (*Ammodramus savannarum*) contains two distinct songs: the "buzz" song, and the acoustically more complex "warble" song. Unlike the buzz song, the structure of the warble song has been relatively under-studied, and its function is less well understood. The two songs are often sung independently, however the warble song can sometimes immediately follow the buzz song in sequence (but never precedes the buzz song). The warble song type can be recognized by a sequence of structurally distinct acoustic elements, with certain elements repeated more than once in each song. It is usually sung in the latter part of a breeding cycle, and is only sung by successfully paired males. We analyzed 20 warble song spectrograms from the Maryland population using qualitative visual judgment. We segmented the songs into repeatable elements, and constructed a syllable repertoire library of the Maryland population. We then compared these data with songs recorded in other populations. Our study aims to assess if certain acoustic features are exclusive to particular populations. Such a distinction would suggest that certain acoustic characteristics might be useful in distinguishing among subspecies, and warrants more detailed study of differences in this species' song.

This work was funded through the UMBC Department of Biological Sciences and an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

A Recombinant Protein as a Cancer Therapeutic to Overcome Tumor-Related Immune Suppression and Enhance Tumor Rejection

Juan A. Alvarez*, Lucas Horn, Samuel T. Haile, Julie B. Wolf, Suzanne Ostrand-Rosenberg*
Suzanne Ostrand-Rosenberg, Professor, Department of Biological Sciences

The immune system has the capability of rejecting tumor cells and overcoming cancer, however, many tumors thrive due to expression of cell surface immunosuppressive ligands. These ligands are potential targets for cancer therapeutic agents. Programmed Death Ligand-1 (PD-L1, or B7-H1) is an immunosuppressive ligand and is expressed on most tumor cells. It acts as an "off signal" to cytotoxic T cells whose job is to eliminate malignant cells, and therefore protects tumor cells from T-cell attack. We have previously shown that a soluble form of CD80, a costimulatory molecule with two Immunoglobulin-like (Ig-like) extracellular domains (IgV and IgC), blocks PD-L1 and prevents the deactivation of T cells in the presence of tumor. The IgV-like domain is thought to be responsible for binding PD-L1. We hypothesize that expression of a recombinant CD80 with a deleted IgC domain may be as efficacious as the full-length protein and would be a potential improvement for large scale production of this molecule as a cancer therapeutic. We have generated a human CD80 gene lacking the IgC-domain and inserted it into the pLHCX vector. Recombinant protein will be assessed for stability and its ability to prevent PD-L1-mediated immune suppression.

*This work was funded, in part, by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC and the Meyerhoff Scholars Program at UMBC.*

Investigating a Potential Chemopreventive Agent in a Brca1 Mutant Mouse Model

Chinwendu L. Amazu
Laundette Jones, Assistant Professor, Department of Pharmacology and Experimental Therapeutics, University of Maryland School of Medicine

Breast tumors with *Breast cancer susceptibility gene 1* (Brca1) mutations are often Estrogen Receptor (ER) and Progesterone Receptor (PR) negative, making them resistant to hormonal therapy. Understanding the basis for this phenotype could provide new ideas for treatment options. Loss of Brca1 function leads to increased ER/PR signaling, and increased proliferation of ER/PR-negative mammary epithelial cells (MEC). This study examined the effectiveness of a novel chemopreventive agent, RLI, in preventing the expansion of the ER/PR negative lesions. Brca1 mutant mice were treated five times per week with RLI or a placebo at three months of age and euthanized at nine months for tissue collection and examination. Preliminary data showed that in contrast to untreated mice, Brca1 mutant mice treated with RLI retained the expression of ER in MEC. My project focused on using western blot analysis to quantitate the levels of proteins associated with ER signaling and proliferation, including PR, Cyclin D1, and Neu in both groups of mice. We found that PR was present in RLI-treated mice. Further characterization and optimization of these proteins will be necessary to determine RLI's effectiveness. Ultimately, we anticipate that RLI may serve as a chemopreventive treatment for breast cancer patients with Brca1 mutations.

*This work was funded, in part, by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC, a grant to UMBC from the Howard Hughes Medical Institute through the Precollege and Undergraduate Science Education Program and by Amgen Pharmaceuticals.*

Investigating Reciprocal Regulation of the Circadian Clock by Plant Innate Immunity

William L. Angel*, Chong Zhang*
Hua Lu, Associate Professor, Department of Biological Sciences

A thorough understanding of plant defense mechanisms is critical to the success of genetic engineering to enhance plant resistance against devastating pathogens. Recent studies have shown that the circadian clock, the internal time measuring machinery, regulates plant innate immunity. Data from Dr. Lu's laboratory further indicate that flg22, a 22-amino acid peptide from bacterial flagellin, not only activates basal defense but also influences clock activity. This leads us to hypothesize that components of flg22-triggered signaling could regulate the circadian clock. To test the hypothesis, we crossed flg22 signaling mutants to a wild-type plant expressing luciferase (LUC), an enzyme that produces light when given its substrate, under the control of the clock promoter *CCA1*. We identified plants carrying a homozygous mutation disrupting a flg22 signaling component and the CCA1:LUC reporter in the F2 generation by PCR and harvested these plants for seeds. Seedlings of such a genotype will be monitored for luciferase activity with an instrument detecting luminescence every hour for seven days in the constant light condition. Any change in the phase, period, or amplitude of luciferase activity would indicate the disruption of the clock activity, which is likely due to the change of flg22 signaling.

Determining the Effects of Autophagy on Morphology of *Aspergillus nidulans*

Sara R. Arussy, *Christopher L. Yankaskas*
Mark R. Marten, Professor, Department of Chemical, Biochemical, and Environmental Engineering

Filamentous fungi are a crucial part of the current biotechnology economy, particularly when used for the production of therapeutics and enzymes. The Marten Lab, in part, focuses on optimizing fungal protein secretion in *Aspergillus nidulans*. To this end, hundreds of mutant strains have been generated and screened for increased secretion capacity. Once mutants with high secretion capabilities are identified, their morphology is analyzed, and ultimately strains that also have favorable morphology for use in bioprocesses (i.e., higher branching rate) are selected for further study. Small, highly-branched fungi increase fermentation efficiency by reducing viscosity, thus improving oxygen and nutrient delivery to the cells. We hypothesize that hyphal branching is, in part, regulated by autophagy. Autophagy is a cellular-level recycling process that occurs in a wide range of species from fungi to humans. To test this hypothesis, the morphology of the parent strain TN02A3 is to be compared to that of two strains missing key autophagy genes atg8 and atg13. In order to achieve this, image analysis protocol was developed and preliminary signs of autophagy were established using confocal microscopy with the fluorescently (i.e., GFP) tagged Atg8 protein.

This work was funded, in part, through an Undergraduate Research Assistantship Support (URAS) Award from the UMBC Office of Research Administration. Additional funding was provided by the National Science Foundation (Award 1159973).

Ion Exchange and Mixed-Mode Chromatography for the Optimization of Protein Purification

Ifemayowa A. Aworanti*, Mayyada El-Sayed*
Douglas D. Frey, Professor, Department of Chemical, Biochemical, and Environmental Engineering

There is an urgent need for the development of efficient and robust protein separation methods in the food and pharmaceutical industries to ensure higher purity, yield and throughput. In this work, ion-exchange (IEX) and mixed-mode (MM) chromatography techniques were used to study the adsorption mechanism for the interaction between proteins and IEX/MM packings. Column experiments using each of the anion exchange and mixed-mode packings were conducted under differing pH and ionic strength. Retention time of protein in the column, under different conditions, was used to calculate the linear equilibrium adsorption constant for the protein-column packing interactions. Experimental data was fitted to analytical and statistical models to enable prediction of the amount of protein adsorbed under a variety of conditions and hence elucidate the underlying mechanism of adsorption. This work is important in developing computer-aided design methodologies for predicting the effect of pH and ionic strength on protein purification.

*This work was funded, in part, by NIH/NIGMS MARC U*STAR T34 08663 National Research Service award to UMBC.*

Study of rbfA suppressor in *Escherichia coli*

Sara Azeem, Monika Bhatt
Philip J. Farabaugh, Professor, Department of Biological Sciences

Proteins are synthesized in cells by ribosomes in a process called translation. Ribosomes are molecular machines that polymerize amino acids into polypeptide chains, which form proteins. A ribosome acts as a platform for messenger RNA (mRNA), an unstable copy of genetic information carried by DNA, and transfer RNA (tRNA), a physical link between DNA /RNA and amino acid sequence of proteins, to come together. The prokaryotic ribosome consists of a large subunit, 50S, and a small subunit, 30S. The small 30S subunit is composed of 16S ribosomal RNA (rRNA), which binds to 21 r-proteins. The large subunit is made of 23S and 5S RNA. The small and large subunits bind together to form a very stable, long-lived, protein-RNA complex. Ribosome assembly has many steps and uses various assembly factors and enzymes that monitor the process. Ribosome binding factor A, rbfA, is a cold shock protein that is considered to be involved in the maturation of a functional small subunit. When rbfA is deleted, the ribosome is not assembled properly, causing the cells to be cold sensitive and slow growing. We will determine how rbfA interacts with the ribosome and the ribosomal protein, rps5.

Enhancing the Inducible Mouse Model for Prostate Inflammation

Sagar Bajpai, *Arya Ashok*
Charles Bieberich, Professor, Department of Biological Sciences

Prostatitis is the most common outpatient condition in men under fifty, and benign prostate hyperplasia (BPH) is the most prevalent male non-malignant growth disorder. In cases of asymptomatic inflammatory prostatitis, 90 percent exhibited elevated IL-1β expression. Using the rtTA-TetOn system, an inducible mouse model for prostate inflammation, pro-inflammatory cytokines such as Interleukin-1 Beta (IL-1β) were used to induce prostatic inflammation to further understand their roles in BPH and prostatitis. The model consists of the Tet-Operator driving the expression of the interleukin that is activated by the presence of doxycycline coupled with rtTA expression driven by the prostate-specific Hoxb13 promoter. The current aim is to increase efficiency of the rtTA-TetOn system by modifying the poly(A) signal of the rtTA gene. By changing the current SV40 poly(A) signal with the β-globin poly(A) signal, which is known to support robust transgene expression, we hypothesize that the rtTA gene expression will encompass all the prostate lobes, driving further expression of genes downstream of the Tet-Operator. A GFP reporter gene will be used to visually characterize expression in the prostate. An improved rtTA-TetOn system that induces gene expression in all prostate lobes may offer insight into understanding roles of inflammatory cytokines in the prostate inflammation.

This work was funded in part by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) and the Howard Hughes Medical Institute's Precollege and Undergraduate Science Program.

Incorporation of L4 into Ribosomes is Temperature Dependent in L4 Mutant Strains

Ademayowa Balogun*, Mohammad Shamsuzzaman, Marlon Lawrence, Janice Zengel, Lasse Lindahl*
Lasse Lindahl, Professor, Department of Biological Sciences

In ribosomes, the vital cellular machinery conserved in all living organisms, rRNA performs the function of decoding mRNA and catalyzing peptide bond formation, whereas ribosomal proteins bind rRNA and assist rRNA folding and function. Ribosomal protein L4 has a globular domain and extension loop. Mutations in this loop confer resistance to macrolide antibiotics. To determine the functional role of the loops we have studied viable *Escherichia coli* mutants lacking L4 loops. Although the loops are not essential for ribosome function, the growth of the mutant strains is compromised. L4 mutant strains lacking the large loop entirely are cold sensitive and, in comparison to wild-type, grow much slower at 37° C than at 42° C. We hypothesize two explanations for this observation: 1) at higher temperature, mutant L4 assembles more efficiently into the pre-ribosomal complex and 2) ribosome function of translation improves at the higher temperature. Our results demonstrate that increased growth rate of L4 mutant strains is due, at least in part, to more efficient incorporation of mutant L4 into the ribosome at higher temperature. Our data also show that there is a build-up of ribosomal intermediates when L4 mutant strains are shifted from higher to lower temperatures during the logarithmic growth phase.

*This work was supported by NIH/NIGMS MARC U*STAR Grant T34 08663 Award to UMBC and NSF grant 092057.*

Captain Henry Dashiell's Papers and Neo-Latin, the Continued International Use of Latin in the 18th Century

Amber B. Barnett
Esther Doyle Read, Adjunct Professor, Department of Ancient Studies

The Dashiell Archival Collection at the Fells Point Visitors Center includes several thousand documents dating from 1785 to the 1980s associated with the Dashiell family of Baltimore. Two of the collection's letters are written in Neo-Latin, and were carried onboard the ship *Venus* in 1799 by Captain Henry Dashiell during a voyage from Baltimore to Batavia, in Sumatra. I translated these letters written to the governor of Gibraltar, an English colony, and found that they allowed Dashiell to enter port there. They raise the question of why the British still used Latin in 1799, and reveal insight into Captain Dashiell's life. When these letters were written, Latin was still an international diplomatic language; Napoleon had just come to power; and the United States was engaged in the Quasi-French War. Dashiell used the Latin letters to try to successfully pursue his commercial enterprise to Batavia, which unfortunately ended when the French captured the *Venus* in July 1799 at Sẫo Iago in the Cape Verde Islands. The letters illustrate why Latin is not just for classicists, but also historians; as a diplomatic language, it provides a window into the past and helps us to understand our connection to that past.

Improving Line of Sight Coverage of Remote Controlled Drone Using an Autonomous Quadcopter

Alex Barton, Kiara Forman, Scott Forster, Sarah Khalife, Fitzhugh Malloy
E.F. Charles LaBerge, Professor of the Practice, Department of Computer Science and Electrical Engineering

Many remotely controlled aircraft are flown with First Person Video (FPV). FPV is a system where video from a camera on the front of an aircraft is transmitted to a monitor on the ground. The pilot uses the monitor on the ground to fly the plane. In order for this system to operate, Line of Sight (LOS) must be maintained between the ground transmitter and the aircraft receiver. This drastically limits the use cases, and current implementations are only viable in open terrain. We have developed an autonomous solution to solve this problem. Our solution uses an autonomous quadcopter to fly radio relay equipment between the FPV aircraft and the pilot. Our system is capable of routing both control and video information around large objects, such as buildings and trees, successfully, and in real time. This methodology can be further extended to operate with any radio controlled vehicle and has great significance in military and civilian reconnaissance.

This work was funded by the Department of Computer Science and Electrical Engineering at UMBC.

Interculturality between U.S. Americans and Chileans

Travis Bell
John Stolle-McAllister, Associate Professor, Department of Modern Languages, Linguistics and Intercultural Communication

While Chile is geographically isolated from the United States, the two cultures are not isolated. In an era of globalization, U.S. exchange students often experience the convergence of cultures, but their experiences are less frequently shared or inquired about. The purpose of this project is to gather opinions about U.S. American culture, Chilean culture, and the exchange of the two cultures from multiple perspectives. To do so, 10 Chilean host family members and 10 U.S. exchange students studying in Chile were asked 20 questions in a recorded video interview. The interview questions asked participants to compare the two cultures' values and customs, discuss their experiences with Chilean and U.S. culture, and give an opinion about the cultural exchange between the two cultures. The results of those interviews were condensed into a 25-minute documentary. Many participants voiced the opinion that cultural differences may stem from Chile being a more collectivistic culture and the U.S. being a more individualistic culture. A majority of participants noted an increase in the presence of American media, businesses, and lifestyle in Chile. The documentary captures a unique dialogue of how culture is viewed by U.S. exchange students and Chilean host families.

Equality in Diaspora: Jews in Ptolemaic Alexandria

Sierra Benson-Brown
Timothy J. Phin, Lecturer, Department of Ancient Studies; Esther Doyle Read, Lecturer, Department of Ancient Studies

During the Ptolemaic period (323-30 BCE), the Diaspora Jewish population in the city of Alexandria, Egypt achieved greater social equality while simultaneously maintaining its religious identity. This was not the case under previous dynasties, nor ever became the case in other regions of Egypt. The consensus among scholars concerning Jews living in Egypt is that they were mistreated, unequal, and abused. However, it can be argued that while the Ptolemies were in power, Jews were not only held in high esteem but they also influenced the city's culture and government. Jewish influence can physically be seen in the city of Alexandria through the city plan and its buildings. Despite the Alexandrian Jews remaining steadfast in their faith, they were well versed in Greek culture. Jewish philosophers resided in Alexandria and it is believed that the Hellenizing of Jewish culture in Alexandria led the way for a more allegorical interpretation of the scriptures in later times. Through occupations, citizenship, and cultural syncretism, Jews in Alexandria made substantial contributions to the multicultural city and reached a level of cultural equality previously unknown to them.

This work was funded, in part, by the Department of Ancient Studies at UMBC.

Periodic Poling of Electro-Optic Polymers for Efficient Terahertz Generation

Kim Berghaus, Matthew Wilcox
L. Michael Hayden, Professor, Department of Physics

In this project we utilized periodic poling as a tool to create a well phase-matched nonlinear optical system. Phase-matching increases the efficiency of the nonlinear processes which lead to the creation of terahertz (THz) frequency radiation. THz frequency waves have applications in diverse fields such as communications, materials science, security imaging, and chemical and biological sensing. We created THz waves by shining femtosecond infrared laser pulses onto poled nonlinear optical polymers. The nonlinear properties of the polymers lead to difference-frequency generation (DFG), which creates the THz waves. However, when the polymer becomes too thick, destructive interference of newly generated light with previously generated light causes a reduction of the total generated THz light. To counteract these effects we use periodic poling, which means to change the polarization of the polymer layer in an alternating way, to create an optical system with high efficiency. We created a system using multiple layers of Z53, an optical polymer with promising nonlinear properties. In this project we focus on acquiring experimental evidence for our promising theoretical predictions. We investigated the benefits of periodic poling by taking data in the bulk system versus the periodically poled system at different pump-frequencies.

Using Machine Learning to Classify Trouble Tickets

Michael Berlin
Tim Finin, Professor, Department of Computer Science and Electrical Engineering

The IT help ticket queue for the UMBC Division of Information Technology uses keywords to sort help tickets into more manageable categories, so that the tickets can be directed to people who specialize in that sort of problem. During the course of a ticket's lifetime, a typical trouble ticket gets reclassified several times, adding significantly to the time it takes to respond to it. In order to properly classify future tickets, the Division of Information Technology decided some sort of AI approach would be best, which would provide much better accuracy. This kind of category choosing is common to machine learning, and is called a Classification problem. A lot of very high quality data were given to me, so I first ran Naive Bayes, a very common machine learning algorithm, on the set in order to establish baseline accuracy. The next step was to try at least two other algorithms on the data, multivariate logistic regression and a Support Vector Machine, in order to see which handles this kind of data best. I also used MALLET's feature selection algorithms to see if I could improve upon all three approaches, or just find a best approach outright.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Characterization of Microfluidic Channels Created Using PDMS and Soft Lithography

Drayton Blanchard, *Brian Stevens*
Gymama Slaughter, Assistant Professor, Department of Computer Science and Electrical Engineering

Diabetes is a very prevalent health issue today. Regulation of insulin levels is a difficult task that currently requires injections of insulin into the bloodstream via needles and other invasive methods. These methods rely on the keen attention of the individual with diabetes to monitor their own blood sugar levels and administer insulin accordingly. This project proposes to develop an intravascular device that dispenses insulin in response to an excessive amount of glucose in the blood. A two-step polydimethylsiloxane (PDMS) oxidation method that uses soft lithography on PDMS has been developed to fabricate reservoirs to contain the insulin. Microfluidic channels with various geometries are created using this method. The influence of these channels with various geometries on bonding strength is investigated and compared to other methods such as plasma-modified PDMS and other silanized polymers.

*This work was funded, in part, by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC and National Science Foundation.*

Enhancing Students' Level of Geometric Thinking through Van Hiele Phase-based Learning

Catherine N. Bloomer
Christopher Rakes, Assistant Professor, Department of Education

The present study investigated the levels of geometric thinking of an honors geometry class containing ninth and tenth grade students from a suburban high school over the span of 18 weeks (two marking periods). The goal was to enhance 85 percent of the target students' geometric thinking by at least one level through Van Hiele's phase-based learning. The Van Heile levels of geometric thought are visualization, analysis, informal deduction, formal deduction, and rigor. The intervention involved teaching the first four levels of geometric thinking in every lesson. Student Van Heile levels were assessed with the *Van Hiele Geometry Test* (25 multiple choice items, five items per level). Students were assessed prior to the intervention, and the class with the lowest levels was chosen for this study. This test was administered to students an additional two times as a pre- and post-test, once before a unit on polygons and once after the unit.

Quantification of Buffering Agents in Cell Culture Media

Robert M. Breen, *Rebecca L. Neubauer, Andrea R. Gray*
William R. LaCourse, Professor, Department of Chemistry and Biochemistry

Cell Culture Media (CCM) is an integral part of bioreactor bioprocesses. CCM contains many key nutrients such as amino acids, salts, sugars, vitamins, and fatty acids. These compounds create an environment that is optimal for cell growth. Buffering agents represent a large portion of CCM as they are necessary to maintain a suitable pH environment. Quantification of these buffering agents (in particular HEPES, TRIS, MOPS, and MES), is necessary for the complete analysis of all manufactured and spent media (i.e., media leftover after bioprocesses are completed). The goal of this project is to develop an analytical method to separate and detect the buffering agents, in order to determine their amounts in manufactured and spent media. These quantitative assays can then be used to improve the CCM formulation in order to create the most efficient cell culture environment.

This project was funded, in part, by B.D. Biosciences and UMBC.

The Influence of Stochastic Parameters on Calcium Waves in a Heart Cell

Matthew W. Brewster
Matthias K. Gobbert, Professor, Department of Mathematics and Statistics; Xuan Huang, Department of Mathematics and Statistics; Bradford E. Peercy, Assistant Professor, Department of Mathematics and Statistics; Padmanabhan Seshaiyer, Department of Mathematical Sciences, George Mason University

Calcium is a critical component in many cellular functions. It serves many important functions such as signal transduction, contraction of muscles, enzyme function, and maintaining potential difference across excitable membranes. In this study we examine spontaneous calcium waves in heart cells and how they initiate, propagate, and affect a transient measure of total cytosolic calcium. Calcium sparks are intracellular release events that are important in converting electrical stimuli into mechanical responses. As a sequence of calcium release units (CRUs) begins to release calcium throughout the cell, a wave is triggered and can lead to irregular heartbeats and possibly a life threatening ventricular fibrillation. We investigate the effects of stochastic release from CRUs on generating calcium waves considering a distribution for the flux density term sampled a) once for all CRUs and b) for each CRU independently. We include a stochastic flux density term as more physiologically appropriate than a fixed release rate. We use an array of statistical techniques as well as parallel computing to facilitate the large number of simulation runs.

This work is funded, in part, through an Undergraduate Research Award from the UMBC Office of Undergraduate Education and NSF grants, and uses the UMBC High Performance Computing Facility.

Increasing College and Career Readiness through Laboratory Experiments

David A. Buckingham
Jonathan Singer, Associate Professor, Department of Education

Lab design, execution, and report ability are essential to College and Career Readiness as determined by the Common Core State Standards and Next Generation Science Standards. This study focuses on the effect of gradually reduced scaffolding on high school students' ability to design, execute, and report a laboratory investigation. The population utilized for this project is composed of an 11^{th} grade honors physics class set in a suburban area high school. Scaffolding consists of a gradually reduced format structure, prompt guidance, and direct instruction given to the students during and following laboratory investigations. Students must learn the importance of rigorous data collection and experimental design as well as the ability to coherently report on their investigations and findings in a technical format. Student learning is measured through performance on labs, with a standardized rubric for pre and post measurement focused on identical performance objectives.

Maternal Psychological Well-being, Parenting Style, and Chinese Immigrant Children's Social-Emotional Adjustment

Grace E. Calvin, *Jing Yu*
Charissa S. L. Cheah, Associate Professor, Department of Psychology

The present study explored predictors of developmental adjustment among young Chinese immigrant children, an understudied group. Poor maternal psychological well-being may predict children's maladjustment through parenting. Prior research demonstrated that Chinese immigrant mothers' higher psychological well-being predicted more authoritative parenting (i.e., high control and high warmth), and mothers' authoritative parenting predicted Chinese immigrant children's high levels of inhibitory control, which in turn predicted low levels of child difficulties. We hypothesized that higher levels of maternal psychological well-being would predict more authoritative and less authoritarian parenting (i.e. high control and low warmth), which in turn would predict lower levels of child difficulties. Chinese immigrant mothers residing in Maryland (n = 151, Mage = 37.72, SD = 4.37) with preschool-age children (Mage = 4.52, SD = 0.90) reported on their authoritative and authoritarian parenting styles and their psychological well-being. Children's teachers rated children's social-emotional difficulties. As expected, correlational analyses indicated that maternal psychological well-being was positively associated with authoritative and negatively associated with authoritarian parenting. Authoritative parenting, but not authoritarian parenting, was negatively correlated with child difficulties. Path analyses will be conducted to explore the mediating role of maternal psychological well-being.

This work was funded by a grant from the Foundation for Child Development Young Scholars Program and NICHD (1R03HD052827-01) to Charissa S. L. Cheah.

Testing For Female Song in Newly Recognized Species: The Puerto Rican Oriole

Susanna K. Campbell
Kevin Omland, Professor, Department of Biological Sciences

Bird song is typically thought of as a male trait, especially in temperate zones. However, in tropical bird species, it is common for both males and females to sing. Previous research by our group suggests that the ancestor of all orioles had both female and male song and that female song has been selected against and lost repeatedly with movement north to temperate areas. The focus of the current project is to test for female song in the Puerto Rican Oriole (*Icterus portoricensis*), which was recently given full species status in 2010, by the American Ornithologists' Union. If we observe female song in this tropical species, I will compare the song recordings to those of male Puerto Rican Orioles and determine the role that female song plays in mate selection and/or territory defense. I will apply this information to more accurately reconstruct the ancestral state of the common ancestor to orioles. The knowledge gained in this study will help us understand the evolution of oriole song in relation to breeding latitude, and lead to better understanding of a tropical icterid native to the United States.

*This work was funded, in part, by The Explorers Club Youth Activity Fund, Sigma Xi Grants-in-Aid of Research, an Undergraduate Research Award from the UMBC Office of Undergraduate Education, an NSF Research Experience for Undergraduates, and NIH/NIGMS MARC U*STAR T34 08663 National Service Award to UMBC.*

Effects of Multitasking on Reading Comprehension and Puzzle Solving

Kim C. Casimbon
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Recent research has examined the effects of multitasking on in-class laptop use, text messaging, and Instant Messaging (IM) during class lectures. Prior studies have found a negative relationship between IM usage and comprehension score. Those who spent more time instant messaging their partners online had poorer academic performance. The current study examines the effects of dual tasking, focusing on the performance of either two related or unrelated activities as compared with single task performance. One hundred fifty participants are assigned to either a dual task group attending to two related tasks (reading a passage while viewing a video), performing two unrelated tasks, (solving three side-by-side puzzles while viewing the video), or doing one task at a time, (either just reading the passage, puzzle, or video task by itself). Performance will be evaluated using assessment scores for each activity. Participants in the dual task groups are expected to score lower on their assessments compared to those in the single task groups. Furthermore, those who are reading a passage and viewing the video simultaneously will score the lowest compared to other groups. Due to various technological advances, it is important to note the consequences of multitasking particularly in learning environments.

Modeling Mathematics

Brittany L. Chatfield, *Emmanuel C. Ramos*
Chris Rakes, Professor, Department of Education

The ability of students to develop strong modeling representations is a critical practice in the Common Core State Standards for Mathematics Practice. Modeling demonstrates students' ability to draw connections between multiple strategies and equivalent representations of mathematical situations. Modeling mathematics allows students to use multiple routes to solve problems that are different and unique. The present study analyzed the degree to which students used appropriate models to solve a variety of mathematical tasks. During the intervention period, students were taught the S.O.L.V.E. strategy and a way to use graphs and tables to enhance their ability to communicate accurate solutions and use multiple representations for modeling mathematical structures and solutions. Students demonstrated their understanding of modeling through problem solving by using tables, graphs, algebraic expressions, and various other tools to represent a situation mathematically. A unit pre- and post-assessment was used to measure the degree to which students use modeling. The ability for students to develop strong modeling representations is critical for all students in problem solving and analysis.

Possibilities: An Anticipatory Look at the Ethical Issues in Stem Cell Research

Benjamin Cherry, Oleksandr Aleksandrovych, *Kit Kearney*
Richard Wilson, Lecturer, Department of Philosophy

This scholarship addresses certain ethical issues raised by induced pluripotent stem cells. They have already successfully been made from human skin cells in the laboratory. These cells have the capability to alter the medical world; injuries deemed irreparable and diseases deemed incurable can be healed and remedied. The life expectancy could not only potentially rise, but become incalculable as a result. Our ability to create iPSCs raises ethical issue concerning lawful and medical use: there is a very thin line between the use and abuse of iPSCs. We take an anticipatory approach to attempt to resolve the social and ethical problems stemming from this technology. We consider the impact iPSCs have on privacy, issues of access to treatment, reproductive medicine, and enhancement versus restorative uses. We identify these issues by employing well established ethical principles. These same principles are then used to provide solutions to those problems. This process of analysis is then repeated using the National Society of Engineers' Code of Ethics since engineers are the main stakeholders considered. Our recommendations consider the existing framework of addressing privacy and rights issues, the prioritizing of treatment recipients (similar to organ transplantation), and the structuring of a basis by medical experts for the therapeutic use of induced pluripotent stem cells.

The Relation between Accurate Perception and Marital Satisfaction in Newlywed Couples

Cho Fung Chim
Robin Barry, Assistant Professor, Department of Psychology

Previous research has examined the impact of partner perception on marital satisfaction on a context-general level, in which most researchers assess couples' personal traits or typical communication behaviors. Nevertheless, controversy remains regarding whether accurate perception or positively biased perception of one's partner contributes to marital satisfaction. In other words, is it better to see your partner accurately or more positively than the partner sees him or herself? Additionally, relatively little research has focused on a context-specific level, which examines behavior during specific conflictual interactions. In the present study, accurate perception is defined as the level of agreement between the married spouses on the items that measure their self-rated and partner-rated communication behaviors during their conflict discussions. It is hypothesized that couples' accurate perception of each other's conflict communication behavior during a conflict discussion predicts their marital satisfaction. This hypothesis will be tested using linear regression in a sample of 114 newlywed heterosexual couples. The results suggest that husbands who more accurately perceived their wives' adversarial conflict behaviors experienced higher marital satisfaction; and wives who more accurately perceived their husbands' collaborative conflict behaviors experienced higher marital satisfaction. The results of this research will inform research on couples' communication and partner perception and potentially help couple therapists find ways to improve couples' marital relationship.

Fear Be Gone: Endocannabinoids Modulate Subsecond Dopamine Release during the Extinction of Fear Memories

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Post-traumatic stress disorder (PTSD) is a debilitating anxiety disorder caused by experiencing dangerous situations. Environmental stimuli associated with such events are capable of independently producing persistent fear responses, a central feature of PTSD. Fear-conditioning models, in which the ability of a conditioned cue to elicit a freezing response is measured, are often used to investigate the therapeutic potential of drugs for PTSD and the neural mechanisms responsible for their utility. Here, we investigate how the endocannabinoid and mesolimbic dopamine systems interact during the extinction of fear memories using a fear-conditioning model, pharmacology and fast-scan cyclic voltammetry. Prior to assessing conditioned fear responses, animals were pre-treated with either the cannabinoid CB1 receptor antagonist rimonabant (0.3 mg/kg IV) or vehicle. In vehicle-treated rats, the conditioned tone produced freezing behavior that persisted through the first 10 trials and produced a sharp decrease in dopamine concentration. In comparison, rimonabant-treated rats were more resistant to the extinction of fear memories, as freezing behavior persisted through 15 presentations of the conditioned tone and the tone-induced decrease in dopamine was less apparent. These data suggest that there is a critical interaction between the endocannabinoid and mesolimbic dopamine systems in the extinction of fear memories.

*This work was funded, in part, by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC and NIH Grants R01DA022340 (JFC) and T32NS007375 (EBO; director Bradley E. Alger).*

Genetic Basis of Natural Variation in Innate Immune Function: The Effects of Syndecan on Phagocytosis

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Jeff Leips, Associate Professor, Department of Biological Sciences

All multicellular organisms rely on the innate immune system to provide the first line of defense against infection. There is a great deal of variation in the ability to clear infection among individuals within populations. This variation is due to environmental and genetic factors. Our lab is interested in identifying genes responsible for this natural variation in innate immune function. We used *Drosophila melanogaster* in a genome-wide association study (GWAS) and identified 1700 polymorphisms throughout the genome that affect the ability to clear bacterial infection. Phagocytosis and the production of antimicrobial peptides, the two main components of the innate immune response, may have contributed to the results of the previous study. In our current study we focus on validating the effect of the Syndecan (*Sdc)* gene on phagocytosis. We are using the Gal4/UAS system along with RNAi interference to knock down expression of the *Sdc* gene in hemocytes of the heart and to assess the cells' ability to engulf bacteria. As many aspects of the innate immune response in Drosophila are similar to those in humans, results from this study could provide a general understanding of the genes regulating phagocytosis and elucidate its relative importance in the clearance of infection.

*This work was funded, in part, by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC and by NIH grant R01-DK084219.*

Determining Song Choice in Song Birds

Sergiu Costinas
Bernard Lohr, Assistant Professor, Department of Biological Sciences

A number of song characteristics may be subject to sexual selection in territorial songbirds. In preparation for conducting tests to study song choice in the context of sexual selection, a software algorithm for performing choice tests with female birds using a modified operant conditioning chamber and procedure was developed. This type of operant chamber presents two alternative choices for the subject and allows for the subject to differentiate between those two choices. The circuits designed facilitate operant conditioning of the subject by providing auditory "rewards" for the subject after a selection. Once the subject is trained to respond in the operant chamber, choice testing can commence. Preparatory work prior to beginning trials consisted of designing and testing hardware and subject housing. The choice test circuit measures the type and number of selections made to activate the playback of specific songs, and uses these results to determine song preference. The initial choice test will focus on the two song types produced by Grasshopper Sparrows, "buzzes" and "warbles." Preferences of the female for the two song types under different conditions will be tested. Initial trials have begun with simple choice tests to acclimate subjects.

This research was funded by the UMBC Department of Biological Sciences and an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Variation in Human Rights Violations in Iraq: 1991 to the Present

Rachel Crane
Ilsa Lottes, Professor, Department of Sociology and Anthropology

Changes in the realization of the human rights of citizens in Iraq were sparked by sanctions placed on that country by the United States in 1991. The research reported here uses both qualitative and quantitative data to illustrate fluctuations in human rights violations in Iraq during four time periods between 1991 and the present. Examples of human rights violations as defined by the United Nations and agreed upon by a large majority of the world's countries are documented using sources that include both Amnesty International and Human Rights Watch. Findings indicate that the invasion of Iraq by the United States contributed to multiple human rights violations committed against the Iraqi people and prevented a positive trend toward the increased freedom of many groups in that country. Suggestions are made for how the foreign policy of the USA can change to reduce its harmful effects. These changes are derived from the work of social scientists who have studied characteristics of countries that either promote or harm human rights realization in countries worldwide.

The Lost Colony: Finding Elyoner

Christine Cruz
Terry Bouton, Professor, Department of History

This research examines the Lost Colony of Roanoke as an historical and cultural phenomenon. When this original colonization attempt failed in 1587, the missing English settlers left to us the first and oldest American mystery, with only a handful of clues to help us solve it. When I began my research, my goal was to find the origination of the Lost Colony legends and explain why, after four centuries, they still resound with modern Americans. To attain this goal, I traveled to many of the locations central to the Colony's history, interviewed experts, professors, and locals, examined primary documents, and collected any and all information I could that was related to the Colony. It was a journey through memory, time, and history that revealed the Colony's legacy to still be very much a living, breathing process. This research uses primary sources as the groundwork upon which present-day Americans affected by Roanoke base their opinions, beliefs, and personal histories. However, the focus of the work is not on the original English settlers themselves, but rather on the modern cultural influence of the Colony and how it has personally touched and shaped the lives of Americans.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

The Study of Charged Nanoparticles of Crotamine and Plasmid DNA

Steven Dakermanji
Richard Karpel, Professor, Department of Chemistry and Biochemistry

At millimolar levels, crotamine is toxic. However at micromolar levels, this 42-residue polypeptide from the South American rattlesnake venom has been shown to penetrate rapidly dividing cells, and carry plasmid DNA molecules into these cells. Thus, crotamine might have a high level of medicinal use as a carrier of recombinant DNA molecules containing genes with anticancer properties. Crotamine has a high net positive charge which allows it to bind to the net negatively charged DNA very easily. Rather than simply attaching to a single DNA strand, there is evidence of aggregation of many strands of DNA and crotamine. This leads to the formation of nanoparticles, which can then be characterized using dynamic light scattering (DLS). DLS experiments are able to give insights on the crotamine–plasmid DNA aggregates under different conditions. We are using DLS to characterize the charge of the crotamine-plasmid DNA aggregates and the effects of different conditions, like salt, on the extent of aggregation, with a view toward understanding how the charge of the nanoparticles affects their ability to be transported into cells.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Production of *Aspergillus nidulans* Mutants for the Study of Protein Secretion Mechanisms

Raissa Dantas, *Karthik Boppidi, Nicholas Rogers*
Mark R. Marten, Professor, Department of Chemical, Biochemical and Environmental Engineering

Our goal is to understand how fungi secrete proteins and to investigate reasons for differences in the total amount of protein secreted. Filamentous fungi are the workhorses of the biotech industry and are extensively used in the production of a variety of enzymes. However, protein expression and secretion can be inconsistent. We hypothesized that there is a correlation between highly branched mutants and high protein secretion. To test our hypothesis and investigate protein secretion mechanisms, we used *Aspergillus nidulans* mutants. A variety of analytic approaches were taken. First, we tested for alpha amylase and cellulase secretion by growing these mutants on solid media plates. The protein secreted is directly proportional to the size of the halo around the colony, and we quantified the images to determine exact protein amount. We also grew mutants on liquid media and analyzed the proteins secreted into the media. The data from the above experiments lead us to believe that we may have a mutant that has higher protein secretion than the wild-type strain. Our next step is to further investigate these promising mutants using proteomic analysis and chemical genetic profiling. These results will then be used to choose a limited number for genomic sequencing.

*This work was supported in part by the National Science Foundation under grant No. 1159973 to Mark Marten and by MARC U*STAR grant T34GM008663 to UMBC.*

Characterization of Novel Signaling Regulators in Cell Migration in Drosophila

Erica A. Dasi*, Afsoon Saadin*
Michelle Starz-Gaiano, Assistant Professor, Department of Biological Sciences

Cell migration is essential in the normal development and maintenance of multicellular organisms. However, the mechanisms that decide which cells are to become migratory and how the cells physically move are poorly understood. In this investigation, we will be observing the migration of cells known as border cells in *Drosophila melanogaster*. Specifically, we will look at the influence of the Janus Kinase and Signal Transducer and Activator of Transcription (JAK/STAT) signaling pathway and how it is regulated in these cells. The use of *D. melanogaster* in our research can be helpful because their tissues are transparent. This allows us to visualize the movement of the border cells *in vivo*. *D. melanogaster* are also useful in gene discovery, since many tools are available to alter gene function, and in explaining possible molecular controls of similar phenomena in other multicellular organisms because their genes are well-conserved. We are using a combination of genetic and imaging techniques to test if candidate JAK/STAT regulators alter border cell migration. This work can help in increasing our understanding not only of the process of cell migration during development generally, but also in mammalian processes such as wound healing and cancer metastasis.

This work is funded in part by an NSF CAREER Award to MSG.

Practitioner Preferences Regarding Psychosis Risk Screening

Beshaun J. Davis
Jason Schiffman, Associate Professor, Department of Psychology

Identifying individuals at high-risk before they develop psychosis may be possible with recent advances in the conceptualization of an "Attenuated Psychosis Syndrome" (APS) characterized by functional decline and sub-threshold positive symptoms such as unusual thought content, perceptual distortions, delusions, or suspiciousness that occur with distress and/or disability. Researchers estimate that 70 to 90 percent of people who develop psychosis will experience attenuated psychosis symptoms prior to diagnosable psychotic illness. Recently, three brief questionnaires (Prime Screen, Prodromal Questionnaire-Brief, and Youth Psychosis At-Risk Questionnaire-Brief) have been validated as viable tools for assessing APS, but little is known about practitioner preferences with regard to these three inventories. This study explored practitioner preference with regard to these questionnaires in an effort to help to establish a brief diagnostic standard for assessing psychosis risk in young patients. To that end, a web-based survey was employed. Participants were presented with background information and de-identified examples of each screener after which they were asked to indicate preference and to state for which age group they thought each was appropriate. We also evaluated how comfortable clinicians who specialize in adolescent care are with treating psychosis and using standardized instruments to assess psychotic symptoms.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Motivating Students by Varying Media and Providing Differentiated Instruction

Matthew Davis
Jonathan Singer, Associate Professor, Department of Education

Students often have difficulty finding meaning in Physics Two, a course taught to seniors at some urban high schools. The material covered goes into detail on topics that are often first introduced in junior-year college courses, exposing students to electricity, magnetism and modern physics. Data were collected and it was determined that roughly 65 percent of students pass their Unit Tests with a score of 75 percent or better. This research was conducted to assess whether the use of dynamic inquiry-based instruction would improve student outcomes. It also implemented different instructional media that allowed students to vary the method in which their content was delivered. Students were able to choose from videos, labs, and online simulations to supplement classroom instruction. At the conclusion of the quantum mechanics unit student data were collected again to determine the effectiveness of providing students a variety of means to acquire deeper understanding of abstract concepts.

Representation of Families in Caldecott Medal Books from the 1990s

Nicole J. De Leon
Kathy Scales Bryan, Senior Lecturer, Department of American Studies

Since 1938, the Caldecott Medal has been awarded annually to children's picture books with outstanding and distinguished illustrations. As children's books are an agent of socialization, it is important to have an understanding of how Caldecott Medal winning books represent different aspects of society such as the family unit. Considering historical and modern constructs of the family, this study analyzes how Caldecott Medal books from the 1990s depict and represent families. Qualitative methods of textual and visual analysis were used to examine familial structure, gender roles, and cultural representations of family. Utilizing the Association for Library Service's list of Caldecott Medal and Caldecott Honor books from each year within the 1990s, books were selected upon review of text and illustrations in order to ensure familial representations. The results of this analysis indicate the diverse range of families represented within Caldecott Medal books of the 1990s, and the importance of such diversity when discussing children's books as an agent of socialization.

Effects of Anticipatory Anxiety on Children's Pain Tolerance

Mariana de Matos Medeiros, Natasha Barlow, Nour Al Ghriwati, *Julia Zeroth, Jessica Hoehn*
Lynnda Dahlquist, Professor, Department of Psychology

Past research has yielded conflicting results regarding the effects of anticipatory anxiety on children's tolerance of acute pain. This study aimed to assess whether a relation exists between child-reported anticipatory anxiety, as measured on a visual analogue scale (VAS), and tolerance of laboratory-induced pain—i.e., exposure to ice cold water via a cold pressor test (CPT). The CPT is designed to induce pain that can be terminated at any time. Pain tolerance is defined by the amount of time in seconds that a participant endures the cold water before removing his/her hand. Forty-four children (22.7 percent females) aged 5-16 years (M = 8.90 years), were asked to rate their level of anxiety on the VAS prior to submerging their hand in approx. 7 $^{\circ}$C cold water. Pearson correlations and linear regressions revealed that anticipatory anxiety accounted for 43.6 percent of the variance in pain tolerance (p = .003, f^2 = .23). These findings highlight the importance of designing interventions to reduce anxiety in children prior to painful medical procedures.

Salt. Rose. Witness.

Alexis R. DeVance
Doug Hamby, Professor, Department of Dance

Salt. Rose. Witness. is a multi-disciplinary performance work that investigates the construct of Blackness as a disruption. An ensemble work, *Salt. Rose. Witness*, interweaves personal and historical narratives to examine individual negotiations of identity and body politics in a "post-racial" society. These narratives assumed a deeper meaning during the summer of 2013 as I followed the televised trial and media surrounding the case of Trayvon Martin versus George Zimmerman. *Salt.Rose.Witness.* premiered in November 2013 at the UMBC Senior Dance Concert. In March 2014 an excerpt of the dance was performed in the adjudicated concert at the American College Dance Festival at Ohio University and was selected for inclusion in the national dance showcase to be held at the Kennedy Center this summer in Washington, DC.

This work was funded by the Summer Research and Study award through the UMBC Dance Department.

Anchor-Free Underwater Node Localization Scheme

Stephen C. DiBenedetto, Bradley D. Potteiger
Mohamed Younis, Associate Professor, Department of Computer Science and Electrical Engineering; Lloyd Emopkae, Department of Computer Science and Electrical Engineering

Traditional underwater localization relies on line-of-sight (LOS) links to properly utilize ranging information. Unfortunately, the accuracy of the ranging techniques such as time of arrival (TOA), time difference of arrival (TDOA) and angle of arrival (AOA) can be significantly degraded by LOS instabilities in the underwater medium. This project proposes a novel underwater signal reflection-enabled acoustic-based localization scheme (UNREAL) that employs both LOS and surface-reflected non-line-of-sight (NLOS) ranging information to locate a node that has drifted away. The LOS and NLOS links are classified by incorporating a surface-based recovery mechanism, which recuperates the channel impulse response information through homomorphic deconvolution. A closed-form least square method is developed to use such classification to locate the node by either using the LOS AOA measurements or the NLOS AOA from the estimated water surface reflection point. Every node in the network can be used as a reference point to locate the lost node when LOS AOAs are available. Simulation results are carried out in a controlled tank with the measured water surface then being used in a simulated environment for validation. The results demonstrate the advantage of our approach over competing schemes in the presentation.

This work was funded, in part, by the National Science Foundation and funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Heaven's Light and Hellfire: A Study of the Post-Vocalic /r/ Among Disney's Heroes and Villains

Juliana R. Doddridge
Thomas T. Field, Professor, Department of Modern Languages, Linguistics and Intercultural Communication

The purpose of this study is to determine whether or not there is a trending difference between the dialect of the protagonist and the dialect of the antagonist in animated children's movies. Studies into dialect and accent stereotyping in the media may reveal insight into the source of language prejudice. This is a useful precursor to studying the effect the media and its treatment of linguistic variation have on a young audience. While there are many possible speech variations and a vast quantity of movies that could be analyzed, this study focuses on the pronunciation, or lack thereof, of the post-vocalic /r/ in Disney movies. In order to obtain the data, 10 of the most popular Disney movies, determined by cross-referencing a number of 'favorites' lists from the internet, were analyzed and data were gathered on two characters from each – the main hero and the main villain. While not every movie followed the trend, there is evidence to suggest that it is common for the protagonist to pronounce his or her /r/ as often as possible, and for the antagonist to eliminate it at least some of the time, if not at almost every opportunity.

Improving Sight Reading

Eugene Dorestal
Jonathan Singer, Associate Professor, Department of Education

Sight reading is the highly valued ability to perform a piece of music while seeing it for the first time. Musicians with this skill are highly sought after and it is expected at the professional level. In music education, there are festivals where school bands and orchestras are adjudicated and sight reading is one area in which the students are evaluated. This study involved eight sixth-grade students in a year-long percussion class and it seeks to increase their music reading fluency by at least 10 percent. It is associated with the Student Learning Outcome, which is also to improve sight-reading ability. Strategies include singing common patterns that frequently occur in music and ear training. Students are also taught the STAR (Sharps/Flats, Time Signature/Tempo, Accidentals, Rhythm, Signs) method. They are assessed to demonstrate the strength of their sight-reading ability at the beginning of the sight-reading unit. They were also surveyed before the unit, at the midpoint, and at the end to gauge their overall comfort with sight reading. They also provided input on which techniques they felt helped them improve the most and why.

Improving Students' Proficiency in Reading Skills, Strategies, and Comprehension through Guided Instruction

Christine B. Dougherty
Jonathan Singer, Associate Professor, Department of Education

High school students often have trouble reading a detailed passage and discerning the relevant information. Whether it is the length of the reading that distracts students or their lack of active-reading strategies and experience, students need guided instruction provided through scaffolding and multiple opportunities for practice. Based on the midterm diagnostic examination, students demonstrated weaknesses in establishing the connections between the text and the meaning of consequent questions. The test had two detailed passages with accompanying multiple-choice reading comprehension and analysis questions for selected student responses. To improve students' proficiency in reading comprehension and their ability in expressing the key ideas, the teacher integrated the use of excerpts from prior standardized test using a “think aloud protocol.” The teacher thoroughly demonstrated her thinking process (underlining, circling, writing in margins, talking to text, etc.) aloud to students as they worked through reading passages together. By the end of the eight-week instructional period, students were re-evaluated using the methods presented in the diagnostic exam.

Functional Characterization of Soybean *JAR1* Gene in *Arabidopsis thaliana*

Vy T. Duong, Patricia Hoang, Arianne Tremblay
Hua Lu, Associate Professor, Department of Biological Sciences

Soybean (*Glycine max*) is a valuable crop in the U.S. and worldwide. Increasing soybean resistance to pathogens is critical for global agriculture, as soybean diseases caused by pathogens lead to tremendous economic losses. This research identifies soybean genes homologous to known defense genes of the model plant Arabidopsis and characterizes these genes for their roles in conferring disease resistance in soybean. Potential soybean defense genes are identified via bioinformatics analysis by comparing their homology to known Arabidopsis defense genes. Candidate genes are amplified from soybean cDNA libraries, cloned into entry vector pENTR and then into binary vector pRAP15 using the Gateway cloning system, and used for transformation of Arabidopsis mutants defective for the homologous gene. The soybean *JAR1* gene (designated *GmJAR1*) is the subject of this study. Arabidopsis *JAR1* is involved in defense signaling mediated by jasmonic acid. Our results show that overexpression of the *GmJAR1* gene complements the *jar1-1* Arabidopsis mutant in disease resistance and responses to jasmonic acid treatment. We will further use the *GmJAR1* construct to transform soybean and test selected soybean transgenic plants for disease resistance. We expect the study to identify important soybean defense genes that could improve soybean disease resistance and increase crop yield.

This work was funded, in part, by United Soybean Board to H. L.

Learning in the French Language Classroom: The Effect of Weekly Listening Comprehension Exercises on Student Learning

Andrea Nicole Duval
Linda Oliva, Assistant Professor, Department of Education

One of the greatest challenges that students face when learning a foreign language is mastering listening comprehension. Constant exposure to the language greatly reinforces vocabulary and pronunciation and boosts student confidence with the subject matter. This project took place over a period of eight weeks and explored the effect of continuous language listening practice on the listening comprehension abilities of the students in a French I class. The participants, who attend high school in an urban setting, comprised a group of about 120 students primarily living within Baltimore City. The data for this project were taken in the form of a pre-assessment and post-assessment, extracted from the listening section of the 2012 French National Exam, a French language assessment exam administered to high school French students across the country. Instructional methods included daily exercises during which students repeatedly listened to an audio clip in French while being prompted to pick out certain words and phrases, until they had gained a better understanding of the clip as a whole. This project is still under analysis.

From Dracula to Ditches: Exploration of Roman Mithraism in Dacia

Erin Edwards
Esther Doyle Read, Lecturer, Department of Ancient Studies; Tim J. Phin, Lecturer, Department of Ancient Studies

I participated in the Apulum Mithraeum III Project in Alba Iulia, Romania, an archaeological excavation of a Roman temple dedicated to the god Mithras. Mithraism was known for its mysterious practices in the Roman Empire. Beginning in the first century AD and continuing into the fifth century AD, it was comprised entirely of men, typically in the military. It arrived in *Dacia* by the third century AD, when Rome conquered the region, establishing a new capital and settlements. My research for this project included a review of current scholarly literature on Mithraism and visiting the National Museum of Alba Iulia where many local Mithraic artifacts are kept. I noted types of artifacts in Mithraeums specific to Alba Iulia; further, I learned a great deal about Roman Mithraism through archaeological excavation. Records of Mithraic practices were rarely written down, thus the archaeological excavation was crucial to my research because most of what scholars know about Mithraism is derived from archaeological excavations. Through this excavation, we were able to confirm that this structure was a Mithraeum and I was able to apply my background research to understanding and interpreting our artifacts as well as planning for further excavation for summer 2014.

The Influence of Brain Eigen Oscillation Frequencies (Control Channels) to the Executive Functions of Brains

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The human brain can be modeled as a complex computer network in which large amounts of information (visual, auditory, and other sensory) are transmitted through data channels. However, much like a computer system, there exist control channels in the brain which synchronize and route data by intelligent algorithms. Recent studies have shown these control channels are related to brain alpha (7 - 13 Hz) and beta (14 - 40 Hz) wave oscillations. High-frequency beta waves synchronize multiple area data to focus attention and the low frequency alpha waves desynchronize competing data inputs so that attention can be focused on a single task at a time. In this investigation, by using a 16-channel electroencephalographic system and apply the technique of binaural beats, we first scan several subjects' brains and identified each brain's preferred frequencies (control channels). We then studied how these control channels influence each subject's brain executive functions. Brain executive functions were tested with computer gaming programs and the Stroop test under the influence of these measured control channel frequencies, which again generated by binaural beat. We found that high-beta waves increase executive function performance and speed up the completion of incongruent tests, while low-alpha waves have little effect on limiting executive function performance.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

The Interactions between the 5'UTR and CANC Protein in Late Phase Viral Assembly of the Murine Leukemia Virus

Alexander Emmanuelli*, Deborah Girma*
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The Moloney murine leukemia virus (MoMuLV) is a retrovirus that causes cancer in mice. The genomic RNA of MoMuLV exists as a dimer, which is necessary for the assembly of virions by the gag polyprotein. Gag consists of three domains: matrix, capsid (CA), and nucleocapsid (NC). NC binds to the viral RNA during assembly, and CA engages in gag-gag lattice interactions but has been shown to affect gag-RNA interactions. The 5'-untranslated region (5'UTR) contains a 350 nucleotide packaging signal (Psi) that directs dimerization and packaging of the viral genome. The RNA dimer forms from intermolecular kissing interactions between the SL-C and SL-D hairpin structures of the monomer. Within the Psi site is a 101 nucleotide core encapsidation signal, containing a sequence, UCUG, which has been shown to interact with NC to initiate viral assembly. Mutations have been made to the UCUG, SL-C, and SL-D regions to further study the role of these secondary structures in viral assembly. We aim to perform gel shift assays with the NC and CANC proteins, which will provide insight into protein-RNA interactions during the late phase of the viral life cycle.

This research is funded in part by NIH grant R01AI81604 and the Howard Hughes Medical Institute.

Characterizing the Foraging Behavior of Malaria Vectors during the Wet Season in Nchelenge, Zambia

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In collaboration with the International Centers for Malaria Research (ICEMR) project, mosquito collections were conducted during the wet season from March-April 2012 in Nchelenge, Zambia to characterize the foraging behavior of malaria vectors. This area experiences holoendemic malaria transmission despite control measures such as distributing long-lasting insecticide-treated nets (LLINs) and indoor residual spraying (IRS). Centers for Disease Control light trap (CDC LTs), aspiration, and pyrethrum spray catch (PSC) collections were performed. Of the 412 anopheline mosquitoes collected, *Anopheles funestus*, *An. gambiae*, and *An. leesoni* made up 83.2 percent, 8.77 percent, and 8.02 percent of the collection, respectively. The relative indoor abundances indicate that *An. funestus* is the primary malaria vector and *An. gambiae* is the secondary vector. Additionally, the human blood index (HBI) of blooded *An. funestus* was 1.00, suggesting that *An. funestus* is highly anthropophilic and exhibits endophagic and endophilic behaviors. Accordingly, it is expected that the sporozoite infection rate and therefore the entomological inoculation rate (EIR) will be higher in *An. funestus* than in *An. gambiae*. Characterizing and understanding the foraging behaviors of anopheline vectors in Nchelenge will contribute to the development of effective control measures against malaria in this region.

This work was funded through the JHMRI Summer Program, JHMRI Fellowship, Johns Hopkins Global Health Established Field Placement Award and "Malaria Transmission and the Impact of Control Efforts in Southern Africa" IRB No: 00003467 to SD, T32 Grant (2T32AI 007417) to SD & LCN, NIAID ICEMR (U19AI089680-03) and JHMRI support to DEN, and UMBC, Meyerhoff Scholars Program, and NIH NIDA support to SE.

Violations of Human Rights in Four Non-Western Countries: Afghanistan, Iran, Nigeria and Saudi Arabia

Narges Ershad
Ilsa Lottes, Professor, Department of Sociology and Anthropology

In recent decades, violations of the human rights of women have been highlighted by the United Nations and other international organizations. This presentation focuses on the human rights of women in four countries with a substantial Muslim population: Afghanistan, Iran, Nigeria and Saudi Arabia. The research questions were: What human rights of women are presently being violated in each country? What are the similarities and differences in these rights' violations among these countries? To what extent can these rights' violations be attributed to scholarly interpretation of Islam? Human rights described in basic UN documents (the International Covenant on Civil and Political Rights, International Covenant on Economic, Social and Cultural Rights and Convention on the Elimination of All Forms of Discrimination against Women, and platforms from the Cairo and Beijing conferences) are linked to specific practices and beliefs in each of the four countries. In the articles and books examined authors generally included information describing whether and how practices and beliefs are due to custom, tradition, or Islam. Findings show both similarities and differences. The differences in violation of rights indicate that either factors other than Islamic beliefs contribute to the violation of rights or that interpretations of Islam show great variability.

The Relationship between Academic and Social Self-Concepts and Reading and Mathematics Achievement

Alexander C. Evans
Shuyan Sun, Assistant Professor, Department of Psychology

Previous research has found positive relations between academic achievement and academic self-concept. However, the effect of social self-concept on academic achievement was less clear. This led to two questions: Are social and academic self-concepts related? Do they correlate with academic achievement? Using a sample of 8,868 eighth graders in the Early Childhood Longitudinal Study Kindergarten Cohort, we examined the relationship between academic and social self-concepts and academic achievement in reading and mathematics. Academic self-concept (i.e., academic interest in reading and mathematics and expectation of future educational attainment) and social self-concept (i.e., self-esteem and locus of control) were measured by questions drawn from the student self-description questionnaire, and reading and mathematics achievement were measured by standardized achievement tests. Results indicated that academic self-concept and social self-concept were significantly correlated with each other. After controlling for student gender and race/ethnicity, both academic self-concept and social self-concept predicted reading and mathematics achievement. Among the five dimensions of self-concept, expectation of future educational attainment was the strongest predictor of academic achievement. Furthering our understanding of the role of self-concepts in academics will have important implications for fostering academic achievement.

Effects of Avoidant Coping on Daily Mood among Blacks and Latinos with Recent Discrimination Experiences

Faith N. Evans*, Angela A. Mensah, Alfred N. Rotimi*
Danielle L. Beatty Moody, Assistant Professor, Department of Psychology; Elizabeth Brondolo, Professor, Department of Psychology, St. John's University

The objective of this study is to determine whether avoidant coping, (e.g., trying not to think about a specific event and/or being numb to it) moderates the relationship of recent discrimination exposure to daily negative mood. A sample of 551 Black and Latino participants living in New York City completed the Perceived Ethnic Discrimination Questionnaire-Community Version (PEDQ-CV) Past Week subscale, Impact of Events Scale (IES) Avoidance subscale, and diary entries assessing the following diary outcomes: negative mood, social exclusion, harassment, and negative social interactions. Greater past week discrimination predicted all four diary outcomes (all *p* values < .0003). The *past week discrimination X IES* term predicted all diary outcomes at *p* values < .04. Simple effects analyses revealed that among those reporting lower IES scores (indicating less avoidance), higher past week discrimination was more strongly associated with all diary outcomes (all *p* values < .0001) than among those reporting higher IES scores (*p* values ranging from .01 -.17). The findings indicate that individuals who avoid thinking about ethnic discrimination have lower levels of daily negative mood when they have experienced ethnic discrimination during the past week. Future research that further assesses the interplay among discrimination, coping, and mood is warranted.

This research was funded in part by NIH grant HL068590 (Brondolo).

Body Weight and Internalizing Problem Behaviors: Social Support, Self-Concept and Locus of Control as Protective Factors

Shafaq Fatima
Shuyan Sun, Assistant Professor, Department of Psychology

Previous research has found that obese individuals are more likely to have internalizing problem behaviors, lower reading scores, and lower self-esteem than their counterparts. The purpose of the current study was to identify protective factors that reduced the risk of internalizing problem behaviors in eighth graders using data from the Early Childhood Longitudinal Study- Kindergarten Cohort. Internalizing problem behaviors were measured by a student self-description survey. Obesity status was indicated by the body mass index (BMI). Potential protective factors included social support, self-concept, and locus of control. Results based on 8,766 eighth graders showed that obesity rates increased over time: one percent in kindergarten, two percent in first grade, five percent in third grade, 17 percent in fifth grade, and 25 percent in eighth grade. In the eighth grade, individuals with higher BMIs tended to have more internalizing problem behaviors. After controlling for socioeconomic status, maternal/paternal education, race, parenting style and BMI, the three protective factors explained 16 percent of the variation in internalizing problem behavior and BMI was no longer significant. In other words, social support, self-concept, and locus of control may protect overweight and obese children from developing internalizing problem behaviors. The findings have important implications for developing obesity prevention and intervention programs.

Quantum Computing

***Matthew Fertig**, David Andrew, Nick Greisser, Alex Guthrie*
Richard Wilson, Lecturer, Department of Philosophy

Quantum Computing is a highly advanced technology that relies on qubits that placed in super positions to create the same zeroes and ones that a normal computer would, but also with the ability to simultaneously exist. The creating of this type of supercomputer is so powerful that it currently does not have any sort of limits on what it can or cannot do. The type of power that a quantum computer holds sparks new scenarios to which the ethical principles deontology, consequentialism and contractarianism, can be applied. Some of these new situations will relate to identity theft, hacking, and loss of privacy. These three different scenarios all are tremendously different, yet they all have the ability to be devastating.

***Brush and Bone*: An Animated Look at the Beauty Beyond Skin Deep**

Deborah Firestone
Neal McDonald, Assistant Professor, Department of Visual Arts

This film explores the inner workings of the body through the medium of 3D animation. Typically, the only way the inside of the living body can be observed non-invasively is through the use of specialized medical equipment. While much can be learned from anatomical drawings and the like, a flat, still image does not tell the whole story. An animation, however, can show so much more. In *Brush and Bone*, pen lines become bone, and brushstrokes become muscle and tendon, revealing the human body as a literal work of art. As the model comes together, its components will move in unison, muscles contracting, tendons pulling, and bones rotating in their sockets. I am building this animation in Autodesk Maya, a 3D modeling and animation program. In creating *Brush and Bone,* I have been extensively examining anatomical references so I can build my models as accurately as possible. My ultimate goal is to help people look at their bodies in a whole new light, and to inspire appreciation for the beautiful complexity that we too often take for granted.

Boalian Theatre in Practice

Mabelle N. Fomundam
Alan Kreizenbeck, Professor, Department of Theatre

Boalian theatre, derived from the teachings of Augustus Boal, differs from common forms of theatre in which actors follow a set script or maintain creative liberty to improvise. Spectator engagement becomes vital: audience members are encouraged to become co-actors by contributing their ideas, voices, and bodies to further the storyline, react to the climax, alter the denouement, or even introduce entirely new discourse. In order to question the possibilities and limitations of Boalian methods, this research investigated whether Boal's techniques could be used by people in the United States and Switzerland to address issues of racial discrimination and suicidal behavior. Literature review, observational studies, and interviews targeting a focus group of Boalian practitioners were the methods used for data collection, testing whether Boal's methods could be applicable to such complex dilemmas. Boalian methods serve various functions: they provide an environment for everyday people to resolve conflicts; they become a creative space for discovering ways of dealing with difficulties; and they nurture a sense of community. They are therapeutic, as they expose injustices and strengthen communities. Boalian methods can be applied within the UMBC student community to deal with various hardships affecting students.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Increasing Student Achievement by Outlining Curriculum with Guiding Problems

Michael Fornaro
Jonathan Singer, Associate Professor, Department of Education

High school algebra students are frequently disengaged in class material partly due to the fact that they are not aware of the purpose of individual lessons in the context of the larger unit. Inserting structures in the classroom to help students make sense of individual topics and apply more meaning to them in a broader context could increase student engagement over the course of the unit, which would also lead to an increase in student achievement and understanding. The goal of the present study was to determine the effect on student achievement of aligning lesson material with guiding questions that assess students on the same skills that they will be assessed on at the end of the unit. New topics were introduced via guiding questions, which were focused on solving problems within a particular context. Such problems engaged students in class material and provided them with more opportunities to engage in higher-order, problem-oriented thinking and development of metacognitive strategies. The results of the study showed that students showed growth in understanding after the inclusion of guiding questions in the instruction, suggesting that aligning lesson material to guiding questions promotes student achievement.

A Compound-Complex Problem: Methods for Increasing Sentence Variation

Elizabeth A. Forney
Cheryl North, Assistant Professor, Department of Education

In English Language Arts, many students struggle with making their writing more interesting and engaging. Several factors, such as a sparse vocabulary and a lack of awareness of sentence variation, contribute to this significant problem within student writing. This research analyzes methods of increasing students' awareness of and attention to sentence structure and evaluates whether this results in more complex and engaging writing. Methods such as incorporating manipulatives into writing instruction, creating activities that encourage word play, and providing explicit instruction on syntactical elements will be implemented over the course of one month in a seventh grade English Language Arts classroom at a suburban middle school. Student growth will be measured using traditional grammar assessments, writing rubrics that target specific areas of growth, and analysis of the text-complexity of student writing using the Microsoft Word Readability Level.

Recording an Experience of Literacy: A Person-Centered Approach

Ian A. Forsythe
Bambi Chapin, Associate Professor, Department of Anthropology

Written-word literacy is valued in our society and has been institutionally established as a way to determine cognitive ability and social-economic worth. Although plenty of child literacy studies define development as a primary concern, adult literacy studies consider the need to create an integrative discourse the primary concern. By conducting fieldwork in an adult literacy center in Baltimore, I attempted to define how this particular "literacy environment" was constructed by a teacher and used by the students. Later I recorded interviews with one non-literate adult discussing her understandings and feelings concerning literacy. This study suggests that adult literacy efforts can better meet students' needs by developing an understanding of each non-literate adult's relationship with literacy through a dialogue concerning this topic in tandem with creating a bridging "literacy environment" that considers students' everyday life.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Improving Students' Critical Thinking When Using Charts and Graphs

Jeremy Fryer
Linda Oliva, Assistant Professor, Department of Education

It is extremely important for students to be able to critically analyze texts of multiple mediums in order to be successful in college, career, and life. This research project investigated the ability of ninth grade students to analyze charts and graphs in human geography. Students were given explicit instruction on analytical skills to interpret visual and graphic information while studying human geography. The baseline data were measured on selected questions given for the midterm exam. The performance data were taken from a summative assessment given at the end of the third quarter. Analyzing charts and graphs is a skill used in multiple disciplines.

Investigation into Dipole Interactions of Ultra-Cold Fermions in a Harmonic Trap

Robert J. Gagliardi, Ralph Kenneth L. Colmenar
Jason Kestner, Assistant Professor, Department of Physics

Ultra-cold atoms are atoms which are maintained at microkelvin temperatures. These temperatures allow for the quantum mechanical properties to become important to the system. The purpose of this research is to find the energy levels of dipole interacting ultra-cold atoms, using an effective interaction potential. Specifically, this research found the energy levels of a two spin up, one spin down fermionic system in a quasi-one-dimensional harmonic trap exhibiting Dipole-Dipole Interaction (DDI). We based our interaction potential on a short-range delta function interaction along with a long-range dipolar interaction. We constructed an algorithm to numerically solve for the energy states with interaction introduced as well as to correctly identify anti-symmetric wave functions with respect to the exchange of two particles with the same spin. Our numerical results converge on the well-known energies of three fermions in a harmonic trap in the absence of an interaction potential. We also discovered that energy levels cross one another; this warrants further investigation into what effect the energy crossings have on the system's states such as affecting the ground state's symmetry.

Innovations in Computer Game Development

Game Developers' Club: Paul Tschirgi, Michael Leung, Alex Lacey, Tad Cordle, Calvin Kumagai, Eliot Carney-Seim, Austin Pagano
Marc Olano, Associate Professor, Department of Computer Science and Electrical Engineering

Every year the Game Developer's Club breaks up into many smaller groups to create games pooling the collective talents of programmers and artists to bring an interactive experience to life. Each project is chosen after a weekend (48 hours) of rapid prototyping. After project selection, teams are organized to focus their energy on pushing the game concepts to completion targeting showcasing dates such as URCAD and Artscape over the summer. This year we have four projects: EMT Merci, a 3D phone game about a medic; Project Jack, a 2D brawler using physics-based animations and damage; Zombie Survival, a 2D top-down shooter about maneuvering around monsters; LeEK Engine, a student-made game engine with 3D physics, scripting, mesh rendering, and hierarchies. This year EMT Merci brings exciting new development in advanced 3D sound technology from Visisonics, a College Park startup. Project Jack uses characters completely based on body-part collision to interact and move while Zombie Survival explores the use of multiple game-engines and how they contribute to a successful project. LeEK Engine is built from the ground up, bringing study to the structure of framework and architecture for processing games in real-time.

Mirror Images: The U.S. and Its "Southern Brother"

Zoe E. Gensheimer
Mark A. Durant, Professor, Department of Visual Arts

This past summer I traveled to Mexico to study darkroom photography. I returned again in the fall for a semester to live with social movement actors and learn about their systems of community-based organizing. My time abroad triggered questions around the deep social and political divisions (as well as the over-funded and guarded border) between the United States and Mexico. Despite our geographical location as next-door neighbors, our populations remain isolated and ignorant of the challenges facing one another. This separation is disturbing because our struggles for equality and justice are, in the end, one and the same. Photography is said to be the universal language, and is therefore an effective medium with which to build communication. While in Mexico, I compiled a body of images portraying the people and places I visited. Now back in the U.S., I plan to share this work which reveals the ways in which the struggles of the Mexican people are mirrors of our own struggles here in the United States. I hope that this series will open dialogue with family, friends, and the wider community of UMBC and Baltimore City around nationalism, immigration, racism, and capitalism.

This work was funded, in part, through an Undergraduate Research Award from the UMBC Office of Undergraduate Education and through the Linehan Summer Research and Study Award.

Tumors May Prevent Anti-Tumor Immunity by Altering Plasma Membrane Molecules Essential for T-Cell Activation

***Sanchari Ghosh**, Pratima Sinha*
Suzanne Ostrand-Rosenberg, Professor, Department of Biological Sciences

T cells, white blood cells of the immune system, are capable of rejecting tumors when activated. This process requires formation of the immunological synapse, the interface between an antigen-presenting cell (APC) and T cell. Several cell surface proteins are integral to this process, including cell surface molecules Major Histocompatibility Complex (MHC I and II) and Intercellular Adhesion Molecule-1 (ICAM-1) on APCs, and T-cell receptor (TCR), and lymphocyte function-associated antigen-1 (LFA1) on T cells. Myeloid-Derived Suppressor Cells (MDSC) accumulate in cancer patients and dampen patients' ability to generate an anti-tumor T-cell response. Previous results showed significant downregulation of ICAM-1 and MHCII on macrophages in the presence of tumor, suggesting that function of the immunological synapse is reduced in individuals with tumor. To determine the mechanism of downregulation we are investigating the enzyme A Disintegrin and Metalloproteinase domain 17 (ADAM17), which cleaves ICAM-1, and the cell surface molecule Membrane-associated RING-CH1 (MARCH1), which stimulates the ubiquitination and degradation of MHCII. Our recent results suggest that the MDSC-induced effects on the immunological synapse may be due to activation of ADAM17 on MDSC. Understanding these mechanisms will help determine the role of MDSC in defective synapse formation, and could lead to therapeutic strategies for the treatment of cancer.

*This investigation was funded through a URA from UMBC OUE, NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC, and NIH RO1CA84232 and RO1CA115880.*

Resource-sharing and Psychological Sense of Community among First-Generation Latin American Immigrants

Kaitlyn Golden
Anne Brodsky, Professor, Department of Psychology

Much discourse surrounds the political, social, and economic effects of immigration to the United States. The U.S. Census Bureau reports that fifty-three percent of immigrants are of Latin American origin (2012). Using qualitative, semi-structured interviews conducted with individuals in the Baltimore-D.C. metropolitan area, this research focuses on two support networks used by first-generation Latin Americans: their families and their fellow members of the Latino/a community. McMillan and Chavis' (1986) theory of psychological sense of community (PSOC), comprised of membership and boundaries, shared emotional connection, integration and fulfillment of needs, and mutual influence, provides the coding and analysis framework for exploring familial and community-based resources. Important findings from this research demonstrate that in the face of acculturation challenges such as language barriers and discrimination, participants' networks offer access to education and job opportunities and emotional support. PSOC fosters connections among Latin community members needed for sharing these resources; reciprocally, resource-sharing strengthens PSOC among the Latino/a community. Family relationships strongly impact the acculturation process of first-generation immigrants. Members of the Latino community often serve as emotional resources for individuals who feel the lack of familial presence in the US.

This work was funded through a URA from UMBC OUE.

The Zebrafish Embryonic Brain Is Tolerant to Oxygen Deprivation

Andrew K. Goodwin, *Katherine Cerra*
Rachel Brewster, Associate Professor, Department of Biological Sciences

Anoxia and return to normoxia, the complete absence of oxygen and subsequent re-oxygenation, are detrimental to humans, causing improper embryonic development, stroke, and other hypoxia-related injuries. In anoxia, oxygen-requiring cellular functions are impaired. Upon return to oxygen, metabolic homeostasis is damaged as oxygen is suddenly reintroduced. Both conditions harm cellular structures, which may cause cell death. Previous studies have shown that zebrafish embryos can tolerate anoxia for up to 24 hours in a developmentally arrested state, resuming normal development upon re-oxygenation. Based on this observation, it has been postulated that zebrafish have an adaptive mechanism in place to survive anoxia. If zebrafish are truly anoxia-tolerant, little to no cell death should result. To investigate this, apoptosis was examined in the hindbrain of control (untreated), anoxia, and anoxia/re-oxygenated embryos. Preliminary data indicate that anoxia alone causes minimal cell death, albeit more than seen in anoxia/re-oxygenated embryos, which are similar to controls. Further experiments on the limits of tolerance are ongoing by extending the length of anoxic treatment. In the long term, the goal of these studies is to establish zebrafish as a model for anoxia-tolerance, whose amenability to genetics may enable the discovery of potential targets for treatment of hypoxia-related injuries.

This work was funded, in part, by NIH 5R01GM085290.

Associations between Early Parental Involvement, Home Language, and Academic Achievement in Later School Years

Deepika P. Gorre
Shuyan Sun, Assistant Professor, Department of Psychology

The present study examines whether parental involvement in early school years and language spoken at home are significant predictors of children's academic achievement in later school years. Data from the Early Childhood Longitudinal Study Kindergarten Cohort were used in this study. Parental involvement in the spring of kindergarten was measured by questions selected from parent interviews. Children's academic achievement in reading and mathematics were measured by standardized achievement tests in kindergarten and third grade. Results show that after controlling for children's race/ethnicity, gender, household income, and mothers' education, parental involvement and home language predict children's reading and mathematics test scores. The findings have important implications for facilitating children's academic achievement through home activities.

Precision in Measurement

Jeremy J. Gosnell
Christopher Rakes, Assistant Professor, Department of Education

Many of the Career and Technology Education programs (e.g., allied health, culinary arts, and diesel truck and power systems) at an urban magnet tech school require students to be able to perform precise measurements in real-world situations. The object and goal of my teaching intervention were to increase students' ability to find the area of given triangles, quadrilaterals, circles, regular, and irregular polygons to the nearest tenth of a unit with given formulas. Students were given a five question pre-test prior to instruction with a unit centered on extending the students' understanding of area measurements. Students were tested on their ability to perform the skill prior to instruction and their ability to perform the same skill after instruction. The objective focused on students who scored less than a five on the pre-assessment. The target for the project was that 85 percent of these students scored at least one point higher on the post-test.

Oxidized Cellulose Route to Production of Silver Nanoparticles

Hamsa N. Gowda
Yordan Kostov, Research Professor, Department of Chemical, Biochemical, and Environmental Engineering; Marie-Christine Daniel, Associate Professor, Department of Chemistry and Biochemistry

Silver nanoparticles have been used for a diverse array of optical, biological, and electrical applications, owing their versatility to their unique physical and chemical characteristics. The chemical approach to the production of nanoparticles utilizes the chemical reduction of silver ions to metallic silver. Traditionally, both a reducing agent and an additional stabilizing agent are required for preparation of the nanoparticles in addition to prolonged high temperature treatment of the reaction mixture. However, we have recently developed a method for silver nanoparticle preparation in which a single compound, oxidized cellulose, an inexpensive, biocompatible, and readily available abundant material, acts both as a reducing and a stabilizing agent. Furthermore, the reactivity is so high that the synthesis proceeds rapidly at room temperature and even at 4^{o} C, which opens the door to novel applications. Characterization and optical properties was assessed through dynamic light scattering (DLS), transmission electron microscopy (TEM), Fourier transform infrared spectroscopy (FTIR), spectrophotometry and fluorometry. The stability of these nanoparticles with time was assessed by following the evolution of their optical properties and overall size distribution. Therefore, this new "green" method offers an alternative for inexpensive mass production of these particles.

This research was supported in part by a grant to UMBC from the Howard Hughes Medical Institute through the Precollege and Undergraduate Science Education Program.

The "(Be)coming of the Greeks:" Reviewing Archaeological Evidence for Greek Arrival ca. 2200 B.C.E.

Molly Greenhouse
Esther Doyle Read, Lecturer, Department of Ancient Studies

In prehistory, Greece was inhabited by a people who spoke a language unrelated to Greek and whose culture appears significantly different from that of the later Mycenaeans. In an effort to explain seemingly abrupt cultural and linguistic developments, a hypothesis popularly termed the "coming of the Greeks" suggests that an invasion or immigration must have brought proto-Greek language and culture to the Aegean during the Bronze Age. By analyzing existing arguments concerning the hypothesis, as well as primary evidence, this research attempts to create an alternative explanation for the development of Late Bronze Age Greek culture by reconciling archaeological, historiographical, and linguistic evidence. It concludes that climatic events had a dramatic impact on the Mediterranean region around 2200 B.C.E., leading to a complicated period of depopulation and immigration that redistributed cultural groups across the landscape. There is no "coming of the Greeks" as a single discrete event, but this migration and cultural mixing, as well as technical innovations such as the pottery wheel, facilitated the development of a distinct culture in Greece after 2200 B.C.E with a much stronger, more continuous material record; one that shows continuity with the Mycenaeans of the Late Bronze Age.

The Effect of Progress Checkpoints on Student Performance

Alexandra P. Grieves
Linda Oliva, Assistant Professor, Department of Education

Students often find themselves upset when they receive unexpected grades the same day progress reports are distributed to parents. In order for students to take home the grades they anticipate, this research examined the effectiveness of frequent progress reports, or "checkpoints," on student performance across Spanish I and Spanish II in a Baltimore City high school. The opportunity for students to self-monitor is a step towards completing work, setting goals, and even improving attendance. Every two weeks, 10 minutes of class time was taken for students to review their individual checkpoints, which included current grades, missing tasks, days absent, and late arrivals. Students were also given written feedback that commented on what they could do to improve and what they were doing really well. Baseline data from first semester, in which only two progress reports were distributed, was compared to the frequent checkpoint data from second semester. A group of 50 students was tracked, and changes in grades between checkpoints were presented in relation to the grades between progress reports from the first semester. Analyses are ongoing through the second semester; however, preliminary results are promising and will be shared during the presentation.

Rhinelander v. Rhinelander: Challenging Racial Hierarchies in the 1920s

Raquel Grinage
Michelle Scott, Associate Professor, Department of History

During the 1920s, Americans' definitions of "whiteness" and "blackness" were associated with more than just a skin color, but a set of characteristics and mannerisms that determined the social and citizenship status of a person. Even with a typical white phenotype, if there was a drop of black blood, a person was still considered black and those who tried to challenge that "one drop rule" could be punished, including whites themselves. Using the 1924 New York state case of Rhinelander v. Rhinelander, in which white Leonard Rhinelander sued his biracial wife, Alice Rhinelander, for an annulment on the claim of fraud based on the notion that he supposedly did not know Alice was biracial, I argue that even the richest and most educated of those deemed white would be punished for violating the one drop rule. By potentially having legitimate offspring with a black woman, Leonard Rhinelander threatened the racial hierarchy of America and was punished for it. Looking at the legislation dealing with miscegenation and the Rhinelander case, I examine how the fears of "passing" and race mixing challenged and changed concepts of whiteness, racial privilege and social status in the 1920s.

This work was funded, in part, by a travel award from the UMBC Office of Undergraduate Education.

DNA Barcoding for Pharmaceutical Discovery in Fungal Endophytes

Brenda Gutierrez
George D. Weiblen, Associate Professor, Department of Plant Biology, University of Minnesota

The tremendous and relatively unexplored biodiversity in tropical rainforests is a potential source of new medicines. A 50-hectare plot in Papua New Guinea (PNG) was established to investigate forest dynamics and to enable pharmaceutical discovery among 500 different tree species. We inferred a Bayesian phylogeny of 350 species using a DNA barcode (rbcL). High biodiversity is promising for pharmaceutical prospecting but finding natural products with antimicrobial properties can be difficult. A fungal endophyte (E279) producing novel antibiotics with anti-tuberculosis activity was cultured from a leaf of *Psychotria leptothyrsa* located in the PNG forest plot. In order to facilitate the discovery of endophytes similar to E279, we used the phylogeny of PNG trees to test the hypothesis that closely related trees host specific endophytes. However, E279 appears to be a generalist with similar endophytes found in different plant species throughout the angiosperm phylogeny. Although we found that plant phylogeny does not predict endophyte distribution in this case, the phylogeny could be useful for finding host-specific endophytes with antimicrobial activity.

This work was funded, in part, by the NSF-REU grant DBI-1062910.

Does Coping Style Account for Differences in Posttraumatic Stress Symptoms among Partner-Violent Men?

Hannah H. Gutjahr, *Galina A. Portnoy*
Christopher M. Murphy, Professor and Chair, Department of Psychology

Research on men being treated for the perpetration of Intimate Partner Violence (IPV) reveals high rates of past trauma exposure with significant variation in the development of posttraumatic-stress disorder (PTSD) and posttraumatic-stress symptoms. The present research study examines differences between partner-violent men's use of twelve coping styles in order to better understand factors that influence the development of abusive partner behavior and posttraumatic stress symptoms following trauma exposure. Data were collected from a sample of partner-violent men who presented for treatment at the New Behaviors Program within the Domestic Violence Center (DVC) of Howard County. Approximately 185 participants were included in the current study. It is hypothesized that partner-violent men with trauma histories and posttraumatic symptoms were more likely to engage in negative coping styles (i.e., self-distraction, denial, venting, substance use, and behavioral disengagement) rather than positive coping styles (i.e., active coping, planning, positive reframing, humor, religion, and partner/friend-focused support). Analyses of variance will be conducted to determine whether significant differences in coping styles exist between three groups of partner-violent men. Better understanding of differences among these groups may help to create more effective and comprehensive prevention and treatment programs for partner-violent men.

Correlation of Initial Steps for Balance Recovery in a Simulated Fall

Jichele M. Harris
Mark W. Rogers, Professor, Department of Physical Therapy and Rehabilitation Science, University of Maryland School of Medicine

Our lab focuses on studying the neuromotor and biomechanical causes of falls in the elderly population by simulating a stumble using a robotic balance perturbation system. This information can then be used to assist in the prevention of falls that result in injuries. This projects aims to analyze how initial stepping reactions to a simulated fall are correlated to overall balance. The project also researched if there was a significant correlation between initial recovery step type and gait velocity. MATLAB was used to analyze previously collected falls data. Future research on this topic could include an analysis of the center of mass (COM) and center of pressure (COP) for those identified as fallers and non-fallers. Conclusive data will be used to underpin the development of interventions for preventative balance training, which will help those who are prone to falls.

*This work was funded, in part, by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC and NIH CA167268-01 and National Institute on Aging /NIH grant R01AG029510 to MWR.*

Baltimore Voices: Creating a Comprehensive Sense of Place and Identity

Samantha D. Hawkins
Sarah Chard, Associate Professor, Department of Sociology and Anthropology

This photo-ethnographic research investigates what it means to be a Baltimorean and explores the complex interaction between place and identity. Identity is, largely, an individualized construction of self-understanding influenced by life experience, culture, and environment. Using Baltimore City as a case study, this research explores how individuals develop a sense of place and identity in the modern urban context. Through in-depth oral history, interviewing, and visual research methods, I have compiled a collection of approximately 20 diverse narratives about what it means to be a Baltimorean. Not only do these qualitative accounts help preserve aspects of Baltimore's lived history, they also provide insight into the development of personal, as well as, cultural identity. These interviews indicate a common view of Baltimore as a "blue collar," hard-working, small town, whose residents share a mutual respect for one another. Additionally, the changing industrial scene in Baltimore has resulted in a collective mourning of a loss of Baltimore history and identity.

This work was funded, in part, by an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Image Processing for Steel Quality Control

Xiaofei He, Patrick Husson, *Qi Tan, Jonathan Becker*
E.F. Charles LaBerge, Professor of the Practice, Department of Computer Science and Electrical Engineering

Over one billion tons of steel are produced every year as raw material for everything from automobiles to food packaging. With such large demand, steel distributors, such as Titan Steel in Baltimore, must find new ways to monitor the quality of the steel they send to customers in order to maximize efficiency. This research seeks to prove that image processing on a digital signal controller is a viable solution to this problem. By successfully implementing an HSV colorspace thresholding algorithm in MATLAB, the analysis concludes that thresholding is more effective than visual inspection in detecting and quantifying rust and chemical stain defects. By implementing the algorithm on a digital signal controller and integrating it with a digital camera, the research shows that inspection can occur at speeds in excess of 300 feet per minute without a significant decrease in accuracy. Image processing in tandem with current visual inspection techniques will allow Titan Steel and other distributors to increase the efficiency of quality control.

This work was funded by UMBC's Department of Computer Science and Electrical Engineering.

Cognitive Effects of Proton Irradiation at Differing Energies and Exposures

Nicholas Heroux*, Kirsty Carrihill-Knoll, Zachary Beck, Chelsea Baxter, Bernard Rabin*
Bernard Rabin, Professor, Department of Psychology

During exploratory missions outside the magnetic field of Earth, astronauts will be exposed to various forms of radiation including solar particle events which are composed of protons and particles of high energy and charge (HZE). Previous research suggests that the relative biological effectiveness (RBE) of different components of space radiation may vary as a function of particle energy and exposure conditions. Behavioral studies were conducted to characterize the role of proton energy and exposure conditions (head only or whole body irradiation) on the disruption of cognitive performance. In several replications, male Sprague-Dawley rats were exposed to either 1000 MeV/n or 150 MeV/n protons and different exposure conditions at the NASA Space Radiation Laboratory (NSRL) at Brookhaven National Laboratory (BNL). After irradiation the rats were shipped to UMBC and tested using novel object recognition, spatial memory, elevated plus maze, and the radial arm maze behavioral tasks. Cognitive performance was variably disrupted across all tasks. Results were not consistent across replications; there were no consistent differences in performance as a function of proton particle energy or treatment. As such, the possible risk of a performance deficit resulting from exposure to protons cannot be reliably estimated without further exploration.

This work was funded through NASA Grants NNJ06HD93G, NNX08AM66G, NNX13AB73G, and an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Arts Advocacy: Promoting Policy Change

Mary B. Hester
Carolyn Forestiere, Associate Professor, Department of Political Science

Research suggests that there is a correlation between participation in the arts by children and academic performance, development of confidence, creativity in problem solving, and motivation, as well as many other variables. However, the arts, specifically dance, are often the first programs to be eliminated when cuts need to be made. This research aims to build upon existing literature on the benefits of dance lessons for children and attempts to communicate the results in a policy-oriented manner. In summer 2013, I volunteered to teach dance lessons to a group of 22 children enrolled in the Easton YMCA and Elementary School Summer Learning Program. I observed positive changes in the students' behavior, motivation, and happiness among other improvements, and found this experience to be in line with existing research. This evidence was then integrated with examples in the literature and research on current arts initiatives, policies, and programs provide a political context for this study. The results of this study bring to light the importance of an education in the arts and the potential benefits of dance lessons.

This work was funded by an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

The Kincaid Legacy

Emily Hinz
Lisa Cella, Professor, Department of Music

This research investigated the role of William Kincaid in the establishment of the American flute school in the twentieth century. This research also examined the impact of Kincaid upon today's finest flute instructors through interviews and text analysis of his works. Through my studies, I have found Kincaid's viewpoints to be distinctly different from the prevalent French school of his day. Most notably, Kincaid's ideas regarding tone production have contrasted with the French school and have infiltrated the styles of many American flutists. Advocating the abandonment of French embouchure, Kincaid argued that one's tone must be molded to the mood and style of the piece. I have discovered, however, that as his ideas were disseminated first through his most prominent students, Joseph Mariano and Julius Baker, and then to the next generations, his core ideas have become progressively fragmented. My research has shown, for example, that while many American flutists hold Kincaid's view of tone production, the French embouchure is still widely accepted in the United States. Thus, after an initial immersion in Kincaid's American style, American flutists have continued to evolve, incorporating aspects of both the French school and the American school, resulting in a rich and diverse style of flute playing.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

BreakingGround with Connect

Marcus Hockaday, Kathleen Greaney, Jamie Jaegers, Arielle Ngameni Mouani
Galina Madjaroff, Clinical Assistant Professor, Department of Management of Aging Services

This research focuses on the lack of intergenerational relationships between UMBC students and the elderly. To build upon these relationships, UMBC students were paired with senior citizens at the Charlestown Retirement Community, located in the Baltimore area. These students lead basic technology courses for seniors interested in acquiring new technology skills. The elderly – a vulnerable target population with legitimate need for assistance – received life-changing guidance from these students. The computer and other forms of advanced technology are intuitive, even second nature to most UMBC students, but older adults found them to be intimidating. In order to evaluate the efficacy of the intergenerational relationship building, the students will conduct a short qualitative study by interviewing the seniors about their experience. Preliminary interviews suggest that seniors are eager to learn new technological skills and are excited to work with UMBC students to achieve formal use of technology, an intergenerational relationship, and learn more about the facilities use of connecting residents through the web.

This work was funded, in part, by BreakingGround.

Exploration of ESL Classroom Pedagogies

Hannah E. Hollamon
Kathy Bryan, Senior Lecturer, Department of American Studies

Bilingual education, or English as a Second Language programs, is an important educational practice in the United States due to the vast assortment of languages spoken in this country. This research focuses on methods and programs for teaching English to non-native speakers in mainstream classrooms in which the language of instruction is English. Expanding on an earlier project in which ESL professors from a local community college were interviewed, I conducted a textual analysis of professional discourse in eight ESL trade publications. This analysis highlights the framework of ESL programs and how certain methods of instruction can work for or against student learning. In addition, various undercurrents that affect ESL learners that may otherwise be invisible to an uninformed observer are recognized. This research emphasizes the complexities of bilingual education in the United States, notes the diversity of learners, and reveals how many programs are not standardized. The respect and value of bilingual individuals are also accentuated through the research completed.

Adaptive User Interfaces

Catherine Hornback, Abdullah Ali
Amy Hurst, Assistant Professor, Department of Information Systems

We are working to build adaptive user interfaces to help individuals with pointing problems access a computer. This work extends models previously built by Dr. Amy Hurst for detecting users' ability to use a computer mouse. We built a two-part program written in Java. The first part is a graphical user interface window that takes in user's clicks within an area. It calculates the click duration and then passes it to the second part of our program, which uses machine learning and models to determine, based on the click duration, whether the user is having difficulty clicking. The result is displayed in realtime on the screen. The goal of our work is to take user input such as mouse movement, click duration, or slip distance and use the machine learning models to detect if the user is having difficulties interacting with the system. If so, the program would either give feedback or turn on accessibility features. The follow up action will be selected after conducting interviews and evaluations in the future with users with physical disabilities and care givers.

This work is funded through a grant from the Department of Education, NIDRR grant number H133A130057.

Evaluating the Efficacy of Low-Tech Processes in Removing Bacterial Contaminants from Drinking Water Supplies

Dalton Hughes, Chris Mullen, Madison Bondoc and Hollie Adejumo
Lee Blaney, Assistant Professor, Department of Chemical, Biochemical, and Environmental Engineering

Approximately 760 million people do not have access to safe drinking water; a disproportionate number of those people are located in Sub-Sahara Africa. In January 2013, the UMBC Chapter of Engineers without Borders (EWB-UMBC) travelled to a 500-person village in Isongo, Kenya to assess drinking water quality. Results from the water quality tests revealed high levels of fecal coliforms and *Escherichia coli*, both of which are indicators of pathogenic bacteria; furthermore, interviews indicated that children suffer from dysentery and other waterborne diseases. The use of readily available, low-tech processes may prove advantageous in decreasing the high bacterial counts in the Isongo water supplies. For this reason, we investigated the ability of UV solar disinfection (SODIS) and PÜR coagulation-disinfection (ferric sulfate/calcium hypochlorite) to treat water from the UMBC Library Pond. Experiments were conducted in triplicate and chemical/bacterial water quality data were measured to determine the effectiveness of each treatment process. Videos were recorded to demonstrate how each process works; these videos will be included in our presentation. Ongoing research is focused on building and testing a slow sand filtration system. The results of these studies will be incorporated into future EWB-UMBC projects in the Isongo area.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Environmental Effects on Cellular Differentiation Regulation

Michael Ishak*, Jacob Kott*
Jose Ortega, Department of Biological Sciences; Stephen Miller, Associate Professor, Department of Biological Sciences

The objective of this study is to investigate the effects of varying growth environments on cellular differentiation in the green alga *Volvox carteri* and how such effects are executed at the molecular level. *V. carteri* possesses only two cell types, reproductive cells (gonidia) and somatic cells. In the wild-type strain EVE, somatic cells remain differentiated because they express the *regA* gene, which suppresses growth and dedifferentiation. In a mutant strain pReg, some somatic cells dedifferentiate into gonidia, and the phenotype becomes stronger as cultures become more crowded. This observation led to the hypothesis that somatic cell differentiation can be influenced by external macronutrient (sulfate, phosphate, or nitrogen) concentrations, especially when *regA* or other cell-differentiation genes are mutated. To test this idea, EVE and pReg were cultured in media limited for sulfate, phosphate, or nitrogen, and it was found that deprivation for each of these macronutrients led to increased rates of dedifferentiation in mutant pReg individuals but not in EVE. To determine whether a defect in the *regA* gene might be responsible for the pReg phenotype, we are cloning and sequencing PCR products made from the pReg *regA* gene, with results to be reported.

A Mathematical Model of Melanopsin Phototransduction and Light Adaptation

Abigail Jackson, Jessica Ortega
Phyllis Robinson, Professor, Department of Biological Sciences; Kathleen Hoffman, Professor, Department of Mathematics and Statistics

Melanopsin is a recently discovered photopigment found in intrinsically photosensitive retinal ganglion cells (ipRGCs). It is involved in non-image forming vision, including circadian photoentrainment and the pupillary light reflex. It is also involved in light-related disorders, such as seasonal affective disorder. When light activates the photopigment, a phototransduction cascade commences, which produces an electrical signal that is sent to the brain. Light adaptation is the ability of the visual system to adjust its performance according to the ambient level of illumination. To describe melanopsin's phototransduction and adaptation pathways, we developed a mathematical model by using the law of mass action to convert chemical equations describing the pathway to a series of differential equations that was solved with MATLAB. Model parameters of the activation and deactivation were determined by fitting the model results to experimental calcium imaging data collected from transfected human embryonic kidney cells expressing the melanopsin gene as well as electrophysiological data collected from ipRGCs. Mathematical simulations of the single flash response and the light-adapted response produce results consistent with those seen in the experimental data.

This work was funded by NSF for Undergraduate Biology and Mathematics Research Training, NSF IOSO721608 to P.R.R., NEI R01Y019053 to P.R.R.

Understanding the Molecular Mechanisms of Synergistic Inhibition of the Hepatitis C Virus (HCV) Polymerase

Kendra V. Johnson*, Jodian Brown*
Ian F. Thorpe, Assistant Professor, Department of Chemistry and Biochemistry

An estimated 200 million people worldwide have been infected by the Hepatitis C virus (HCV). Chronic HCV infection can lead to cirrhosis or cancer of the liver. The RNA polymerase (gene product NS5B) of the HCV is a vital component of viral replication. Its critical role in replication coupled to lack of evidence for a mammalian homolog, make this enzyme a promising target for small molecule therapeutics. Presently, there is no vaccine for HCV and limited approved treatments for the infection. A challenge in treating HCV is the resistance of the polymerase to current inhibitors. An approach to combating this challenge is the use of combination therapy. Specifically, we are interested in targeting the polymerase with two allosteric inhibitors. In this study, we focus on parameterization of thumb and palm binding allosteric inhibitors. Empirical bond energies, distances and dipoles of the individual ligands and the ligand-enzyme complexes are calculated using the Gaussian09 software, while the classical mechanical values are reproduced using CHARMM. The goal for parameterization is to model the potential energy of these ligands for future molecular dynamics simulations, allowing us to garner information about protein-ligand interactions in the context of synergistic inhibition. Understanding the molecular mechanisms of synergistic inhibition may allow for further optimization of small molecule inhibitors.

Examining a Metal-Binding Motif in Novel Inhibitors of the Hepatitis C Virus NS3 Helicase

Jesse A. Johnson
Paul Smith, Associate Professor, Department of Chemistry and Biochemistry

A number of compounds have been identified that inhibit individual protein products of the hepatitis C viral (HCV) genome. Non-structural protein 3 (NS3) is a particularly popular target for inhibition based on its multifunctional role in viral replication. Our lab has synthesized several compounds that inhibit NS3 helicase function at micromolar concentrations. Further modification of these compounds is required to produce structural analogs that are able to achieve more potent HCV inhibition. The lead inhibitors contain a convergent group of three Lewis-basic sites, which includes the hydroxyl group from a phenol that makes up part of the structure. This motif creates a metal-binding pocket that may be essential for viral inhibition; the importance of metal-binding will be tested by synthesizing a compound that lacks the hydroxyl group. Two synthetic routes are being investigated, one of which utilizes novel palladium-catalyzed coupling chemistry and the other employs a key Grignard reaction. The extent to which the potency of this new compound is affected will provide insight as to the structural significance of the hydroxyl group and metal binding, and can lend guidance to future syntheses of potential drug candidates.

Investigating a Requirement for the *shep* Gene in Cell Migration

Michaela B. Jones
Michelle Starz-Gaiano, Assistant Professor, Department of Biological Sciences

One of the many focuses of developmental biology relates to cell migration because it is important for animal development and disease. Specifically, one model for understanding cell movements is the study of border cells in *Drosophila melanogaster*. The border cell migration process is an important system to study because with the advances in genetics and the ability to observe the migration in real time, it offers a unique perspective beyond tissue culture. This reveals how cells migrate and the processes that are involved while they are in their natural environment. We have identified a novel gene, called alan shepard *(shep*), that is expressed in border cells. We are currently investigating whether the *shep* gene is required in cell migration. To do so, we will knock down (KD) the *shep* gene specifically in motile cells and compare the KD phenotype to that in wildtype. *Shep* encodes a predicted RNA binding protein, so future work will be directed toward learning how this may function to promote cell motility. Upon completion of this project, there will be a better understanding of border cell migration, which will aid in the overall understanding of cellular movements and developmental processes.

This work is funded through an NSF CAREER Award to MSG.

An Updated Perspective on Fishman's Eight Stages of Language Loss

Dimitri Jordan, Jean Hopewell
Robert L. Rubinstein, Professor, Department of Sociology and Anthropology

In 1991 Joshua Fishman, a sociolinguist focused on endangered languages, developed a scale of language loss comprised of eight stages. Each of the stages outlined the waning dominance of the language in society, as well as several suggested interventions to counteract the loss of the language. However, due to the strides in technology over the past two decades, a reexamination of the scale to better suit the needs of indigenous populations at this time is in order. After exploring the historiography of language retention and reacquisition models, as well as speaking to professionals in the field as well as native speakers from the National Museum of the American Indian, we have developed a new scale in line with Fishman's that contains new measures better suited to incorporating new technologies. It is our hope that this scale can be used to create plans of action to revitalize dying Native American languages.

This work was funded, in part, by the Department of Anthropology at UMBC.

Song Output and Patterning in Grasshopper Sparrows (*Ammodramus savannarum*)

Ki Jung, *Julia Gao, Neema Philippe*
Bernard Lohr, Assistant Professor, Department of Biological Sciences

Sexual selection may have a strong impact on several song-related features in oscine passerines including: repertoire size, dialect, performance characteristics and song output. We operated twenty-five autonomous recording units (ARUs) from 04:00 – 10:00 EDT (6 hours/day), the major morning singing peak in this species, during May - August of 2011 and 2012. An additional nine units were operated for 18 hours/day (04:00 - 22:00 EDT) to record all songs sung by territorial sparrows throughout the course of the day. Digital sound files were analyzed using the Syrinx sound analysis software. We counted the number of buzz, warble, and combined songs produced, and mapped these onto specific periods of the female breeding cycle (egg-laying phase, hatching, etc.). We identified the major singing peak from 04:00 – 08:00 in the morning. We found a smaller, though substantial singing peak around 20:30 (sunset), and examined the output of each song type during these singing peaks. We also found that birds gradually transitioned from buzz to warble song throughout each cycle and had variable song output, suggesting that this song feature might be available for females to use in selecting either pair mates or extra-pair mates.

This work was funded, in part, by the Chester River Field Research Station, the UMBC Department of Biological Sciences, and an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Attracting a Younger Audience to Live Theatre in Baltimore

Caroline Jurney
Susan McCully, Senior Lecturer, Department of Theatre

In order for live theatre to survive as an art form, we need to diversify our audiences, specifically by focusing on the demographic group that patronizes theatre the least- people ages 18-30. Baltimore has a large and thriving theatre community that caters to a wider variety of patrons than the national average. Therefore, I sought to identify which theatres and which specific practices are most successful in attracting younger audiences in Baltimore. To gather this information, I interviewed marketing representatives from community theatres, Do-It-Yourself theatre groups, semi-professional theatres, and professional theatre houses in the Baltimore area, asking about their current marketing practices as well as their current typical audiences. I then conducted a more in-depth analysis of a few of the theatres I determined to have the most success in attracting the target demographic. Finally, I compiled all of the qualitative and anecdotal data in the search for correlations between certain traits or practices and the presence of the target demographic.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Clinical and Psychosocial Factors Associated with Pediatric Sickle Cell Retinopathy

Imesha N. Kalansuriya
Shawn M. Bediako, Associate Professor, Department of Psychology

Sickle cell retinopathy (SCR) is prevalent among children with sickle cell disease. The symptoms of SCR are often not diagnosed until the condition has reached an advanced stage –further complicating the disease experience and potentially resulting in permanent vision damage. Previous studies have shown a significant, but weak, association between clinical factors and SCR in pediatric samples. The association between the presence of SCR and other factors, however, is not well known. This study investigates the association of both clinical (e.g., pain crises and number of hospitalizations**)** and psychosocial (e.g., perceived disease severity and parental knowledge of sickle cell disease) factors with the presence of pediatric SCR. Using publically available data from the Cooperative Study of Sickle Cell Disease, we hypothesized that psychosocial factors would be independently related to an SCR diagnosis. This study is important because recognizing factors that predict SCR may help to encourage earlier screening and reduce the risks of permanent vision loss.

The Association among Race, Marital Status, and Preventive Services

Noora S. Kanfash, *Caryn N. Bell*[1], *Thomas A. LaVeist*[1], *Roland J. Thorpe, Jr.*
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The relationship among race, marital status, and preventive services is poorly understood. Using data from the 2000-2010 National Health Interview Surveys, we examined the relationship among race, marital status, and preventive services in 104,333 Black and 311,696 White men aged 18 and over. Preventive services included seeing a physician, specialist, eye doctor and receiving a flu shot in the past year. After adjusting for age, income, education, insurance status, weight status, self-rated health, and having usual source of care, Black men were found to have lower odds or reporting a physical (odds ratio [OR]= 0.95, 95% confidence interval [CI]= 0.87, 0.97), seeing a specialist (OR= 0.62, 95% CI=0.59,0.65), having an eye examination (OR= 0.77, 95% CI= 0.73,0.82), and receiving a flu shot (OR= 0.83, 95% CI= 0.78, 0.88). There was a significant interaction between race and marital status for all preventive services except visiting a physician. Divorced White men were found to have lower odds of seeing a specialist (OR=0.90, 95% CI=0.85, 0.95), an eye doctor (OR=0.78, 95% CI= 0.74, 0.83), or having a flu shot (OR=0.71, 95% CI= 0.67, 0.76) than divorced Black men. Efforts to improve participation in preventive services should be aimed towards Black men regardless of marital status and divorced White men.

This research was funded by grant #P60MD000214 from the National Institute on Minority Health and Health Disparities (NIMHD) of National Institutes of Health.

***Bartleby 2014*: Interpretive Artwork, Engaging with Poetry and Prose**

Stephen Kelley, Marissa Regelin
Sally Shivnan, Senior Lecturer, Department of English; Guenet Abraham, Associate Professor, Department of Visual Arts

UMBC's creative arts journal is an interdisciplinary effort that showcases the talent and diversity found in the university's student body. Every year the staff selects among the large number of short stories, essays, poems, and artwork submitted, for inclusion in the journal. With the publication of each new *Bartleby*, advanced graphic design students are invited to interpret select pieces in the journal to translate into a visual medium. Importantly, these students have no contact with the authors of the works, as they develop their interpretations. This year, however, this initiative has been expanded substantially. Interpretive posters have been designed for all of the prose and poetry in *Bartleby 2014*. This is a great step forward for *Bartleby*, as it not only allows more people to engage with the writing and with these unique artistic interpretations of the writing, but it also furthers the collaboration between departments, and between *Bartleby*'s student editorial staff and graphic design students in Visual Arts. This presentation will include a continuous slide show of the graphic design students' interpretations, playing alongside a collection of small poster panels featuring their comments on their influences and design decisions.

This work was funded, in part, by the Undergraduate Research Initiative from the UMBC Office of Undergraduate Education, and the Student Government Association.

Body Mass Index Moderates the Relation of Diary Negative Mood to Ambulatory Blood Pressure in Urban Blacks and Latinos

***Noore-Sabah Khan**, Danielle L. Beatty Moody, Elizabeth Brondolo*[1]
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Danielle L. Beatty Moody, Assistant Professor, Department of Psychology

This study examined whether body mass index (BMI) moderates the relation of negative mood to ambulatory blood pressure (ABP) in 645 African Americans and Latinos (mean age 39.4 $\pm$ 9.7) in New York City. Participants completed a daily diary and ABP monitoring across a 24-hour period. The diary assessed anger, sadness, and nervousness for which a composite negative mood variable was created. Significant main effects were not found for negative mood, but were found for BMI with higher BMI associated with higher ABP across the 24-hour period, daytime, and nighttime (p's all $\leq$ 0.006). To determine whether negative mood and BMI interact to predict ABP, a Negative Mood x BMI interaction term was created. Among individuals with lower BMI, greater negative mood was associated with higher 24-hour systolic blood pressure (SBP; $B = 0.18$, $p < 0.05$) and diastolic blood pressure (DBP; $B = 0.14$, $p < 0.05$), and daytime SBP ($B = 0.21$, $p < 0.01$) and DBP ($B = 0.16$, $p < 0.001$). Further research is needed to assess the role of health behavior and related physiological pathways associated with BMI that buffer the effects of negative mood on ABP.

This work was funded, in part by the National Heart, Lung, and Blood Institute, HL068590 (Brondolo).

Using Geolocators to Track Migratory Pathways of Orchard Orioles and Baltimore Orioles

Jin Ah Kim
Kevin E. Omland, Professor, Department of Biological Sciences; Peter P. Marra, Smithsonian Migratory Bird Center, Smithsonian National Zoological Park; Keith Hobson, Environment Canada, Prairie and Northern Wildlife Research Centre, Saskatoon, SK

Migration is the regular seasonal movement of individuals, usually between breeding and non-breeding grounds. This phenomenon is observed across a wide range of animal groups, from fish and insects to mammals and birds. Unfortunately, due to the large-scale journey, it has been difficult to track individual populations of animals. However with the innovation of light-weight tracking devices, it is possible to track the routes as well as the wintering locations of individual birds. These tracking devices, known as geolocators, use light levels and sunrise/sunset times to determine the location of the bird; the length of daylight corresponds to latitude whereas specific dawn/dusk times correspond to longitude. Using decoy models and recorded male songs, we mimicked a territorial intrusion to lure birds into our nets. We used a harness to attach the geolocators onto six Baltimore Orioles and 12 Orchard Orioles. The geolocators will constantly store data points until we recapture the returning birds in the following spring to remove geolocators, download and analyze the data. This information will be essential in studying patterns in migrational movement and timing which is important for both basic understanding of animal behavior and the conservation of our state bird and other orioles.

This work was funded, in part, by a travel award from the UMBC Office of Undergraduate Education and NSF Research Experience for Undergraduates Supplement to Kevin E. Omland.

Applying Mathematical Modeling in the STEM 8 Classroom

Amy S. Kim
Christopher Rakes, Assistant Professor, Department of Education

Analyses of the 2012-2013 Maryland School Assessment (MSA) data indicated that students struggled with mathematical modeling, one of the eight Common Core Standards of Mathematical Practice. Mathematical modeling means representing and interpreting real-world problems mathematically using a variety of methods, including graphs, tables, diagrams, or equations. In the present study, mathematical modeling processes were modeled explicitly in various situations using a mastery approach (i.e., until the students are able to successfully model a problem in a variety of ways). Building up modeling skills allows the students to have a deeper understanding of how to better apply mathematics to a problem or situation. The intervention also included research-based practices such as think-pair-share model, self-reflection after quizzes, tests and assignments, and computer applications. The pre- and post-test included specific questions related to mathematical modeling. Quizzes and assignments served as benchmarks during the intervention period. The sample consisted of three classes of STEM 8 students. The sample consisted of a wide range of ethnicities, socio-economic backgrounds and academic ability levels. The sample also included students with special needs and non-native English speakers.

Writing and Remembering History

Gregory Klock
Linda Oliva, Assistant Professor, Department of Education

This research project investigated an intervention designed to improve knowledge of Cold War history (i.e., key people and events) in inclusion classrooms as well as improve the ability of ninth grade students to form clear, direct, and well-supported pieces of writing about the Cold War. The Cold War is one of the defining international conflicts of the twentieth century, and writing about it helps students synthesize and communicate their understanding. To help co-taught students improve on knowledge of content, differentiated instruction was used to deliver information at the proper ability level of students, with the goal of improving that ability in order to retain and implement information in activities such as reading and organizing data. To help students with their writing abilities, differentiation was used in addition to modelling proper writing techniques. This study followed a two group pretest-posttest design. Two pretests were used; one involving a writing assignment given to students to determine writing ability, and the other a multiple choice test designed to determine base knowledge of the Cold War. Post assessments consisted of a different writing prompt and set of questions. Separate assessments were used to specifically gauge growth in writing and content in the two populations. Data analyses are ongoing, and results will be shared during the presentation.

Analysis of Cell Cycle Proteins after Distortion of Ribosome Biogenesis

Omar Koita*, Md. Shamsuzzaman, Janice M. Zengel*
Lasse Lindahl, Professor, Department of Biological Sciences

The ribosome is the universal machine for translating the genetic code and synthesizing protein in all biological organisms. If the balanced synthesis of ribosomal components and assembly factors is disturbed, nucleolar stress is induced. This leads to cessation of ribosome biogenesis. The ribosome also has effects on cell cycle progression. Our lab has previously examined cell cycle and cell morphology in *Saccharomyces cerevisiae* after repression of the synthesis of 54 individual ribosomal proteins. The responses are protein-specific with some proteins associated with arrest in G2/M phase, while others are associated with G1 phase arrest. The aim of the current work is to study the cellular distribution, localization and interaction of different cell cycle associated proteins after cessation of the synthesis of specific ribosomal proteins. We are currently tagging cell cycle proteins with different fluorescent protein markers. This includes linking the genes for the fluorescent protein tags to selection markers for the construction of chromosomal tagged cell cycle protein genes. Since many genes in the networks of ribosome biogenesis and cell cycle progression are conserved between yeast and humans, our work will impact the understanding of ribosomopathies, human diseases with an origin in mutations of ribosomal protein genes.

This work was funded, in part, by NSF grant MCB0920578.

Two Hearts Beat as One: A Study of Spouses' Agreement Regarding Disengaged and Engaged Communication Behavior

Sam Kott
Robin A. Barry, Assistant Professor, Department of Psychology

In romantic relationships, disengaged communication behavior between partners can have a damaging effect on the quality of couples' communication. Moreover, this effect can be exacerbated when partners cannot reach agreement about the extent of their disengagement (e.g., when a spouse perceives their partner to be less engaged than the partner perceives themselves to be). Disengaged behavior is likely to be less observable than engaged behavior because partners may disengage in both overt and covert manners. The present study was conducted to determine if self-partner agreement for disengaged behavior is lower than self-partner agreement for engaged behavior during couples' conflict communication. One hundred fourteen heterosexual married couples participated in two conflict-oriented discussions, and, following each discussion, individually completed measures of their own and their partner's engaged and disengaged communication behavior. We expected that husbands' and wives' agreement about disengaged behavior would be lower than their agreement for engaged behavior. Analyses did not support the hypothesis. Husbands and wives demonstrated comparable agreement for engaged and disengaged behavior. This research advances the understanding of how couples experience conflict communication, and may inform couple therapists' efforts to improve couples' communication.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Gender Differences in Pain Tolerance and Pain Intensity among College Students

Valerie Koury
Lynnda M. Dahlquist, Professor, Department of Psychology

There is no distinct pattern of gender differences in commonly studied outcomes such as pain tolerance and pain intensity. The present study sought to examine whether gender differences exist in cold pressor pain. Participants were a sample of undergraduates (N = 69 males; N = 109 females) at the University of Maryland, Baltimore County. To capture pain tolerance, participants placed their hand in cold water for as long as they were able to tolerate the pain. After the participants removed their hand, they were asked to rate their pain on a scale of 0 to 100; this measured pain intensity. Independent samples *t*-tests were conducted. There was a significant difference in pain tolerance between males (M = 52.00, SD = 45.00) and females (M = 31.16, SD = 31.16); t (176) = 3.97, $p < .001$. However, there was not a significant difference in pain intensity between males (M = 61.70, SD = 22.48) and females (M = 61.81, SD = 23.12); t (176) = -.032, $p < .98$. The results suggest that when exposed to cold pressor pain, females and males differ in their ability to tolerate the pain, but rate their experiences of pain similarly.

Alternative Control Paradigms for Remote-Controlled Helicopters

Sekar Kulandaivel
John Park, Lecturer, Department of Computer Science and Electrical Engineering

Helicopters are one of the most difficult vehicles to control and require numerous hours of extensive flight training to master. Pilots must be capable of operating collective, cyclic, directional, and throttle controls simultaneously while managing many onboard flight systems and sensors. The development of an alternative control paradigm that is more intuitive for novice pilots may decrease the difficulty of learning general helicopter flight and increase the number of experienced helicopter pilots. The design and implementation of this alternative control paradigm on a small-scale level using a collective pitch remote-controlled (RC) helicopter focused on developing a control system that simplifies user inputs for general helicopter flight. The investigation of an unmodified helicopter's reactions to user inputs through testing and simulation determined the structure and design of an onboard control system that directly controls an RC helicopter's servomotors. By utilizing an Arduino microcontroller to analyze simplified user inputs and produce a series of more complex controls of the servomotors, this alternative control paradigm may prove to reduce the difficulty of general helicopter flight.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Reframing the Window of Chinese Society II: Contemporary Art of the Millennial Generation

Robbin Lee
Fan Yang, Assistant Professor, Department of Media and Communication Studies

For this research, I traveled to China to study the young urban population's engagement with artistic practices and to develop an understanding of the unconscious ideological motivations behind a group that is considered the product and agent of social change. The Chinese Millennials, as they are referred to in the media, those who are currently between the ages of 18-30, struggle with finding their identity while feeling separated from the historical trajectory of the Chinese people. In addition, China's One-Child Policy has shaped a very isolated, pressured, and introspective environment for young individuals, as expressed in their art. Building on my research on Chinese Contemporary Art done in Part I, I engaged with young Chinese peers on a local level, through viewing artwork and interviews. Experiencing the artwork first-hand allowed me to observe artistic trends, whereas interviews provided conceptual background. A socio-historical analysis of their creative practices within the context of globalization revealed that the few who are ushered into the artistic elite at an international level inaccurately represent the unique upbringing of the Millennial population.

This work was funded, in part, by an Undergraduate Research Award from the UMBC Office of Undergraduate Education and by a grant from the Benjamin A. Gilman International Education Scholarship Program.

Numerical Modeling of Lipid Biosynthesis in Microalgae

May M. Li*, Nicole J. Carbonaro*
Ian F. Thorpe, Assistant Professor, Department of Chemistry and Biochemistry

In recent years, extensive studies have been focused on the development of alternative sources of energy to address depleting supplies of petroleum. There is a global push towards renewable sources of energy and, in particular, biofuels. Under the right conditions, microalgae can serve as one source of biofuel. These organisms are capable of producing large amounts of triacylglycerols (TAG), lipids that can be converted into usable biodiesel. Our lab uses numerical modeling to explore optimization of lipid biosynthesis in the well-studied microalgae *Chlamydomonas reinhardtii.* Using a deterministic kinetic model of the lipid pathway we created in MATLAB, we manipulated rate parameters in the model to observe the effect on lipid production. Through sensitivity analyses, we predict which enzymes in the pathway have the largest impact on TAG production. So far, our studies suggest that six enzymes have a dominant effect on TAG synthesis. These enzymes are found in the cytosol, in the steps immediately preceding TAG formation. We ultimately intend to test these predictions *in vivo*. While developed specifically for *Chlamydomonas reinhardtii,* this model should be generally applicable to other microalgae with similar mechanisms of lipid biosynthesis.

This work was funded, in part, through an Undergraduate Research Assistantship Support (URAS) Award from the UMBC Office of Research Administration.

Is the Voting Rights Act Still Necessary? Attitudinal Support of Electoral Reform in a Post-Jim Crow Era

Lauren A. Lochocki, *Tyson King-Meadows*
Tyson King-Meadows, Associate Professor, Department of Africana Studies and Political Science

The Supreme Court's ruling in *Shelby County, Alabama v. Holder* (2013) declared an important part of the Voting Rights Act (VRA) to be unconstitutional. The Court ruled that the coverage formula reauthorized by Congress in 2006, the provision determining which jurisdictions must obtain federal preclearance of proposed changes in election laws, was inappropriate for an era where race-based electoral discrimination has significantly declined. The Court raised doubts about the evidence used to document the impact of anti-black sentiment on minority participation. To interrogate this "Bull Connor is Dead" concept, this study utilized the Cooperative Congressional Election Study, a national Internet-based survey, to examine white support for three election reforms in 2008 (n = 1466) and in 2012 (n=901). The three reforms were voter photo ID, requiring voters to read from the U.S. Constitution, and Election-Day registration. Through bivariate analysis and multivariate logistic regression, we assessed the attitudinal, demographic, and contextual factors driving support for each reform. We found that racial sentiment measures were strong predictors of support, even after controlling for other factors. Our findings underscore the tradeoffs associated with considering attitudinal support of electoral reforms in an era where racial jurisprudence and public opinion have tilted against provisions of the VRA.

This work was funded, in part, through an Undergraduate Research Assistantship through the Department of Africana Studies.

Chromosome Conformation Capture in the chr13q22.1 Pancreatic Cancer Risk Locus

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Although pancreatic cancer is the tenth most common cancer in the United States, it is the fourth most common cause of cancer mortality. Like any disease, pancreatic cancer is a result of lifestyle and genetic factors, but the full extent of genetic causation is still undergoing much research. Chr13q22.1 has been shown to harbor a risk locus for pancreatic cancer through genome wide association studies (GWAS). Using chromosome conformation capture (3C) and expression quantitative trait locus (eQTL) analysis, the risk locus has been shown to influence expression of the *DIS3* gene located ~600 kb upstream on 13q22.1. Consequently, any regions that may affect *DIS3* expression are now being investigated within the laboratory. This project's region of interest is located upstream of the *DIS3* promoter on chromosome 13 in a gene desert. To determine whether our region of interest enhances or inhibits *DIS3* expression in pancreatic cancer cells, I cloned the region of interest in a construct made up of the genomic region of interest and a firefly luciferase gene. PANC-1 pancreatic cancer cells were then transiently transfected with this construct in order to perform a luciferase assay. The assay's result showed that the region of interest does enhance promoter activity.

This work was funded by the National Institutes of Health for the National Institutes of Health Summer Internship Program.

Structural Elucidation of RNA using Modern Energy Optimization Methods

Gaurav Luthria
Bruce Johnson, Research Professor, Department of Chemistry and Biochemistry

Understanding the structure of RNA is important for investigating gene expression, vital cellular functions, and retroviral infections. Due to RNA's complex structure, energy minimization using optimizers is an efficient approach to elucidate stable molecular configurations. In the present study, a modern, non-gradient based optimizer, CMA-ES (Covariance Matrix - Adaptation Evolution Strategy) is used to determine the structure of RNA. As opposed to traditional, gradient-based optimizers, it is predicted that CMA-ES will provide fast convergence to the global minimum, corresponding to a stable structural configuration. This optimizer minimizes a self-defined energy function that incorporates steric, torsion angle, and atom distance constraints from NMR data. To increase the rate of optimization, a course grained model is incorporated which simplifies the RNA nucleotide by minimizing the number of atom interactions. Derived structures and minimized energies for the retrovirus were compared to those generated by the CYANA 3.0 program, which uses a gradient-based molecular dynamics approach. The current energy values generated using this modern algorithm are slightly higher than those generated by CYANA. After superimposing our derived structures onto CYANA's, there were minimal deviations. Additional research with fewer constraints is required to demonstrate the generality of CMA-ES optimization for structural elucidation of biomolecules.

This project was funded by NIH grant P50GM103297, One Moon Scientific, Inc.

Using a Microelectrode Array Plate to Induce Action Potentials in Neural Cells Affected by Alzheimer's Disease

***Vanessa Mackley**, **Vani Ravichandran,** Dalton Hughes*
Jennie B. Leach, Associate Professor, Department of Chemical, Biochemical, and Environmental Engineering

Imagine being able to counteract the effects of Alzheimer's disease by pointing a laser at neurons in the brain. The goal of this project is to induce therapeutic effects on injured neurons by optical stimulation. One cause of neurodegenerative diseases is the inhibition of neuronal action potentials. Microelectrode Array (MEA) plates have been previously used to study the electrical excitability and action potentials of neural cells. Herein our goal is to use MEA plates to record voltage changes in the nerve membrane in order to determine how laser light and Amyloid Beta (AB; a protein thought to be the cause of Alzheimer's disease) affects action potentials. In our work, we hypothesize that optimizing the cell-to-plate interaction will provide the means necessary to study action potentials of the cells. We are culturing PC12 cells in the presence of nerve growth factor to allow the cells to produce action potentials. We plan to culture the cells on various plate coatings and image the cells to determine the most suitable environment for cell growth. These results will allow the research to proceed to the next phase wherein PC12 cells will be analyzed in the MEA plates during exposure to optical stimulation and AB.

This work was funded, in part, by the University of Maryland, Baltimore County.

Rogue Species Unleashed: Examining Non-Native Invasive Species, a Biological Problem with Socioeconomic Consequences

Caitlyn Maczka
Effie Siegel, Professor, Department of English, Montgomery College

Invasive species are one of the world's most severe yet most overlooked issues. Contrary to the belief of many, damage by invader animals, diseases, and plants is not just biological. Estimates for world-wide economic damage due to species invasions run into the hundreds of billions of dollars per year. This project analyzes the issue of invasive species, and how socioeconomic side effects of species invasions are felt most drastically by the world's poor. Species invasions in developing nations both exacerbate preexisting issues and create an array of new problems. This paper examines the issue via two case studies. The first is the water hyacinth in Lake Victoria, Africa, and the second is Prosopis in the Afar region of Ethiopia. In addition to causing widespread economic damage for the surrounding communities, both plants also cause extreme social tension. Social strain in these areas stems from gender roles and responsibilities in maintaining livelihood. This paper analyzes the biological, economic, and social implications of species invasions, and the multi-faceted world-wide crisis is exposed.

Fatigue of Dentin after Diamond Abrasive Bur Preparations

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Dwayne Arola, Professor, Department of Mechanical Engineering

The durability of restored teeth to cyclic loading and their resistance to fracture are dependent on the fatigue properties of the restorative materials and hard tissue foundation. The objective of this investigation was to evaluate whether cutting with diamond burs causes a reduction in the fatigue strength of dentin. Beams of human coronal dentin were obtained from unrestored third molars and subjected to either quasi-static or cyclic flexural four-point loading to failure. Flaw free control beams (N=35) were prepared with diamond abrasive slicing wheels. Treated beams (N=35) were prepared by cutting with medium grit diamond abrasive burs under ultra-high-speed rotation and with copious water coolant; the bur rotation was oriented parallel to the beam length. Under quasi-static loading there was no difference ($p>0.05$) in the average strength between the flaw-free control and the treated dentin beams. However, the fatigue life diagrams distinguished that dentin treated with diamond burs underwent a substantial reduction in fatigue strength overall, which was statistically significant ($p\leq0.01$). When evaluated by the apparent endurance limit there was a 35 percent reduction in the fatigue resistance of the bur-treated dentin with respect to the control. Research focused on new methods of preparation is warranted.

This research was supported in part by an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

An Analysis of the Function of L24 in the Ribosomal Complex

Oleg D. Makarevich*, Jesse Fox*
Lasse Lindahl, Professor, Department of Biological Sciences

We examined the non-essential large subunit ribosomal protein 24 (L24) in *Saccharomyces cerevisiae* to ascertain its role in ribosome biogenesis and/or function. L24 deletion mutants can grow, but the lack of L24 affects translation efficiency. We have constructed a shuttle plasmid (replicates in both *Escherichia coli* and *S. cerevisiae*) that contains the sequence for HA-tagged L24 protein (pLGSD5-HA-L24) expressed under a galactose promoter. The HA tag allows us to trace the L24 protein expressed from the plasmid. We showed that synthesis of the HA-tagged L24 protein is induced by estrogen (β-estradiol) in a strain with a hybrid transcription activator containing an estrogen response element. In conclusion, we have constructed a strain in which tagged L24 can be induced efficiently. This will allow us to address a new question in ribosomal biology: Why are some ribosomal proteins dispensable and what is their function? We will be the first to observe the transition in a cell culture without L24 to the same culture with the production of L24 induced.

This work was funded, in part, by NSF grant 0920578 to Janice Zengel and Lasse Lindahl as well as by an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Student Learning Objective: Relevant Ideas in Writing

Sarah Malesh
Cheryl North, Assistant Professor, Department of Education

Eighth-grade students at a suburban middle school completed a diagnostic composition at the beginning of the school year which revealed that they had difficulty staying on topic and incorporating relevant and thoughtful ideas into their writing. These results were confirmed via formative assessments throughout the school year. The goal of this research is for students to improve their writing in those areas. To achieve this goal participants will engage in discussions that encourage elaboration, engage in peer revision, and complete research assignments that will help them gain background knowledge on their topic while learning the craft of writing. Students will be evaluated via performance-based assessments at the end of each unit and will be scored out of a four-point scale.

Using Nuclear Introns to Infer the Evolutionary History of a Vulnerable Australian Songbird, the Norfolk Island Robin

***John Malloy**, Anna Kearns, Matthias Gobbert, Kevin Omland*
Kevin Omland, Professor, Department of Biological Sciences

The Australasian robin genus *Petroica* is commonly used as a textbook example of island speciation due to the radiation of the species outward from the Australian mainland (Mayr, Animal Species and Evolution, 1950). Although their common name sounds familiar, the Australian Robins comprise a distinct group not at all closely related to our American Robin. Recently, based on evolutionary analyses, a previous subspecies in the *Petroica* genus, the Australian mainland Scarlet Robin, was raised to full species status while the closely related Norfolk Island Robin remains a subspecies. The Norfolk Island Robin is considered vulnerable (Norfolk Island Robin Recovery Plan, 2004) and conservation efforts are therefore critical. However, the evolutionary analyses of this group that resulted in this new taxonomy were performed solely with mitochondrial DNA. Previous work done by the Omland Laboratory at UMBC has shown mitochondrial analyses to potentially be misleading. This project uses nuclear intron DNA from a wide sampling of Australian Robins to infer a more conclusive and thorough evolutionary history of the genus as a whole, as well to determine whether the Norfolk Island Robin should be considered a distinct species.

This work was funded, in part, by the Undergraduate Biology and Mathematics Training Program at UMBC.

Vocabulary and Geographic Features Student Learning Objectives

Logan D. Masters
Linda Oliva, Assistant Professor, Department of Education

This study examined the effects of sustained explicit instruction on students' ability to analyze geographical features and improve vocabulary competencies. The subjects were sixth grade special needs students with Individual Education Plans and 504 plans. The intervention included supports, such as proper scaffolding, graphic organizers, and appropriate reading strategies. The specific skills in vocabulary that were examined were the interpretation of words and phrases as they are used in text, including the determination of technical, connotative and figurative meanings and the analysis of how specific word choices shape meaning or tone. The specific skills in analysis of geographic features include the ability to use photographs and thematic maps to identify and describe physical and human characteristics of early civilizations. Formative and summative assessment data were collected and analyzed. The target Student Learning Objectives were that at least 85 percent of targeted students would score a minimum of 70 percent on a post-unit vocabulary assessment and that 85 percent of targeted students would score a minimum of 70 percent on a post-unit geography assessment.

The Characterization of All Carbon Structures, C_4, C_5, and C_6

Kori McDonald
Joel F. Liebman, Professor, Department of Chemistry and Biochemistry

With many carbon structures still unknown and undiscovered, it becomes increasingly important to find a way to discover, characterize, and understand these structures. One of the projects in the Liebman lab seeks to characterize the all carbon structures with the formulas of C_4, C_5, and C_6. A matrix method is applied to characterize all drawn structures, upon which every carbon is numbered and used to generate an adjacency matrix, as well as uniquely derived matrices, for the structure. From the adjacency matrix we derive certain combinations of eigenvalues and eigenvectors. The eigenvalues and eigenvectors are a representation of the energy levels for each structure and the type of structure. With this we hope to gain a better understanding of what is chemically reasonable for our produced structures.

This research was supported in part by a grant to UMBC from the Howard Hughes Medical Institute through the Precollege and Undergraduate Science Education Program.

Usability of a Universal Jamming Gripper for Mobility Impairments

Samantha A. McDonald, Jeremy Chang
Shaun Kane, Assistant Professor, Department of Information Systems; Amy Hurst, Assistant Professor, Department of Information Systems

The ability to grab and move objects can be increasingly difficult for those with mobility impairments. Robotic arms have been applied to this issue by mimicking the gripping ability of a human hand. However, most robotic arms are costly and require immense programming and customization for use. There is also the issue of creating a gripper that can pick up a universal set of items. A robotic gripper for persons with disabilities must be able to pick up a variety of items without the need for constant interchanging parts or programming. The gripper must also be inexpensive, with easily replaceable materials. In this research we are applying Brown's invention of a robotic gripper, which uses granular jamming, to an accessibility application. By creating our own universal gripper with a balloon, coffee grounds, funnel, vacuum, and power supply, we were able to recreate a similar model to Brown's gripper and test its effectiveness for mobility impairments. This research has shown a potential design for an assistive gripper. With a higher degree of engineering, one can use this design to create an inexpensive and assistive robotic arm.

This work was funded, in part, by the UMBC Department of Information Systems.

Tactile Tools for Educational Research

Samantha A. McDonald, Joshua Dutterer
Shaun Kane, Assistant Professor, Department of Information Systems; Amy Hurst, Assistant Professor, Department of Information Systems

As our society enters an era of digitalized education, we must consider the effects on the variety of users, including students who are visually impaired. Homework, presentations, and in-class lectures are increasingly presented online through dominantly visual mediums, disproportionately disadvantaging these students. In this study, we examine a set of tactile education tools custom-created for a specific user in a classroom environment. Our test student is enrolled in a course that is inherently visual-based: Graphic Design for Interactive Systems. To assist his education, we created over 10 novel tools with the use of a laser cutter and 3D printer in order to help him grasp ideas such as color formats, font types, web layouts, and web design. These tactile tools were inexpensive and made in a relatively small amount of time, suggesting the feasibility of our approach. Our designs proved to be extremely helpful. His feedback concluded an increased understanding of the class material and the confirmation of tactile tool potential for other class environments.

This work was funded, in part, by the UMBC Department of Information Systems.

Pottery Production Techniques of Ancient Greece

Cara M. McGaughran
Esther Doyle Read, Lecturer, Department of Ancient Studies

Although Athenian painted pottery is considered the norm in studies of Greek vases, there were many other, more purely utilitarian, types manufactured in Greek workshops. The focus of my study is a "worker's bowl" from Olympia in the UMBC Marie Spiro Collection, which is of unknown date. This bowl may be more representative of the types of pottery used by the lower class, whether slave worker or poor free person, or it may be indicative of the variety of types of pottery used in a household. Using data from various museum collections, archaeological excavation reports and journal articles, I will concentrate on different methods of ceramic production, which include the collection of raw materials, the methodology used to create and fire pottery, and the decoration techniques that were used. This research will then enable me to establish a temporal provenance for the bowl and to determine for whom this type of ceramic ware may have been produced. This will add to our knowledge of artifacts in the Spiro Collection.

"The Law Won Over Big Money": Tom Watson and the Leo Frank Case

Leslie McNamara
Anne Sarah Rubin, Associate Professor, Department of History

In 1913, in Atlanta, Georgia Leo Frank, a Jewish factory superintendent, was convicted and sentenced to death for the murder of thirteen-year-old Mary Phagan. This project focused on the sensationalization of Phagan's murder as covered by *The Atlanta Constitution* and the coverage of Frank's subsequent trial. After Frank's conviction, the Frank case garnered national attention from the media, which questioned Frank's conviction. The questioning of Frank's conviction led Tom Watson, a Georgia Populist leader, to write various articles about Leo Frank. I analyzed Watson's rhetoric as it appeared in his two publications, *Watson's Magazine* and *The Jeffersonian.* I concluded that Watson's rhetoric was rooted in Populist ideology, but contained aspects of anti-Semitism. Watson viewed the campaign to overturn Frank's conviction as impeding Georgia's right to self-governance, which Watson alleged was due to Jewish control of the financial industry. In 1915, Governor John Slaton of Georgia commuted Frank's sentence and in the aftermath, Frank was lynched by a mob due to the perception that the commutation had stripped Georgia's citizens of their right to seek justice. The lynching of Frank was subsequently defended by Watson since from his perspective, despite the "Big Money" interests that attempted to strip Georgia's right for justice in the end, justice prevailed in the form of a lynching thus, "The Law Won Over Big Money."

Experience and Enjoyment of Videogames and Virtual Reality Distraction from Pain

Amy N. Mickhael, Alex E. Woo, Abigail L. Matthews*, Emily C. Foxen-Craft*
Lynnda M. Dahlquist, Professor, Department of Psychology

Virtual-reality (VR) videogames can distract from acute pain, although this effect is inconsistent. Positive emotional experience, but not videogame experience, has been associated with improved pain tolerance. Therefore, those who enjoy the videogame may derive an increased benefit from VR videogame distraction. UMBC undergraduates (n = 179, M age = 20.58 years, SD = 3.04, % male = 38.5) completed two cold pressor trials (i.e., exposure to ice cold water) to assess pain tolerance at baseline and during VR videogame distraction. Enjoyment of the videogame was rated on a scale from 0 ("I did not like it at all") to 100 ("I really liked it and want to play it again"). Amount of improvement in pain tolerance during VR distraction was positively correlated with enjoyment of the videogame (r = .16, p = .04), self-reported days per week of videogame play (r = .17, p = .02) and self-reported hours per week of videogame play (r = .22, p = .003). Enjoyment and experience with the videogame were related to improved pain tolerance during VR videogame play. Individuals who have more experience with and enjoy videogames may differentially benefit from videogame and VR distraction from painful medical procedures.

Extraction of Interacting Orthologs from Literature

Rajashree Mishra, *Emily Doughty*
Maricel G. Kann, Assistant Professor, Department of Biological Sciences

Information about protein-protein interaction is essential to understand function within cells, pathways and relationship to diseases. Most interactions are not available in the databases. We hypothesize that protein interaction evidence conserved across species can be used to uncover the positive interactions missing from the databases. A novel methodology, Literature InterologG ExtractoR (LIGER), was developed to retrieve interologs from the literature. LIGER retrieved mouse interactions using the human orthologs to direct the extraction from literature. A set of human protein interactions built from the Search Tool for the Retrieval of Interacting Genes/Proteins (STRING) database was used as a starting point (seed) to identify putative mouse interactions (target). We used HomoloGene to retrieve all mouse orthologs to human to build a database of putative mouse protein-protein interactions. LIGER performed a search for mouse interactions in PubMed defined by their orthology to human and has approximately a 74 percent precision rate after manual curation. We further evaluated LIGER's performance by comparing LIGER with a web-based tool that assists text mining of biointeractions. We performed the web-based tool, LIGER, and a combination of the two methods on 1000 randomly generated abstracts. We expect the combination of the two methods to have the strongest performance.

*This work was funded, in part by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC, NCI (1K22CA143148) and by a grant to UMBC from the Howard Hughes Medical Institute through the PreCollege and Undergraduate Science Education Program*.

Gold-Tip Nanoprobe Array Fabrication for Brain Characterization

Larry L. Morton
Gymama Slaughter, Assistant Professor, Department of Computer Science and Electrical Engineering

Being able to study the brain while a person or animal is alive could lead to breakthroughs in curing, preventing, or diagnosing neurological diseases before the onset of the diseases. An example would be mapping brain activity prior to and during a stroke, in order to enable the detection of the beginning of a stroke. However, this detection mechanism is limited by the size and weight of current probe technologies. We are therefore focusing on fabricating gold tips with a pitch of less than one micrometer. We have fabricated gold nanotips using inverted-pyramid silicon with a well-controlled, anisotropic wet etching process using different potassium hydroxide bath temperatures. The influence of the etchant concentration and temperature on the etch rate is being investigated. The realization of feature sizes as small as thirty nanometers will enable the miniaturization of the current technology that is needed to characterize and map brain activities. This technique has produced a high yield of molds. These molds will allow for different ways to put down gold and retrieve the gold in the shape of the tips.

*This work was funded, in part, by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC and the NSF*.

Human Rights Violations in the Prison Industrial Complex

Tim Mullaney
Ilsa Lottes, Professor, Department of Sociology and Anthropology

Social scientists, legal researchers, and human rights advocates have expressed concern about the trend toward privatization of correctional facilities in the United States. The research presented here is the result of a comprehensive review of the literature regarding this concern. Following the emergence of private prison corporations in the 1980s, these corporations have implemented cost-cutting measures to maximize profits. Through the measure of outsourcing of medical treatment, private prisons have denied the basic human right of access to healthcare to prisoners in instances where treatment was seen to be too costly. Furthermore, prison corporations have lobbied for and supported legislation for harsher drug and immigration law, reflecting an interest in increasing the rate of incarceration. In the private prison industry, profit is dependent on incarceration. Thus, the profit-motive of prison corporations runs contrary to the human right that prisons should serve the purpose of rehabilitating criminals. This presentation concludes with suggestions for reducing human rights violations in private detention facilities.

Calcium Waves in the Neuronal Dendrite: Signal for Cellular Learning

Danya Murali
Bradford Peercy, Assistant Professor, Department of Mathematics and Statistics

The study of calcium is vital in understanding the cellular mechanism for memory development because of calcium's contribution to the plasticity within neurons. Neuroplasticity refers to the change in neural pathways and synapses in response to certain stimuli. Studies have shown intra-neuronal calcium waves in dendrites are related to physiologically relevant stimulus protocols that modulate messaging between neurons. We mathematically describe calcium dynamics using diffusion/reaction partial differential equations to capture the behavior of calcium, show its dependence on second messengers, particularly IP_3 (inositol 1,4,5-trisphosphate), and further simulate this behavior using the mathematical computational package MATLAB. Specifically, we seek to investigate the phenomenon of a resurgent calcium wave and understand its dependence on IP_3 by characterizing components of our previously existing model and adapting it to account for this phenomenon. Through understanding of these calcium dynamics, we hypothesize that IP_3 diffusion is limiting to autocatalytic calcium propagation, forcing a pause and decline in calcium that recovers with IP_3 spread.

*This work was funded, in part, by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC.*

United States Immigration Policy and Violations of Human rights

Steven Murcia
Ilsa Lottes, Professor, Department of Sociology and Anthropology

Immigration policy in the United States has been highlighted as an important and controversial issue. Recently it has received more attention from politicians with varying views on this topic. This research analyzes the effects of current immigration policy and documents how this policy violates basic human rights of undocumented immigrants. In a poster presentation, I show how specific human rights as listed in the Universal Declaration of Human Rights, the International Covenant on Civil and Political Rights, and the International Covenant on Economic, Social and Cultural Rights are violated. Narratives and statistics are used to support claims of violations of rights. An example illustrating the violation of human rights is the basic right of assembly and association. The Obama administration's tough enforcement of immigration policy has led to the deportation of a record 1.1 million people in the last three years. This has caused intense suffering due to the millions of family members who have been separated. After documenting violations of human rights of immigrants, suggestions are listed for how these policies could be improved to reduce the scope of human rights violations. Social scientists have also highlighted how such policies would benefit the United States.

Empathy Reconceptualized as a Dynamic Skillset

Jonathan Neal
Diane Alonso, Senior Lecturer, Department of Psychology

As a concept, empathy has lacked concrete definition, having been known in turn as sympathy and pity; terms that have proved vulnerable to semantic corruption over time. If one accepts that empathy can be decisive in the practice of compassion in social services and assumes that empathy is, in part, learned, then providing a mechanism for "teaching" empathy could be useful. This study sought to further support for a model of empathy based on neurocognitive evidence related to the discovery of mirror neurons as informed by social work practice wisdom. Sixty social science undergraduates completed a measure of empathic attitudes, the Empathy Assessment Index (EAI), with thirty participating in one of three standardized Cognitive Affective Workshops. These workshops explore five distinct components of empathy identified by cognitive neuroscientific research through lecture, demonstration, discussion and guided role play. Using a repeated measures design in which measurements collected after participation in the workshop are compared to those taken before participation, results are expected to show that participation in these workshops will inform future professionals' comprehension of empathy as a functional, teachable skill set including applications in affect mentalizing, perspective-taking, self-other awareness, and emotion regulation.

Development of a Real World Screening Method for Nutraceuticals Using DSA-TOF

Rebecca L. Neubauer*, Greg T. Winter, Joshua A. Wilhide, Suejane I. Tan, Ian W. Shaffer*
William R. LaCourse, Professor, Department of Chemistry and Biochemistry

Nutraceuticals represent a rapidly growing industry dedicated to providing alternatives to traditional pharmaceuticals and healthcare practices. Defined as vitamins, minerals, herbal products or specially treated foods, nutraceuticals claim to improve health and are readily available in a wide variety of dosages and forms. However, despite their popularity, the term nutraceutical is not recognized by the FDA, and therefore they are considered dietary supplements without any unique regulations or standards. Direct Sample Analysis (DSA), a new commercially available ambient ionization source, coupled with a Time of Flight (TOF) mass spectrometer offers a quick and effective analysis of nutraceutical products. DSA uses principles of Atmospheric Pressure Chemical Ionization (APCI) to quickly screen for masses over a desired range from a sample requiring little to no preparation. Optimal DSA conditions, producing strong peak intensities for the desired m/z ratio and little additional noise, were determined for each of five nutraceutical standards: ascorbic acid, l-carnitine hydrochloride, co-enzyme Q, riboflavin and melatonin. These methods will be applied to analyzing a wide range of commercially available products in a variety of mediums (tablet, liquid, gummy) to confirm the existence of the active ingredients and identify any unexpected or potentially harmful compounds.

This work was funded, in part, by the Molecular Characterization and Analysis Complex (MCAC) and PerkinElmer.

Identifying Regulatory Sequences in Metagenomic Samples via Parallelized Search Algorithms and Permutation Analysis

David Nicholson, *Talmo Pereira*
Ivan Erill, Assistant Professor, Department of Biological Sciences

Advances in next-generation sequencing technologies have heralded a new age of "big data" in biology. Even modest DNA sequencing endeavors can generate massive amounts of data, creating a new challenge for researchers seeking to use genetic sequence information to answer questions of biological significance. This problem is exacerbated in the case of metagenomics – the study of the genome-level composition of microbial communities originating from a common environment. Metagenomic datasets may reach sizes of hundreds of billions of base pairs spanning thousands of different species, making the task of analysis and extraction of biological significance from such sequence data particularly non-trivial. For this project we analyzed 85 human gut metagenomes from the MetaHit database. We exploited the computational power of a graphics processing unit (GPU) to optimize a naïve sliding window search and used this optimized search to identify sequences that resemble a previously established binding motif for a bacterial stress response transcriptional regulator. To assess whether the identified sequences are biologically relevant, we leveraged the GPU processing power to perform a permutation test. We report the results in terms of comparison of computing times with alternative approaches and of the efficiency of permutation tests to infer biological relevance.

*This research was supported in part the Howard Hughes Medical Institute through the Precollege and Undergraduate Science Education Program, an Undergraduate Research Award from the UMBC Office of Undergraduate Education, and NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award.*

Expression Profile of Putative Receptors involved in Xenobiotics Detection in Mouse Olfactory Epithelium

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The main olfactory epithelium (MOE) detects environmental odors that are important for survival and transmits this information to the brain. To protect the MOE from environmental toxicants and pathogenic bacteria, cellular mechanisms to detect these xenobiotics are critical. However, data regarding such cellular mechanisms and the receptors involved are sparse. We previously reported that bacterial lysate and chemical irritants stimulate populations of non-neuronal cells that reside in the MOE (Ogura et al. *J. Neurophysiology,* 2011). To further investigate the expression profile of potential receptors involved in xenobiotics detection, we used real-time quantitative polymerase chain reaction (RT-qPCR) on total RNA obtained from freshly dissected olfactory turbinate tissue. Using specific primers designed against unique sequence fragments of 30 known receptors or receptor-associated protein transcripts, we found that the MOE expresses multiple receptors at varying levels. Using *Gapdh* as calibrator, we found an abundance of Rgs5, Tmem30b, Il13ra1, Tyro3, and Plag2a7. Our results suggest that cells within the MOE may respond to diverse chemical ligands and contain different biological pathways important to MOE function.

*This research was supported in part by the Howard Hughes Medical Institute through the Precollege and Undergraduate Science Education Program, an NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC, and NIH/NIDCD 009269, 012831 to WL.*

Improving Students' Argumentative Writing Skills Using Informational Texts

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The new Common Core standards emphasize informational reading and writing and the need to improve students' ability to analyze informational documents to craft essays. The adoption of rigorous Common Core standards was even more demanding for students with reading and writing difficulties. This study investigated the effectiveness of several months of instruction aimed to improve skills in argumentative writing using informational documents. The subjects were eleven 7th grade students with Individual Education Plans due to their special needs. The students' writing skills were scaffolded using a variety of writing prompts and strategies. The students' argumentative writing was analyzed with a pre-assessment, a series of formative assessments, and a post assessment that was administered at the conclusion of the research. The target performance was for 85 percent of students to score a minimum of 70 percent on a post-unit argumentative writing question evaluating the effect of a culture on history.

The Minimal Important Difference in the Borg Dyspnea Score for Patients with Pulmonary Arterial Hypertension

Chisom Nwaneri
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Pulmonary arterial hypertension (PAH) is a disease of the pulmonary vasculature that leads to right heart failure and death. Despite advances in therapy, PAH remains a chronic disease without a cure. Attention to patient symptoms such as dyspnea, which means shortness of breath, is an important part of assessing response to therapy. Little is known regarding clinically meaningful changes in dyspnea in patients with PAH. The purpose of this study was to estimate the minimal important difference (MID) for the Borg Dyspnea Score and Borg Fatigue Score. A study of 129 PAH patients was conducted. Baseline demographics, clinical characteristics along with six-minute walk test (6MWT), Borg dyspnea (BD) and fatigue (BF) scores at baseline and follow up after at least three months of PAH therapy were collected. Distributional and anchor-based methods (using 6MWT as the anchor) were used to determine the minimal important difference for the BD and BF scores. We estimated the MID for the BD in PAH is <1 unit and around one unit for BF. This MID is smaller than the reported MID for other pulmonary diseases such as COPD and may reflect differences in the perception of dyspnea between diseases. Further research is needed to determine the clinical utility of BD and BF in the assessment of PAH patients.

The Oxidative Stress Response Transcription Factor Nrf2 Does Not Impact the BM Progenitor Cell Differentiation into MDSC

Maeva Nyandjo, *Dan Beury*
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Nuclear factor (erythroid-derived-2) related factor 2 (Nrf2), is a transcription factor which regulates oxidative stress by controlling antioxidant enzymes that restore redox balance. Myeloid-derived suppressor cells (MDSC) are a heterogeneous population of immature white blood cells that accumulate in the presence of tumor. MDSC partially suppress anti-tumor immunity by making reactive oxygen species (ROS), which reduces the cytotoxicity of T cells. In contrast to T cells, MDSC are resistant to the ROS they produce. In addition to regulating genes that help cells survive oxidative stress, Nrf2 also regulates genes involved in the differentiation of white blood cells. To determine whether MDSC differentiation involves Nrf2, we isolated bone marrow cells from wild-type and Nrf2-deficient C57BL/6 and BALB/c mice and stimulated them in culture for five days. The resulting cells were then assessed by flow cytometry and immunofluorescence for the four dominant myeloid cell populations. Wild-type and Nrf2-deficient bone marrow had similar numbers of total cells, monocytic and granulocytic MDSC, macrophages, and dendritic cells, suggesting that Nrf2 deficiency does not affect the differentiation of hematopoietic stem cells into MDSC. Thus, Nrf2 is not implicated in MDSC differentiation; differences in MDSC function may be due to Nrf2-deficient MDSC being more susceptible to oxidative stress.

*Sponsored by NIH/NIGMS MARC U*STAR T34 08663 NRSA to UMBC, a grant to UMBC from HHMI through the Precollege and Undergraduate Science Education Program, and NIH R01CA84232 and RO1CA115880.*

Increasing Percent Survival of *Drosophila melanogaster*

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In mammals, administration of an optimal concentration of a medication would function to reduce hypertension by inhibiting an enzyme of the Renin-Angiotensin System. If corresponding homologous mammalian genes were found in *Drosophila melanogaster*, then this medically induced-inhibition would lead to an increase in percent survivorship in the tested flies. Male and female fruit flies were treated with a 1- or 10-millimolar concentration of an antihypertensive medication, or left untreated, in order to observe drug effects on survivorship. It was hypothesized that the 1-millimolar concentration of the drug would result in a favorable outcome, leading to a relative increase in survivorship, while the 10-millimolar concentration would have adverse effects, decreasing survivorship. Compared to untreated groups, male flies treated with 1-millimolar drug concentration showed the largest increase in survivorship. Female flies treated with a 10-millimolar drug concentration showed consistently lower survivorship across all days of treatment compared to untreated groups. Through these results, we determined an optimal concentration of an antihypertensive drug to increase survivorship in fruit flies. Further studies must be conducted in order to verify if these results can be translated into mammalian studies, and thus improve methods of drug treatment and its effects on survivorship.

This work was funded, in part, by NIH grant R01 DK 084219 to JL.

Characterizing the AC1-Exemestane Resistant Cell Line in Estrogen-Dependent Breast Cancer

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Angela Brodie, Professor, Department of Pharmacology and Experimental Therapeutics, University of Maryland School of Medicine

Aromatase inhibitors (AIs) are used to treat estrogen receptor positive (ER+) breast cancer patients by reducing the levels of estrogen produced via the aromatase enzyme. We aimed to gain a better understanding of acquired AI resistance by developing and characterizing a novel breast cancer cell line (AC1-ExR) that mimics clinical acquired exemestane resistance. The cell line was derived from ER+ tumors of xenograft mouse models treated with aromatase inhibitors. The tumors initially regressed, but after long-term treatment, they became resistant to the AI inhibitor exemestane and began to grow. We characterized the AC1-ExR cell line by analyzing its drug sensitivity. Aromatase activity was measured in these cells *in vitro* following treatment with 10^{-6} M of exemestane. The aromatase activity in the AC1-ExR cell line was reduced relative to the AC1 parental cell line: average aromatase activity of 31.1 fmol/mg protein*hr from average aromatase activity of 72.1 fmol/mg protein*hr in the parental cell line. The interaction between the ER-alpha receptor and several growth factors increased the hypersensitivity of this receptor to estrogen stimuli. Identification of growth factor signaling pathways relevant to the ER+ pathway and crosstalk between ER-alpha and EGFR may reveal their potential role in aromatase resistance in ACI-ExR cells.

*This work was funded in part by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC and an RO1 CA-62483 Grant by the National Cancer Institute of the National Institutes of Health.*

An Analysis of SecM-induced Ribosomal Pausing in *Escherichia coli*

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Lasse Lindahl**,** Professor, Department of Biological Sciences

At the conclusion of translation, a process in which proteins are synthesized, all nascent peptides exit the ribosome through a narrow channel known as the exit tunnel. We are working with two peptides from *E. coli* that pause translation when passing through the tunnel: SecM and CrbCmlA. SecM is involved in regulation of SecA which pumps proteins into periplasmic space. CrbCmlA is involved in the regulation of chloramphenicol resistance. In *E. coli*, the L4 and L22 ribosomal proteins are closely associated with the exit tunnel. It has been found that mutations in the L22 protein that confer erythromycin resistance prevent SecM induced ribosomal pausing, whereas mutations in the L4 protein that confer erythromycin resistance prevent CrbCmlA-chloramphenicol-induced ribosomal pausing. At the moment we are conducting experiments to study how erythromycin interferes with SecM-mediated pausing. To do so, we made a plasmid in which we inserted a copy of the pause sequence into a T7 expression vector. We transformed BDL-DE3 cells with the plasmid because this cell line has a promoter for T7. We are now inducing expression of the plasmid in the presence of erythromycin after which we will look at changes in expression patterns through western blot.

*This research was supported in part by NSF grant 0920578 to Janice M. Zengel and Lasse Lindahl, and NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC.*

Flexible Guanine Nucleobase Inhibitors of the HIV-1 Nucleocapsid Protein NCp7

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One of the most common antiviral treatments today employs nucleoside analogues. Nucleosides can act as enzyme inhibitors in viruses by competing with DNA or RNA for the active sites of important nucleic acid binding proteins. One of the most important obstacles these drugs must overcome is the development of resistance. Human immunodeficiency virus type 1 (HIV-1) is one of such viruses that has proven to be very challenging to treat due to the prevalence of mutations exhibited by viral enzymes. The HIV-1 nucleocapsid protein (NCp7) is a protein of interest because it is an essential protein involved in numerous processes of viral replication. This project specifically aims to synthesize flexible nucleobase analogues that can inhibit viral replication by binding to the nucleic acid binding site of NCp7 thus preventing DNA or RNA binding. A synthetic pathway was developed to reach a flexible analogue of guanine that could potentially inhibit NCp7. Currently, key intermediates have been realized along this synthetic pathway, but problems with stability and purification are impeding the finality of the complex synthesis. Once the synthesis is successful, introducing flexibility into these nucleobases may increase their efficacy as therapeutic agents and against HIV-1, even in the event of mutation.

*This work was funded, in part, through an Undergraduate Research Award from the UMBC Office of Undergraduate Education and by NIH/NIGMS MARC U*STAR T34 08663 NRS Award to UMBC.*

Determining the Role of Melanopsin C-tail in Deactivation and Trafficking Using Chimeric Constructs

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Melanopsin is a unique non-image forming visual pigment expressed in intrinsically photosensitive retinal ganglion cells in the vertebrate retina. These cells are involved in many non–image forming functions such as the photoentrainment of circadian rhythm and the pupillary light reflex. Melanopsin is deactivated through the phosphorylation of the C-tail followed by the binding of a β-arrestin molecule. β-arrestin contains a signal on its C-terminus that allows for internalization of G-protein coupled receptors (GPCRs) after inactivation. However, preliminary data suggests that melanopsin is not internalized. We hypothesize that the C-tail of melanopsin plays an essential role in the prevention of internalization. Angiotensin II type 1A receptor (ATII1AR) and B2 adrenergic receptor (B2AR) are two GPCRs known to bind β-arrestin and undergo endocytosis. To study the role of the C-tail in melanopsin deactivation and trafficking, the C-tail of melanopsin is replaced with either ATII1AR or B2AR c-tail using cloning and PCR. Through the use of DNA sequencing, we have confirmed that several chimeric constructs have been created. Our next step is to introduce our plasmids into Human Embryonic Kidney (HEK) cells to assess the localization and signaling of the constructs. These results will help determine the role of the melanopsin C-tail in its deactivation and trafficking.

*This study was supported, in part, by the Howard Hughes Medical Institute program, the NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC, and a National Eye Institute grant to P.R.R. (R01EY019053).*

Examining the RANK-L Inhibitor as a Potential Chemopreventative in BRCA1 Mutant Mouse Models

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Women with mutations in the breast cancer susceptibility gene-1 (BRCA1) have an increased risk of developing breast cancer. Traditional hormone therapies against these cancers are often ineffective because the tumors lack receptors for estrogen and progesterone. Thus, new therapies targeting the specific mechanisms subverted in BRCA1 cancers are of clinical importance. The receptor activator of nuclear factor kB ligand (RANK-L) has emerged as a potential target as it's been shown to drive mammary gland growth. Here, we examined the effects of a RANKL inhibitor (RANK-Fc) in a mouse model with loss of *Brca1* function. *Brca1* mutant mice were treated five times per week with RANK-Fc or placebo at three months of age and euthanized at nine months of age. We found that RANK-Fc treated mice had significantly fewer ductal abnormalities than null-treated mice. Moreover, Immunohistochemistry assays revealed that ducts from RANK-Fc treated mice retained progesterone receptor expression, a favorable quality in breast cancer treatment. Future studies look to further characterize the effects RANK-Fc treatment has on ductal morphology in *Brca1* mutants. Overall, these data support the use of a RANKL inhibitor as a potential chemopreventative in BRCA1-associated breast cancers.

*This work was funded, in part, by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC, the HHMI Undergraduate Scholars Program at UMBC, and the Howard Hughes Medical Institute.*

Synthesis of a New Potential Inhibitor of the Hepatitis C Virus Helicase

John Papanikos, *Dan Talley*
Paul Smith, Associate Professor, Department of Chemistry and Biochemistry

The hepatitis C virus (HCV) is a worldwide health concern, infecting approximately two percent of the global population. The current FDA approved therapy for HCV produces harsh side effects and is very expensive, especially in third-world countries. As such, new treatments for HCV are desperately needed. Several compounds have recently been identified that inhibit HCV replication at low to sub-micromolar concentrations. Two of these novel inhibitors have been shown to target the HCV non-structural 3 (NS3) helicase enzyme. The objective of the present research project is to synthesize a new compound based on these lead structures that has the potential to show activity at nanomolar concentrations. Starting from resorcinol and succinic anhydride, a Friedel-Crafts acylation and a Clemmensen reduction were utilized to give the corresponding acid. Subsequent benzylation followed by hydrolysis has yielded a key intermediate *en route* to the target compound. The full synthetic scheme to achieve the target compound, along with results to date, will be presented.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

The Diversity of Ribosomal Protein Function

Clarence G. Pascual, Lasse Lindahl, Mohamed Shamsuzzaman
Lasse Lindahl, Professor, Department of Biological Sciences; Mohamed Shamsuzzaman, Department of Biological Sciences

Cells contain many small translational machines called ribosomes. Each ribosome has 80 ribosomal proteins (RP) and four rRNA in *Saccharomyces cerevisiae* (yeast) but their biogenesis requires hundreds of additional unique proteins. Our lab has reported that repression of RPs synthesis in yeast not only disrupted ribosome biogenesis, but it also caused arrested cells at different stages of the cell cycle. These experiments employed a genetically engineered galactose inducible system to control the production of each of 54 RPs that made it possible to observe and classify the events occurring after the repression of individual RP synthesis. To characterize the cell cycle further, we relied on cell cycle dependent proteins that change their location and/or structure based on the position of the yeast cell within the cell cycle. In combination with fluorescent proteins and confocal microscopy, we were able to determine the location of these proteins after repression of RP synthesis. In-depth characterization of cell cycle arrest phenotype will further elucidate our understanding of how ribosome biogenesis is linked to cell cycle progression.

*This work was funded, in part, by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC.*

Children's Views about How Math Is Used by Themselves and Others

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Children's mathematical beliefs and understanding are often shaped by the math activities they engage in and see others do. Documenting children's beliefs about math is important for developing ways to improve children's math skills, an area of concern for educators and policy makers. However, there is limited research examining children's beliefs about math. The present study investigates children's awareness of how math is used in daily life, how others use math, and how these factors are associated with children's home math engagement. A sample of 99 children in first through fourth grade completed interviews detailing their uses of math and their beliefs about how others use math. Preliminary results show that children view math as something that is done primarily at school with teachers and classmates. That is, children do not see much of math's relevance to their daily lives. There are also grade-related differences in children's understanding of math and its uses. Discussion addresses how children's math development can improve by increasing their awareness of math's relevance for their everyday lives.

Building Egypt's Pyramid: A Lithic Past

Heather Perry
Esther Doyle Read, Lecturer, Department of Ancient Studies

Lithic or stone tools have been used by human populations for thousands of years. This research considers the function of several lithics in the UMBC Spiro Collection that were recovered on the ground surface at the site of the Bent Pyramid in the necropolis of Dahshur which dates to 2600 BCE. In order to establish whether these lithics were stone tools, the debris from manufacturing stone tools, or the debris from masons shaping the stones used in the pyramid, I examined their physical composition and compared their structure and appearance to lithics in other regional collections, as well as to the types of stones used in the construction of the pyramid itself. My research included an overview of the history of the Bent Pyramid, general pyramid construction techniques, and a consideration of the stone tools used during this period.

Using Quasi-Phase Matching for Enhanced Terahertz Generation

Timothy S. Pillsbury
L. Michael Hayden, Professor, Department of Physics

The goal of this project was to use a quasi-phase matching method to enhance the efficiency of difference frequency generation (DFG) to create terahertz (THz) frequency radiation in a layered nonlinear optical system. THz light has many applications from communications to medical and security imaging. Research has shown that applying femtosecond pulses of infrared light to poled nonlinear optical polymers creates THz light through DFG. It was found that as more layers of polymer were added, the THz generation increased. However, when the polymer becomes too thick, destructive interference of newly generated light with previously generated light causes a reduction of the total generated THz light. Theory suggests that by layering an inactive phase-matching layer between active layers of nonlinear polymers, this destructive interference can be diminished, and more efficient THz generation is possible. This project focused on providing experimental evidence to support the theoretical work. A system was created using layers of the nonlinear polymer DAPC in sequence with layers of fused silica. We observed an increase in the amount of THz light generated in this quasi-phase matched system as compared to the bulk DAPC system. Refinements to the theory were made based on comparison with the experimental data.

This work was funded, in part by the National Institute of Science and Technology (NIST), an Undergraduate Research Award from the UMBC Office of Undergraduate Education, and the UMBC Department of Physics.

Empathy Scores of Alcoholics and Non-Alcoholics

Alexander B. Pilon
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Limited research has been done measuring empathy in alcoholics. Previous research has shown that newly sober alcoholics (three to five weeks) have less empathy than non-alcoholics. The most effective treatments for alcoholism to date are 12-step programs. Essential to success in 12-step programs is helping other alcoholics. The empathy-altruism hypothesis suggests empathy motivates altruistic behavior – helping without conditions. A connection therefore can be suggested that links success in 12-step programs to empathy. The current study looks at empathy in alcoholics with long-term recovery (greater than five years), newly sober alcoholics (less than five years), as well as non-alcoholics. Both groups of alcoholics must regularly attend AA meetings (once or more per week). Empathy scores are determined by the Empathy Quotient (EQ) test. The current study tests the initial hypothesis that alcoholics with long-term sobriety will score higher on the EQ test, than non-alcoholics, who will score higher than newly sober alcoholics. The results will be used to evaluate AA's efficacy, and suggest possible improvements to be made in the field.

Autonomous Capacitor Bank Controller: A Means for Distribution Line Voltage Regulation

Timothy Potteiger, William Heckert*, Bradley Potteiger, Stephen DiBenedetto*
E.F. Charles LaBerge, Professor of the Practice, Department of Computer Science and Electrical Engineering

Among the concerns of an electricity-distribution company are losses in standard three-phase distribution lines due to a primarily inductive load. Capacitor banks are often used to counteract the inductive nature of the load on the lines, thus pushing the power factor on the line closer to the ideal value of 1.0. Existing capacitor bank controllers operate using a one-way paging system, with control messages coming from a central distribution center. Voltage drops due to reactive losses are detected at the distribution center and a control message is sent to a remote capacitor bank. After the control message is received the power factor is monitored to determine if the targeted bank switched correctly. We have developed a replacement to existing capacitor bank controllers that is capable of autonomously determining the need for capacitive compensation and verifying that the capacity bank switched successfully. In addition, our system is capable of independently controlling the bank corresponding to each phase of the distribution line, contrary to existing solutions where all three phases are switched together regardless of the needs of each phase individually. Together these solutions will help our system improve distribution efficiency and optimize resources involved in distribution maintenance.

This project was supported by a grant from Baltimore Gas and Electric Company, and by the UMBC Department of Computer Science and Electrical Engineering.

The Role of Polycomb Genes in the Development of *Volvox carteri*

Munanchu Poudel*, Salar Khaleghzadegan, Jose Ortega, Stephen M. Miller*
Stephen M. Miller, Associate Professor, Department of Biological Sciences

Volvox carteri is ideal for studying the evolution of multicellularity because it has a simple type of multicellular development and is closely related to unicellular species. *Volvox* has two cell types: large immortal reproductive cells called gonidia that produce juveniles and small mortal somatic cells that live for several days. The somatic cell fate is maintained by the *regA* gene: *regA* mutant somatic cells dedifferentiate, enlarge and develop as gonidia. Interestingly, *regA* encodes a transcription factor (RegA) related to the trithorax group (TrxG) protein Ultrapetella1 from *Arabidopsis*. TrxG proteins are chromatin regulators that act in opposition to repressive polycomb complex proteins. To determine whether RegA might act like a TrxG protein, we are using RNAi to knock down the expression of two *Volvox* polycomb genes, *extra sex combs* (*esc*) and *enhancer of zeste* (*Ez*). We made RNAi hairpin constructs that target *E(z)* and *esc*, and will transform a *regA* mutant separately with them to determine if either can suppress the *regA* phenotype. We are also preparing a hairpin RNAi construct that targets a different region of the *E(z)* gene as a second test of the function of this gene. The phenotypes of transformants will be described.

Increasing Success in Honors Chemistry

Ryan Price
Jonathan Singer, Associate Professor, Department of Education

This research targeted the achievements of tenth through eleventh grade Honors Chemistry students. The course was open to all students, allowing students with different backgrounds, learning styles, prior knowledge, and needs to enroll. Students enrolled in second semester Honors Chemistry have previously taken one semester of chemistry. As a result, they are familiar with their learning styles and recognize which methods do and do not result in their personal success. They articulated this to the teacher via journal entries collected on the first day. The instructor then incorporated real-life examples and group work/instruction, building from known vocabulary and ideas based on student journal entries. This study focused on Honors Chemistry students who scored less than 50 percent on the pre-test. Of those students, at least 75 percent are predicted to improve from the pretest to the Unit Assessment Test by 20 percent. Progression will be based on a mid-term quiz and finally the county-wide Unit Test.

Hardware Implementation of Support Vector Machine Learning Algorithm for Personalized Seizure Detection using EEG Signal

Alec Pulianas
Tinoosh Mohsenin, Assistant Professor, Department of Computer Science and Electrical Engineering

With health sensors improving and computing speed increasing, the field is ripe for exploration and innovation that will improve a patient's life. With this project, we are hoping to detect an epileptic seizure as it occurs so the proper steps can be taken. We do this by using an advance headband embedded with sensors. The data from the sensors is processed and goes through a support vector machine algorithm to determine if a seizure is occurring. The support vector machine algorithm is modeled and verified in MATLAB, and then the coefficients and support vectors are loaded onto an FPGA's onboard memory. This approach allows for the fastest and most accurate results while still being optimized for low power and a small footprint. Since the algorithm looks up the loaded values from MATLAB, the algorithm can be tailored for each individual patient for personalized health monitoring. The algorithm is being developed in a generic manner using test data so that it can be easily adapted to the real world data we receive from individual patients.

This work was funded, in part, through an Undergraduate Research Assistantship Support (URAS) Award from the UMBC Office of Research Administration.

Dance Literacy

Elizabeth Quinones
Christopher Rakes, Assistant Professor, Department of Education

Discipline-specific literacy is an important component within a dance class. Dancers' vocabulary understanding must go beyond comprehension and be applied to the physicality of dance movement. The present study examined the efficacy of an intervention to improve dancers' understanding of six important dance vocabulary terms and their ability to apply that vocabulary to their dance movements. The terms were: isolation, improvisation, flexed feet, pointed feet, plié, and relevé. The sample consisted of fifth-grade students at an urban elementary school. The terms were introduced verbally, through physical application, and through visual representations. By the end of the dance unit, the students were able to identify, demonstrate, and perform the vocabulary terms. The results of the diagnostic, formative, and summative assessments demonstrated that the use of multiple representations within the classroom has the potential to enhance dance literacy.

Diagnosis in the first view: Dropped-Head Congenital Muscular Dystrophy Caused by *de novo* Mutation in the *Lamin A/C* Gene

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Lamin A/C-related dropped-head syndrome is a rapidly progressive congenital muscular dystrophy and may lead to loss of ambulation, respiratory insufficiency, and cardiac complications. Thus the genetic diagnosis of dropped-head syndrome as LMNA-related congenital muscular dystrophy (L-CMD) and the implicated clinical care protocols are of vital importance. This disease may be underdiagnosed, as only a few genetically confirmed cases have been reported thus far. Therefore, we report the detailed clinical phenotype and a novel mutation. A boy exhibited an inability to raise his head during infancy. He then developed progressive axial and limb-girdle weakness and eventually lost ambulation at two years of age. Upon investigation of the genomic sequence a heterozygous deletion was observed in the patient that was absent from both unafflicted parents, indicating a novel de novo mutation p.Glu31del in the head domain of *Lamin A/C*. Based on the patient's distinctive symptoms, and due to the fact that the deletion occurred within the exon in a region which is highly conserved across vertebrates, we diagnose this mutation as pathogenetic.

This work was funded, in part, by the Muscular Dystrophy Association.

The Correlation between Aural Musicianship and Accuracy of Instrumental Music Playing

Catina Ramis
Jonathan Singer, Associate Professor, Department of Education

Students in a wind ensemble often cannot discern between correct and incorrect notes. This is due to the nature of the instruments; some jump octaves, intervals, and semitones with the slightest adjustment of embouchure. In order to address this situation, students participated in a series of ear-training and musicianship exercises every day in order to improve their performance of two county adjudication pieces. The ensemble was recorded playing those pieces at the beginning of March and during the rehearsal before adjudication three months later to evaluate success. The pre-assessment and post-assessment recording was compared to observe which portions of the pieces were improved over time with musicianship exercises including learning sol feg, singing passages, matching pitch, and using classroom instruments. The results of this particular class of 23 students were also compared to that of another class of seven students with relatively the same playing abilities and were not given specific musicianship training.

Carbon Monoxide Analysis in the Baltimore Area

Rosalind K. Ramsey
Christopher Hennigan, Professor, Department of Chemical, Biochemical, and Environmental Engineering

Carbon Monoxide (CO) is a criteria air pollutant due to its detrimental impacts on human health. Its main source in urban environments is fossil fuel combustion by motor vehicles. The goal of this research was to deploy a CO analyzer (Model 48C, Thermo Scientific) to make continuous highly time-resolved measurements in Baltimore, Maryland. Many steps needed to be taken before the analyzer could be deployed though. When the lab first received the analyzer, it was unable to work properly due to additions and broken parts. The CO analyzer works by measuring the attenuation of light at 4.6 µm, where CO strongly absorbs. After repairs were made the next step was to calibrate the instrument using zero and span gases. Once calibrations were completed, the data acquisition system and protocol were set up. The analyzer was then deployed on the roof of the UMBC Engineering Building to measure CO down to ppb levels in the Baltimore atmosphere. These results were be analyzed and are displayed at URCAD.

This work was funded, in part, by the Department of Chemical, Biochemical, and Environmental Engineering and through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Increase in Efficiency for Noise Cancelling in a Spin Qubit Array

***Muhed Rana**, Fernando Calderon*
Jason Kestner, Assistant Professor, Department of Physics

Quantum computing has the potential to perform difficult computations at significantly greater speeds than classical computing. The primary form of data representation in quantum computing is a quantum bit ("qubit"). A classical bit exists in only two states ("0" and "1") compared to a qubit which can exist in infinitely many states allowing for greater processing power. In our approach, the qubit is defined by the spin states, singlet and triplet, of a two-electron system in a double quantum dot. The fluctuations of the background nuclear spin bath and fluctuations in electrostatic quantum dot confinement potential affects the precise manipulation of the qubit. Our goal is to be able to cancel out these errors without knowing their quantitative value. We created an identity operation that would eliminate these errors to first order by forcing rotations of a certain speed and length on the qubit. Previously, the identity operation would correct both errors relatively slowly. To speed up these results, we chose one error to cancel under the constraint that this error was significantly greater than the other. As a result, we halved the time of error-canceling.

Do People with Antisocial Personality Disorder Engage in Different Patterns of Abuse than Other Partner Violent Men?

Casey A. Rezac
Chris Murphy, Professor, Department of Psychology

Most research on Antisocial Personality Disorder (ASPD) examines how current treatment methods are not effective in treating the disorder. One likely reason that treatment methods have limited effects is that people with antisocial personalities have different motivations and reactions to their problematic behaviors. This study examined how men with ASPD behave differently before and after committing intimate partner violence (IPV) in contrast to men without ASPD. Specifically, antecedent behaviors including steps to prepare for abuse, and emotional reactions and behaviors after the abuse were examined. Participants were males who were recruited from the Domestic Violence Center of Howard County during treatment for an IPV incident, and data were collected from surveys completed before treatment. Results showed that men with ASPD took more steps to prepare for abuse than men who did not have ASPD. In addition, men with ASPD reported different emotional reactions after abuse than those without ASPD. This is significant for treatment of this subset of abusers because if motives are different for abusing, as seen by behaviors before and after, then treatment programs currently designed for the general population may need to be adapted to address the abusive behaviors found among people with ASPD.

The Evolution of Trades and Occupations in Industrial England

William Henry Thomas Rice
David Mitch, Professor, Department of Economics

Many occupations have evolved over the span of centuries. Whilst some have been enhanced dramatically over the course of time, others have come to be totally outdated. This research investigates how job responsibilities and wages evolved during England's Industrial Revolution. In order to gain insight regarding the development of different positions, I utilized contemporary guides written for parents and young people. These guides explained potential occupations and trades by providing rich detail on occupational job content. I looked at these guides from various time periods and traced out changes as well as aspects that remained the same. When investigating these trends I needed to take into consideration the motivations of those who published the information. Some were interested in educating middle class families, others wanted to provide clear job expectations for the working class, and a few seemingly published their work to gain favor with the upper class. My presentation features a few contrasting occupations including professions that did not change during the Industrial Revolution as well as some that only emerged for the first time during this period. The aim of this presentation is to clearly depict how wages and vocational responsibilities evolved in Industrial England.

This work was funded, in part, through an Undergraduate Research Assistantship Support (URAS) Award from the UMBC Office of Research Administration.

Development of a Cell Migration Model to Characterize Clustered Movements

Donald B. Richardson, *David Stonko, Bilal Moiz, Ann Marie Weideman*
Michelle Starz-Gaiano, Assistant Professor, Department of Biological Sciences; Bradford Peercy, Assistant Professor, Department of Mathematics and Statistics

A main issue in developmental biology is how cells transition from a stationary to a migratory phase. Many factors determine a cell's movement through complex and changing environments. We aim to understand how the adhesive, repulsive, migratory, and stochastic forces are involved in the initiation of motility, and the subsequent rearrangement of non-migratory cells. Our group uses egg development in Drosophila to study cell movement because it is well-characterized and amenable to molecular and genetic analysis. We developed a mathematical model defining computationally identical mathematical cells (IMCs), which represent motile cells *in vivo*. Sets of IMCs make up large non-motile biological cells. Using this dynamic cell model based on force balance, we can simulate the impact of different forces to determine how they contribute to cell movements. We hypothesize that the initiation of motion follows two steps: 1) increased adhesive force causing cell clustering followed by 2) increased sensitivity to chemical gradients causing migration. These two steps allow a cluster of cells to migrate out of a tissue, while promoting the re-closure of the gap left behind. Understanding this process could potentially help further studies in other contexts such as the metastasis of tumor cells throughout the human body.

*This work was funded, in part, by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Determining the Degree of Radiative Deceleration of Blazar Jets Due to Inverse Compton Scattering from Seed Photons in the Molecular Torus

David Rivas
Markos Georganopoulos, Associate Professor, Department of Physics

Although superluminal jets have been observed propagating outside the pc-scale molecular torus region in some blazars, there remains a question as to whether these jets actually originate inside the molecular torus or at larger distances from the nucleus. One way to resolve this question is to determine the degree to which these jets will slow due to inverse Compton (IC) scattering from infrared photons produced in the molecular torus. Calculating the deceleration of these jets as a function of distance provides a method for determining whether or not jets produced inside the torus are capable of sustaining the highly relativistic speeds routinely observed with radio interferometry. Using the IC deceleration model, we have determined the jet speed as a function of distance using a power-law electron energy distribution and a non-radiating contribution to the total energy content of the jet (the baryon loading factor). The degree of deceleration is highly dependent on this factor, but can be very significant for ratios of electron energy to non-radiating energy less than or equal to approximately 0.5, a value that we have inferred to be reasonable for the bright flares of quasar 4C 21.35. The characteristics of this quasar may also be shared with other blazars and therefore provide broader implications.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education

The Search for DNA Binding Sites on Crotamine through Protein Chemical Modifications

Amy S. Rizkallah, James T. Han
Richard Karpel, Professor, Department of Chemistry and Biochemistry

Crotamine is a protein that is a toxic component of the venom of *Crotalus durissus terrificus*, the South American rattlesnake. Previous research has shown that crotamine has a high specificity for actively proliferating cells and could potentially serve as a drug carrier, because of its binding affinity for DNA. Analysis of the DNA binding surface on crotamine is of interest and is the key point of this project. Previous research conducted in Dr. Karpel's lab showed that there are at least three pairs of basic residues, arginine and/or lysine, which form ionic bonds to DNA. In addition, previous studies have shown that tryptophan fluorescence quenching occurs after DNA binding, possibly due to the π-stacking of the aromatic ring. The purpose of the study is to conduct specific protein chemical modifications on the arginine amino acid residues of crotamine and to determine where DNA-crotamine complexes are formed. Use of mass spectrometry will ascertain which of these residues contribute to DNA binding. The discovery of the significant DNA binding sites on crotamine could be used for drug design and medical applications in the future.

This work was funded, in part, by DRIF funds from UMBC.

A Perspective of BMX Culture in Baltimore

Dustin F. Roddy
Kathy Scales Bryan, Senior Lecturer, Department of American Studies

BMX bike riding is an activity that takes place in public spaces such as city streets, skateparks, and wooded trails, where individuals perform stunts and engage in a community. This participant-observation study examines reasons why individuals participate in this sport and the culture of the sport in the Baltimore area. Qualitative research methods were used, which included video recorded interviews, as well as video recording of the participants performing their activity and participant observation. The interviews were conducted with individuals that were 18 and up to gain a range of insights, and concentrated on their viewpoints on riding BMX bikes. The analysis was incorporated into a short documentary film showing the skills of the participants and providing a perspective into the microculture of BMX bike riding in Baltimore.

Retention of Computing Majors

Patrick Roderick, *Rebecca Chhay, Nicholay Topin*
Marie desJardins, Professor, Department of Computer Science and Electrical Engineering; Megean Garvin, Research Associate, Department of Computer Science and Electrical Engineering

The number of students declaring a Computer Science or Computer Engineering major at UMBC has risen recently; however, many incoming students do not finish with a computing degree. In addition, there is a significant lack of gender and racial diversity in the student population entering and succeeding in the computing majors. Utilizing data gathered from UMBC's data warehouse, we analyzed what factors are most significant in identifying students who would struggle in the computing majors. We extracted relevant variables from this data and then applied machine learning algorithms and data visualization tools in order to rate and analyze these factors for their potential to impact student success in the major. By analyzing the student cohort as subgroups, we were able to discover which factors had the highest real impact on retention overall. One goal is to determine which classes are most critical in forming a student's foundation for learning and what are the "keystone" courses in which students may have difficulty, possibly causing them to lose interest in the computing fields. These findings will enable us to reevaluate our curriculum and tutoring resources in order to better serve our students and more efficiently use educational resources.

This work was funded in part by NSF REU Supplement CNS-1340444.

Production and Characterization of *Aspergillus nidulans* Mutants for Increased Protein Secretion

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Mark R. Marten, Professor, Department of Chemical, Biochemical, and Environmental Engineering

Filamentous fungi are widely used in the biotechnology industry for production of therapeutics, commodity chemicals and enzymes, whose combined value exceeds $10 billion annually. One of the challenges related to fungal production of recombinant protein has been inconsistent secretion of heterologous proteins. Since this big difference in secretion phenomena is poorly understood, the overarching goal of this project is to gain insight regarding various cellular mechanisms involved in fungal protein secretion. We hypothesize a relationship between aberrant morphology (i.e., highly-branched) and increased protein secretion. To test this hypothesis, roughly 700 highly branched, temperature-sensitive (Ts) mutants of the model fungus *Aspergillus nidulans* were generated and screened for increased α-amylase and cellulase protein secretion. Qualitative analysis of α-amylase secretion showed that 125 mutants secreted high amounts of α-amylase while analysis of cellulase secretion showed that only a few of them had higher cellulase secretion compared to wild type. Currently, in depth phenotypic characterization processes are being conducted on the 125 high secreting mutants. This allows categorization of mutants, 25 of which will eventually be sequenced. Understanding the genetic alterations leading to various phenotypes will provide a better understanding of the genomic causes for the resultant high secretion phenotype for α-amylase.

*This work was supported, in part, by NSF grant No. 1159973 to MRM, a grant to UMBC from the Howard Hughes Medical Institute through the Precollege and Undergraduate Science Education Program, an Undergraduate Research Award from the UMBC Office of Undergraduate Education, and the MARC U*STAR Program at UMBC through the National Institute of General Medical Sciences.*

Reading Tables and Graphs in the Science Classroom

Nicole R. Ryan
Jonathan Singer, Associate Professor, Department of Education

This study takes place in a high-needs middle school. Its focus is to improve students' ability to interpret tables and graphs. This is a skill that they will use in nearly every school subject and on every standardized test for the rest of their academic careers. It is also an essential life skill, as tables and graphs are used by all adults on a regular basis. In order to help students improve in this area, the teacher has infused regular course content with tables and graphs and has used warm-ups and exit tickets containing real-world examples for further practice. The teacher has modeled and used think-alouds to demonstrate thought processes when looking for trends, broken graphs into essential parts so that students understand the function of each piece of information that is presented, and helped students make graphs in order to better understand how to read them. The baseline data were established with a pre-test. Student progress was assessed using a midpoint test and a post-test. The goal of this study is to have 80 percent of students improve by 20 percent from the pre-test to the post-test.

Functional Response of Parasitoid Wasps to Host Density: Implications for Density Dependent Selection

Adam T. Rybczynski
Jeff Leips, Associate Professor, Department of Biological Sciences

The functional response measures the influence of prey density on predator attack rate. The functional response elucidates the role of prey density on predator population dynamics and can shed light on the coevolution of predator and prey traits. Here we studied the functional response of the parasitoid wasp *Leptopilina boulardi* to the density of its host, larvae of the fruit fly *Drosophila melanogaster.* The interactions between *L. boulardi* and *D. melanogaster* larvae were examined through statistical analysis to measure the impact of varying larval density on both the survival of the host (with and without exposure to the parasitoid) and the number of parasitoid wasps that emerged from hosts. Our data will not only clarify the role of host density on parasitoid fitness, it will also reveal density dependent survival of hosts without parasitoids, setting the stage for future studies of how density dependent selection influences the coevolution of hosts and parasitoid traits.

Investigating the Association between Having a Same-Sex Relationship and Self-Reported Health in Europe

Becca Scharf
Jamie Trevitt, Assistant Professor, Department of Health Administration and Public Policy

The purpose of this project is to examine the general association between homosexual relationship status and self-reported health. Self-reported health (SRH) is the measure of a study participant's general well-being that is based on their personal perception of their health status. SRH has been commonly used to investigate trends and inequalities in population health to identify disparities within subpopulations. This exploratory research analyzes data from the Gender and Generations Study (GGS), a large multinational harmonized dataset which allows for cross-country comparison. Specifically, this study focuses on data collected from Germany, France, Belgium, and The Netherlands and utilizes a probability sample that is representative of each country's non-institutionalized population ages 18-79. Through the use of descriptive statistics we compare the self-reported health of study participants who reported being in a same sex relationship to those who reported having a heterosexual relationship or no relationship, while controlling for other demographic variables (sex, age, education, employment status, and number of children). Findings from this study can contribute to existing literature on homosexual health in order to help identify potential health risk factors within the homosexual population that could be addressed through public health campaigns and targeted programs.

College Students' Reading Comprehension Monitoring of Lexical and Semantic Violations in Think Aloud and Response Time

Alicia Serrato, *Keerthi Yarlagadda, Narcisse Fon, Allyson Nedzbala, Jonathan Shonk*
Linda Baker, Professor, Department of Psychology

Comprehension monitoring, the ability to actively evaluate and construct while reading, is a critical skill for academically successful college students. The present study examined how college students monitored their understanding of passages containing lexical and semantic violations. Using either a think-aloud or computerized response-time procedure, participants read a passage and judged its comprehensibility. Passages varied in clarity on the basis of a single target word intended to be coherent, a slight violation of word knowledge, a blatant violation, or an unknown word. In both tasks, participants indicated whether the target word was a good completion for the sentence context. The think-aloud protocol allowed participants to explain their reasoning. Analysis of the computerized response times and accuracy data revealed coherent passages to have fastest response times and highest accuracy rates, whereas slight violation passages had the longest response times and lowest accuracy. Furthermore, blatant violation passages had shorter response times than non-word passages but also lower accuracy rates. Validated passages are currently being used in an fMRI study assessing individual differences in brain activation during cognitive monitoring. Results may reveal if training in comprehension monitoring can enhance critical reading abilities in college students, a vital skill for academic success.

This work was funded, in part, by the UMBC Office of Research Administration

Investigation of Dimerization Mechanisms in the Simian Immunodeficiency Virus 5'-Untranslated Region

Michelle Seu*, Thao Tran*
Michael F. Summers, Professor, Department of Chemistry and Biochemistry and Investigator, Howard Hughes Medical Institute

Simian Immunodeficiency Virus in chimpanzees (SIVcpz) and Human Immunodeficiency Virus Type 1 (HIV-1) are similar genetically and structurally in their viral genomic 5'-Untranslated Regions (5'-UTR). HIV-1 studies have shown that dimerization, the interaction between the Dimer Initiation Site (DIS) stem loops in the 5'-UTR of two copies of RNA, leads to genomic recognition by the Gag polyprotein. Because dimerization plays a major role in the genomic packaging during the late phase of the viral life cycle, it is our experimental focus. We hypothesize that the SIVcpz 5'-UTR has a dimerization mechanism similar to that of HIV-1. In the monomeric conformation, the DIS interacts with the unique-5' region (U5), while in the dimeric conformation, the AUG stem loop displaces the DIS, exposing DIS for interaction with the DIS of another viral RNA copy. We utilize time-dependence, magnesium-dependence, and protein-RNA binding analyses through gel electrophoresis to work with three different SIVcpz RNA constructs: wild type (wt), truncated AUG (trAUG), and deleted AUG (dAUG). Thus far, we have found that each construct reaches their equilibrium within the first two hours of incubation, the amount of dimer increases as magnesium concentration increases, and protein-RNA binding tests have been inconclusive and are currently in progress.

Funding was provided by NIH grant No. 5 R01 GM04265 and the Howard Hughes Medical Institute.

A Multifaceted Approach for the Analysis of Electronic Cigarettes using DSA-TOF and Headspace GC-MS

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William R. LaCourse, Professor, Department of Chemistry and Biochemistry

Electronic cigarettes have become increasingly popular as a proposed safer and cleaner alternative to conventional cigarettes. These electronic cigarettes have also been adopted as a tool to help people quit smoking. Electronic cigarette companies claim the produced aerosol is harmless; however, with the lack of FDA regulation and research in this area, more experiments are needed to conclusively refute or support this claim. DSA, an ambient ionization source for mass spectrometry, easily detects compounds in the aerosol that is produced. Additionally, headspace GC-MS will detect any volatile organic compounds present, helping to identify what is in the sample. The goal of this research is to analyze differences between the electronic cigarette aerosol compared to the liquid itself. Ultimately, DSA-TOF will be used as an initial screening tool of volatile and non-volatile molecules and headspace GC-MS will be used to confirm and quantify volatile molecules in the electronic cigarette aerosol. The research will explore the differences between the liquid and the aerosol by the use of the various techniques currently available.

This work was funded, in part, by the Molecular Characterization Analysis Complex (MCAC) and PerkinElmer.

Removal of Moxifloxacin from Wastewater by Adsorption onto Activated Carbon

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Lee Blaney, Assistant Professor, Department of Chemical, Biochemical, and Environmental Engineering

Antibiotic residuals have been widely detected in different environmental compartments (i.e., wastewater, surface water, and sediment) due to the intensive use of pharmaceuticals for the past several decades. Moxifloxacin (MOX), a fluoroquinolone antibiotic used in medication prescribed for sinusitis and bronchitis, was routinely detected in raw wastewater and wastewater effluent with concentrations ranging from 17-125 ng/L. The incomplete removal of MOX in wastewater treatment plants and subsequent discharge of MOX into surface water represents a risk to human health and ecological function. To ameliorate this situation, we investigated treatment of MOX by adsorption onto powdered activated carbon (PAC). Batch equilibrium tests using buffered solutions demonstrated that PAC was capable of adsorbing MOX with capacities as high as 23 µg/mg at near-neutral pH and room temperature. Different wastewater matrices (i.e., raw wastewater and wastewater effluent) and temperatures were also studied to elucidate adsorption equilibrium. Despite the fact that dissolved organic matter from these matrices decreased MOX adsorption onto PAC, PAC remains an effective solution to treatment of antibiotics in wastewater.

This research was supported in part by a grant to UMBC from the Howard Hughes Medical Institute through the Precollege and Undergraduate Science Education Program. Additionally, this work was funded, in part, through an Undergraduate Research Assistantship Support (URAS) Award from the UMBC Office of Research Administration.

Examining the Photoluminescence and Band Gap Energy of Gallium Arsenide (GaAs)

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Gallium Arsenide (GaAs) is a useful III/V semiconductor material that can be used as a substrate and/or an active component for infrared optoelectronic devices in applications for health and the environment. GaAs has a direct band gap that can therefore emit light which is useful in LEDs and laser diodes. The purpose of this experiment is to examine the photoluminescence (PL) and the band gap energy of GaAs when undergoing large temperature changes by using a Titanium Sapphire laser, a cryostat to cool down the sample, and a spectrometer to measure the intensity and the wavelength of the PL. GaAs is excited with the Ti:Sapphire laser and the sample absorbs energy that is larger than the band gap energy. Electrons are excited from the valence band to the conduction band, leaving behind a positively charged hole. Electrons will lose some energy due to phonon scattering before coming to rest in the conduction band minimum. PL is the emission of the photon as the electron recombines with the hole. We are assuming that the PL intensity peak is the band gap energy, and the main purpose is to measure the temperature dependence of the GaAs band gap.

This work is based upon work supported by the National Science Foundation under Grant No. EEC-0540832.

Hungry Monsters: A Computational Model for the Evolution of Metabolic Gene Regulation

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Ivan Erill, Assistant Professor, Department of Biological Sciences; Muruhan Rathinam, Associate Professor, Department of Mathematics and Statistics

Prokaryotic cells live in variable environments where information signals may fluctuate rapidly. These cells use transcription factors to regulate gene expression in response to these noisy signals. The interaction between transcription factors and genes form Gene Regulatory Networks, and these networks feature commonly repeated patterns known as network motifs. It has been hypothesized that many of these motifs have evolved because they efficiently deal with transient signaling from the environment. To test this hypothesis we have developed a computational model of the evolution of Gene Regulatory Networks that deals with sugar metabolism in a variety of environments. The model describes the dynamics of gene regulation and the evolution of network structure. The primary aim of this model is to identify efficient network structures and to determine how these structures are derived by natural selection.

This work was supported by the UBM program of the National Science Foundation under Grant No. DBI 1031420.

ROS Mediators Control E-cadherin Expression in Drosophila Prohemocytes

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Pluripotent stem cells play a critical role in the treatment of many diseases and disabilities due to their characteristic ability to produce many cell types in the body. However, although they serve as a vital tool to understanding the cell biology of various diseases, many of the molecular mechanisms that regulate stem cell multipotency and differentiation remain unknown. Previous studies have shown that E-cadherin inhibits embryonic stem cell differentiation and induces pluripotent stem cells. Additionally, increased levels of reactive oxygen species (ROS) are concomitant with differentiation. However, whether ROS controls E-cadherin levels to regulate stem cell differentiation has not been established. We are using the model organism, *Drosophila melanogaster*, due to the many conserved regulatory pathways that exist, to determine if ROS downregulates E-cadherin to promote differentiation. Our results indicate that antioxidants superoxide dismutase 2 (SOD2) and catalase (Cat) maintain E-cadherin expression. These findings suggest that E-cadherin is downregulated in response to elevated ROS levels. Better characterization of these regulatory networks responsible for stem cell multipotency and differentiation will allow for improved stem cell based regenerative therapies.

*This work was funded, in part, by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC, the HHMI Undergraduate Scholars Program at UMBC, and the Howard Hughes Medical Institute.*

Mathematics Instruction in Mendelian Genetics

Callison C. Sims
Jonathan Singer, Associate Professor, Department of Education

This research project was developed at a local technical high school in order to improve students' mathematical and probability skills, as a basis for increasing student learning of Mendelian genetics. Past data indicated students had difficulty manipulating and drawing conclusions from mathematical data, affecting their performance in understanding genetic concepts. The research focused on a class of 14 ninth-grade boys, five of whom had Individualized Education Plans (IEPs). To determine baseline data, students were given the Genetics Benchmark exam and a test on Punnett squares. In order to increase student learning, intervention strategies such as explicit mathematical instruction in probability and inquiry-based learning activities were enacted. Instruction was also differentiated to accommodate the needs of all students, including those with IEPs. After five weeks, students were given the same tests as a post-assessment measure.

A Simplified Mathematical Model to Predict Activation of Migration of Drosophila Egg Chamber Border Cells

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Bradford E. Peercy, Assistant Professor, Department of Mathematics and Statistics; Michelle Starz-Gaiano, Assistant Professor, Department of Biological Sciences

Cell migration is a critical phenomenon in developmental biology. In particular, egg chamber development in the model organism *Drosophila melanogaster* provides an optimal opportunity to observe the migration of epithelial border cells that plays a role in the development of the embryo. A key pathway in this process, the Janus Kinase/Signal Transducer and Activator of Transcription (JAK/STAT) pathway, involves the uptake of the ligand Unpaired (Upd) by follicle cells, which causes the activation of this signaling pathway. We used a previously derived system of differential equations that modeled the JAK/STAT signaling pathway. We simplified this system and coupled it with a spatio-temporal model of Upd to quantify the number of cells that migrate. Going forward, we will visualize STAT signaling *in vivo* and use genetic mutants to address the requirement of this pathway on cell movement. At the same time, we will advance our mathematical model to simulate the biological situation and predict the variation in cell activation patterns due to mutations. This research will help to understand cell migration, which may lead to the discovery of migratory pathways for the metastasis of cancer and the occurrence of other developmental defects.

This work was funded by a grant from the National Science Foundation for the Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences (UBM Program).

Plain Ware Artifacts from Israel

Alexandra Slepushkina
Esther Doyle Read, Lecturer, Department of Ancient Studies

The Spiro Collection comprises ancient artifacts from the Mediterranean Region. One group in particular, SP-362, contains a number of small sherds from Israel that, according to the notes in the Spiro catalog, may be "plain ware." My research attempts to determine whether the sherds are domestically made, what time period(s) the sherds are from, and what type of ceramic ware(s) is represented by these sherds by comparing images of plain ware of known provenience from Israel and images of typical elite wares from the same time period to the sherds that are in SP-362. Plain wares are conventional vessels that would have been used to cook or consume food every day by non-elites. As such, these sherds may indicate different class structures in the civilization that used them. By determining whether the sherds are domestically made or imported, we can learn about the civilization's economy and trade.

Design of a Non-invasive, Low-cost Brain-Computer Interface to Communicate Emotional State

Eric Sluder, Nicole Whewell, *Stephen Moore, Xuanzhu Zhu*
E.F. Charles LaBerge, Professor of the Practice, Department of Computer Science and Electrical Engineering; Fow-Sen Choa, Professor, Department of Computer Science and Electrical Engineering; Kaleb McDowell, Branch Chief, Translational Neuroscience at Army Research Laboratory

Brain-computer interfaces (BCIs) are mechanisms that facilitate direct communication between an individual's brain and an external machine, with emergent technologies now making practical and commercial applications viable. The goal of this project was to design a BCI system that communicates the emotional state of one user to another. Our design collects, in real time, data from a user by means of electroencephalography (EEG), the measurement of current flows of the brain's neurons via the scalp. The system then uses the recorded electrical data to statistically determine the emotional state of the user over a period of time. Lastly, the system haptically and visually communicates the state to another individual via an electromechanical device worn around the wrist. The design incorporates commercially available EEG hardware for data collection, a custom smartphone application, a microcontroller for data processing and reception, and light emitting diodes (LEDs) with a vibrating motor for emotional state communication. Potential uses of such a system include the development of more robust lie detection methods, warning and prevention of adverse behaviors influenced by strong emotion, and cost effective aids to therapeutic counseling.

This work was funded, in part, by UMBC Department of Computer Science and Electrical Engineering.

Identification of Potent Transformation Products of Fluoroquinolone Antibiotics formed during Water Treatment

Sebastian J. Snowberger
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Increases in worldwide consumption of pharmaceuticals have resulted in unprecedented pharmaceutical concentrations in wastewater. Fluoroquinolones (FQs) are a commonly prescribed group of antibiotics that are regularly detected in wastewater streams. Previously, we investigated the transformation of FQs using ultraviolet (UV) light as a potential wastewater treatment method. While FQs have been experimentally degraded by UV light, we hypothesized that some transformation products were not environmentally benign. Liquid chromatography tandem mass spectrometry analyses indicated that decreasing concentrations of treated FQs coincided with the generation of structurally similar FQs, which suggested the potential for treated wastewater streams to retain antimicrobial potency. These transformation products were degraded, along with the original compound, with continued UV exposure. An *Escherichia coli* assay was used to investigate the antimicrobial activity of treated solutions by comparing the inhibition profile of a standard FQ solution to that of treated solutions containing the FQ of interest and transformation products. Three pairs of FQs were investigated: enrofloxacin, which degraded into ciprofloxacin; difloxacin to sarafloxacin; and pefloxacin to norfloxacin. The maximum observed yield was approximately 25 percent, and the required treatment objective was up to 30 percent greater when accounting for antimicrobially active transformation products.

This work was funded, in part, through an Undergraduate Research Assistantship Support (URAS) Award from the UMBC Office of Research Administration and an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

The Impact of Free Writing on Formal Writing Assignments

Amanda A. Sockriter
Cheryl North, Assistant Professor, Department of Education

Research in the area of writing pedagogy focuses on how to promote student achievement on formal writing assignments because students must be able to write in a way that is appropriate to task, purpose and audience. This study contributes to this area of research by analyzing the effect of completing informal writing before formal writing to determine if pre writing activities have a positive effect on students' formal writing in the areas of organization and clarity. Eleventh grade English II students at an urban high school who struggle in these two areas responded to exit tickets, wrote free verse poetry, took notes from class discussion and wrote Friday Free Writes. These assignments acted as pre-writing activities before the formal writing and the prompts were similar to what will later be included in the formal assignment. These students were given a formal timed prompt for the pre and post assessment and their writing was graded using a rubric by two people to determine if pre-writing helped improve their writing on timed prompts found on tests.

Anticipatory Ethics in Engineering Regarding the Future of Powered Exoskeletons for Social, Explorative, and Military Use

Joshua Standiford, Daniel Abid
Richard Wilson, Lecturer, Department of Philosophy

A fundamental component of being an engineer is the ability to predict the impact of releasing a new technology on the world. Using the tools of anticipatory ethics, this research project will delve into what effect powered exoskeletons will have on the future. This project focuses on using different paradigms of ethical analysis such as contractarianism, consequentialism and deontology. Using the ethical paradigms listed we made predictions on how previous technologies akin to this were used upon their release. We first looked at the impact that powered exoskeletons would have on the military. Our first topic conclusion was that powered exoskeletons will become weaponized and change the way war is waged. Therefore, this technology should be released with constraints that prohibit its usage in warfare. Our research also looked into the usage in social and explorative affairs. We used the same research methods on explorative and social applications and concluded that this technology will have significant impacts on how we explore space and the ocean, as well as how we assist the elderly and sick and how we perform our jobs.

Targeting the Nucleocapsid Protein of HIV-1 (NCp7) With Nucleobase Flexibility

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Katherine Seley-Radtke, Professor, Department of Chemistry and Biochemistry

One of the challenges in medicinal chemistry is the development of drug resistance to current therapeutics through various mechanisms. Our laboratory is focused on overcoming point mutations to amino acid residues that are critical to inhibitor binding in an enzyme's active site. The human immunodeficiency virus type-1 (HIV-1) can develop drug resistance at a rapid rate and circumvent available treatments, thus there is a need for more efficacious drugs. To overcome this challenge, we will endow the nucleobase with flexibility, allowing the molecule to "wiggle and jiggle" in the binding site and engage secondary amino acid residues that are not normally involved in the enzyme's mechanism of action, thereby retaining its biological activity. We will use this approach to target the highly conserved nucleocapsid protein of HIV-1 (NCp7), which is essential for proper viral packaging and replication, making it an ideal drug target. Using existing NMR spectroscopic data, our collaborator Dr. Maurizio Botta performed computational studies of NCp7 using a series of flexible guanine nucleobase analogues as potential inhibitors. We hope to realize one of these targets through a series of synthetic steps to build the requisite nucleobase.

This research was supported in part by a grant to UMBC from the Howard Hughes Medical Institute through the Precollege and Undergraduate Science Education Program.

Using Structural Parameters in Transcription Factor Binding Site Prediction

Nicholas Stewart
Ivan Erill, Assistant Professor, Department of Biological Sciences

This project addresses the problem of identifying transcription factor binding sites using physical parameters, as opposed to current methods that only use nucleotide sequences to predict possible binding sites. Proteins called "transcription factors" bind to sites on the DNA strand and control whether the transcription of genes will be promoted or inhibited. Identifying the sites where they bind gives researchers a clearer picture of how genes are being regulated. Typically, prediction is done by analyzing DNA sequences, using a sequence-based model of transcription factor binding. Research has shown that some transcription factors will bind to specific sites at one genomic location, but not to another location with the same nucleotide sequence. This shows that some transcription factors are dependent (for binding) on the structure of the DNA molecule and not just nucleotide sequence. The goal of this project is to calculate structural parameters from a nucleotide sequence, and then use those parameters to enhance the prediction of binding sites. This project builds on previous research by creating portable libraries for the inference of structural parameters that can be deployed inside of existing prediction programs. It is currently being used to analyze the structural preferences of well-known transcription factors in bacteria.

This work was funded, in part, through an Undergraduate Research Assistantship Support (URAS) Award from the UMBC Office of Research Administration.

Optimization of Triacylglycerol Production in *C. zofingiensis* and Enzyme-based Conversion for Biodiesel Production

Stephanie D. Stookey
Yantao Li, Principal Investigator, Institute of Marine and Environmental Technology; Jin Liu, Research Assistant, Institute of Marine and Environmental Technology

Microalgae are promising feedstock for biodiesel production due to their rapid growth and high lipid accumulation. This study examines growth and triacylglycerol production in the unicellular microalga *Chlorella zofingiensis* under nitrogen-rich (1.5 g/L $NaNO_3$) and nitrogen limited conditions (0.15g/L $NaNO_3$) for eight days. The results showed that *C. zofingiensis* grew slower in nitrogen-limited media while accumulating a higher amount of Triacylglycerol (TAG). This study also analyzes enzyme-based and chemical conversion of algal oils into biodiesel, and optimizes the method for enzyme-based conversion. The results indicate that an enzyme-based method can completely convert algal lipids into biodiesel without the need of acid as a catalyst. A 1:5 oil to *t*-butanol ratio and six-hour incubation at 45° C with algal lipids was found to be optimal for enzyme-based conversion. Our results suggest that *Chlorella zofingiensis* is suitable for biodiesel production while enzyme-based conversion provides an efficient and environmentally friendly alternative to chemical based conversion for biodiesel production.

This work was funded, in part, by Institute of Marine and Environmental Technology, The Living Marine Resources Cooperative Science Center, Dr. Yantao Li and Dr. Jin Liu.

Optimization and Exploration of Sampling Methods Affecting Ionization Efficiency for Direct Sample Analysis (DSA)

Suejane I. Tan*, Ian W. Shaffer, Rebecca L. Neubauer, Margaret E. LaCourse, Gregory T. Winter, Joshua A. Wilhide*
William R. LaCourse, Professor, Department of Chemistry and Biochemistry

DSA is a recent innovation by PerkinElmer that streamlines the way samples are ionized for mass spectrometric analysis while providing rapid, continuous sampling with high throughput. DSA is currently in a class of its own with an expanding scope of applications, creating a need to explore and optimize conditions affecting sample ionization to enhance productivity and performance in both the real world and laboratory settings. Caffeine and rhodamine-6G standards are applied to the sample screen of the DSA and exposed to the ionization source to study instrumental parameters and environmental variables predicted to affect ionization. These factors include: dryness of a sample, screen materials, surface area covered, distance between the screen and source, and voltages applied. Each variable was tested independently and in different combinations, producing mass spectra that can be compared using multiple factors including signal-to-noise ratio and peak area. After preliminary trials, we observed that dried samples showed better peak intensities and signaling to noise ratios compared to wet samples and that increasing the voltages applied to the needle resulted in spectrum with higher resolution. With continuing efforts to develop optimal methods, we hope that understanding and producing efficient sampling methods will lead to improved quality of spectrum data.

This work was funded, in part, by the Molecular Characterization Analysis Complex (MCAC) and PerkinElmer.

From the Lion's Mouth: the Syrian Refugee Crisis from a Jordanian Perspective

Ke Tang
Brigid Starkey, Lecturer, Department of Political Science

The Syrian civil war has raged over the last three years, sending the country and its neighbors into a state of prolonged humanitarian crisis. Jordan, one such neighbor, has suffered greatly in the face of the growing number of Syrian refugees flowing across its borders. During my stay in Jordan from January to August of 2013, I had the opportunity to work with the displaced Syrian population as part of Jordanian non-governmental organization work inside refugee camps. The focus of my subsequent research has been on Jordanian expert public opinion on the ramifications of the refugee crisis. I sought out members of Jordanian civil society – a sampling of the country's intellectual elite – and interviewed them on their perspectives of the crisis and the Jordanian response to it: specifically, how they saw their country's level of preparedness, its response, and their outlook for the future – during a time when the crisis seems indefinite and tensions between Syria and Jordan are very high. Through these filmed interviews, I was able to tap into a voice that has not been heard to any great extent. The project ultimately showcases Jordanian civil society and its positioning vis-à-vis the ongoing Syrian refugee crisis.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

The Effect of Microgravity on the Intestinal Tight Junction Proteins

Devin Taylor*, Ron Marchelletta, Kim Barrett, Declan McCole*
Ron Marchelletta, University of California San Diego School of Medicine

After exposure to microgravity, or weightlessness, the human body becomes more susceptible to digestive diseases such as inflammatory bowel disease (IBD) and diarrhea. Prior research has shown that this is due to the combination of attenuated barrier function of the epithelial lining in the small and large intestines, along with the proliferation of pathogenic bacteria, such as Salmonella, when exposed to microgravity. Tight junction proteins, such as occludin, E-cadherin, and ZO1, are responsible for maintaining the barrier properties of the intestine. The focus of this study is to investigate alterations on tight junction protein levels in cells exposed to microgravity by examining cells incubated in normal gravity versus simulate microgravity. We predict that the presence of tight junction proteins will be decreased in cells that undergo microgravity. This can be measured by performing western blots to measure the amount of tight junction protein. Preliminary data show that the presence of the protein ZO1 might be decreased under microgravity exposure, although the other proteins of our interest have not shown any change in expression. The project will continue to target these tight junction proteins, along with other proteins in the family, as we continue with the research. We hope that our data will eventually help address digestive disorders in individuals exposed to microgravity once the mechanism responsible for the disruption of barrier function of the intestines has been found.

This work was funded, in party by NIH grant AA019708-01 to Declan McCole.

Effects of Irritant Exposure on Mice

Doris Taylor, *Imad Aoude,*
Weihong Lin, Professor, Department of Biological Sciences

Long-term irritant exposure is believed to damage the nose and adversely affect the sense of smell. To test this hypothesis, we exposed an experimental group of mice to a mixture of 1 mL triethylamine, 1 mL propanoic acid, 1 mL ammonium hydroxide and 1 mL ethyl acetate and chitin for 10 minutes, 5 times a week (for a varying number of weeks). We hypothesized that continuous exposure to an irritant would cause an impaired sense of smell; the longer the mice are exposed, the worse their ability to smell will be. In each mouse cage, we placed a vile with a Kim wipe inside and soaked the Kim wipes with either the irritant mixture (experiment) or water (control). To get a sense of how impaired sense of smell became, we conducted behavior tests. We hid a piece of cookie in the mouse cages and timed how long it took for the mice to locate the cookie. The mice were eventually euthanized and their Main Olfactory Epitheliums were collected to observe structural disparity. In the future we plan to correlate changes in morphology and behaviors to evaluate the effect of nasal irritation on sense of smell.

*This work was funded, in part, by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC, the HHMI Undergraduate Scholars Program at UMBC, and the Howard Hughes Medical Institute.*

Characterizing Extractables in Polymers

James B. Taylor, Kedar M. Perkins, *DeLauren McCauley, Joshua A Wilhide,*
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Extractables are small molecules that can seep out of a container into whatever product is contained within when it is put under stress (e.g., heat). These molecules often include monomers, plasticizers, stabilizers, and antioxidants, and usually afford useful properties to the container. However because these molecules have the tendency to contaminate the contents of the container, they are becoming an increasingly alarming issue, especially in product safety and drug compatibility. Medical products in particular are often sterilized at high temperatures before use in healthcare, allowing extractables to enter vaccines, medicines, and other sealed fluids. The aim of the project is to characterize the diffusion of common extractables (including n-nonanoic acid and ε-caprolactone) by calculating their diffusion coefficients and the associated activation energies. In doing so, we hope to understand to what degree common extractables would contaminate healthcare products through sterilization, providing insight on how their presence can be minimized.

*This project was funded in part by Baxter Healthcare and the NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC.*

Creating Extended Temporal Actions through State Abstraction Techniques

Tenji Tembo, Michael Bishoff, Nicholay Topin
Marie desJardins, Professor, Department of Computer Science and Electrical Engineering, James MacGlashan, Department of Computer Science, Brown University

Artificial intelligence allows us to represent the environment around us in multiple ways. With these representations, we can study how intelligent agents can solve a wide range of problems. An object-oriented domain representation describes the task environment as a set of objects with associated attributes. Previous research has described how to use learning algorithms to solve problems in object-oriented domains, but the information learned cannot be transferred to other tasks in similar environments. We present a novel method for option discovery in object-oriented domains that enables agents to identify options, or subgoals in the task space, and to transfer this learned information to solve similar tasks more quickly. Our research demonstrates how an agent can automatically discover options in environments represented by object-oriented Markov decision processes (OO-MDPs) by extending the Policy Blocks algorithm by Pickett & Barto (2002). As part of this work, we introduce novel techniques for state abstraction during policy merging, and for domain space sampling when developing abstractions from different OO-MDPs.

Identification of a Novel Alternatively Spliced mRNA Isoform of the Human Taste Receptor TAS1R3

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Members of the TAS1R family of G protein-coupled receptors (GPCRs) function orally as receptors for sweet- and umami-tasting stimuli as well as in extraoral tissues where they are implicated in post-ingestive nutrient detection. Each member contains a large extracellular venus-flytrap domain (VFTD) with sites for several TAS1R agonists including sugars, sweeteners and/or amino acids. To better understand the functions of TAS1Rs, we used RT-PCR to assess expression of the gene for TAS1R3, the receptor subunit common to the sweet and umami taste receptors in human tissues and in the NCI-H716 human enteroendocrine cell line. Transcripts for two different TAS1R3 isoforms were amplified from human tongue and intestine as well as from NCI-H716 cells: one encodes a full length TAS1R3, while the other lacks 121 bp encoded by exon 5. Expression of both transcripts was confirmed by ribonuclease protection. RT-PCR indicates that the shorter transcript is expressed at levels two-to-six-fold lower than the full-length variant. The exclusion of exon 5 in the short TAS1R3 transcript leads to a frame shift predicted to encode a truncated protein consisting of the full VFTD but lacking transmembrane domains. Such a protein could be secreted or membrane-bound and could act as a co-receptor or help regulate extracellular ligand concentrations.

*Funded by the National Institute on Deafness and Other Communication Disorders (DC010110, SDM), NIH/NIGMS MARC U*STAR T34 08663 NRSA, and the HHMI Undergraduate Science Education Program.*

Comparison of Electrophysiological Biomarkers in Rodents and Humans under Acute and Chronic NMDA Receptor Antagonism

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Patricio O'Donnell, Adjunct Professor, University of Maryland School of Medicine

Electroencephalograms (EEG) are highly used for translational psychiatric research. Whether translation between rodent and human EEG is valid has yet to be seen. We tested whether rat skull EEG was similar to the observed spontaneous and evoked oscillations in humans under an acute N-methyl-D-aspartate receptor (NMDAR) antagonist. We recorded EEG from the skull surface and also local field potentials from the auditory cortex and hippocampus during a paired-click auditory paradigm. Evoked oscillations and potentials were recorded at baseline and after acute or chronic NMDA receptor antagonism (MK-801; 0.1 mg/kg i.p). The MK-801 acute treatment showed an elevated evoked gamma band power but a reduced beta band power. The same effect was not observed after chronic daily MK-801 injections while the rats were drug-free. This suggests that MK-801 oscillatory effects are only seen during acute treatment. When compared to human scalp EEG, it is seen that rat skull EEG recordings are similar. The effects of acute MK-801 treatment on a rat skull EEG were similar to those of a healthy human volunteer with an acute ketamine treatment. These results help to support the translation between rodent and human EEG studies.

This work was funded by the grant R01 MH85646.

Dietary Restriction and the Effects of the *Syndecan* Gene on Life Span in *Drosophila*

Thanhlong Gilbert Tran
Jeff Leips, Professor, Department of Biological Science; Maria De Luca, Professor, Department of Nutrition Sciences, UAB School of Health Professions

In natural populations, the average life span varies a great deal among individuals. This variation results from genetic differences among individuals as well as the environments that they are exposed to. For this study, we use the fruit fly, *Drosophila melanogaster,* to identify genes contributing to natural variation in life span. A previous genome-wide association study identified *Syndecan* (*Sdc*) as a candidate gene regulating life span. Follow up work in the De Luca lab found that reduced *Sdc* expression in the head increased the metabolism rate in *Drosophila*, which may be linked to lifespan. In this study, we used the GAL4/UAS – RNAi system in *Drosophila* to validate the effects of the *Sdc* gene on life span. We found that reducing *Sdc* gene expression in the antennae (the main organ of the olfactory system), and (v) gustatory sensilla of the labellum increases life span. Recent work in the De Luca lab found that *Sdc* knockdown in these tissues reduces food intake, suggesting that the life span enhancing effects result from a reduced caloric intake, a well-known mechanism of life span extension.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education and the NIH Grant R01 DK084219 to MDL and JL.

Synthesis of Dendritic System for the Delivery of Chemotherapeutic Agents

Phoebe S. Tsoi
Marie-Christine Daniel, Associate Professor, Department of Chemistry and Biochemistry

Ideal drug treatment combines accurate targeting with high efficacy. While chemotherapy has been used to treat cancer, the treatment is far from ideal. Many healthy cells are affected by the chemotherapeutic agent, leading to severe side effects that limit the dosage of treatment that can be given to each patient. Drug delivery systems, in particular nanocarriers, offer advantages (e.g. passive targeting) which make them ideal candidates for optimizing chemotherapy. The main objective of the project is the design, construction, and evaluation of new dendritic drug delivery systems for pancreatic cancer chemotherapy. This specific project focuses on functionalizing the dendron with gemcitabine and ensuring that the connecting pH-sensitive bond remains stable during circulation. Thus far, the backbone dendron has been prepared and attached to a tetra(ethylene glycol) spacer in order to increase its versatility for incorporation into more complex systems. Each product was characterized by proton NMR and mass spectrometry. The next step is to conjugate gemcitabine to the dendron. The final compound will be sent for evaluation to the Translational Laboratory at the University of Maryland School of Medicine Greenebaum Cancer Center.

This work was funded, in part, through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Capital Stigma: Fundamental Human Rights Violations of Transgender Persons in the Baltimore-Washington Metropolitan Area

Carlos Turcios
Ilsa Lottes, Professor, Department of Sociology and Anthropology

In the DC area, transgender people experience institutional discrimination and social marginalization. This study examines how persistent assertions of orthodox gender roles do more than perpetuate a gender normative system; they quietly violate the fundamental rights of transgender people asserted by the Declaration of Human Rights and the Declaration of Sexual Rights. This study builds upon the work of queer theorists, adding unique perspectives of transgender individuals living in the nation's capital. A diverse group of 12 individuals, located using convenience sampling, participated in 30-40 minute semi-structured interviews. They responded to questions about how external factors have helped or hindered their gender expression and overall well-being. Data collected in the study support and expand existing research findings. Human rights violations experienced by these participants are consistent with the current body of literature. They experience depression, attempted suicide and substance abuse. Additionally, because the transgender population in the area is marginalized, locating participants willing to participate proved more difficult than initially expected. The sample size of this study is therefore small and more focus was placed on qualitative analysis. This study clearly shows that despite the body of literature regarding transgender experiences, this topic unquestionably and imperatively requires more research.

This work was funded, in part, through the DOER from the UMBC Department of Sociology and Anthropology.

Characterization of Microvillous Cell Function in the Murine Main Olfactory Epithelium

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Weihong Lin, Associate Professor, Department of Biological Sciences

The main olfactory epithelium (MOE) of the olfactory system plays an important role in the sense of smell. In its supporting cell layer, the MOE contains putative sensory cells called microvillous cells, however much about the function of these cells remains unknown. This research aims to investigate whether the microvillous cells play a role in maintaining the integrity of the MOE. To do this, immunohistochemistry was performed on MOE tissues dissected from homozygous and heterozygous "jerker" mice, and wild-type mice. Jerker mice have a mutation in the *espin* gene coding for a structural protein in the microvilli, causing them not to function properly. Using an antibody against olfactory marker protein (OMP), the thickness of the MOE was measured to determine if there was deterioration. An antibody against cyclooxygenase-1 (COX-1) was used to label COX-1 expressing cells, including microvillous cells, to determine whether the body would stop producing them when they cannot properly function. Preliminary results show that without properly functioning microvillous cells, the olfactory epithelium becomes thinner and microvillous cell count decreases. These results will serve as a baseline for future experiments in which we monitor MOE morphological and functional changes in mice under exposure to various chemical irritants.

This research was funded, in part, by NIH/NIDCD research grants 009269 and 012831 to W. Lin and a grant to UMBC from HHMI through the Precollege and Undergraduate Science Education Program.

Detection and Discrimination of Botrytis Species Using Quantitative Polymerase Chain Reactions Melting Curve Analysis

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Brenda K. Schroeder, Assistant Professor, Washington State University

The onion (*Allium cepa* L.) is an important crop in the United States. Bulb rots cause significant losses to growers with the *Botrytis* species being the most common causal agents. A cost effective, early, and rapid detection and discrimination method of the *Botrytis* species for onion bulbs is needed for timely management because infection symptoms are not evident at the time of harvest and curing. Isolates of *Botrytis cinerea*, *Botrytis byssoidea*, *Botrytis squamosa*, *Botrytis allii*, *Botrytis aclada*, and *Botrytis porri* were cultured on one-half V8 media agar from colonized filter paper. DNA from each isolate was obtained after three to seven days of growth. Agarose gel electrophoresis confirmed DNA isolation. qPCR melting curve analysis used primer set BA2f and BA1r which targets the L45-550 gene region. Preliminary results demonstrated that qPCR melting curve analysis was able to differentiate three of five *Botrytis* species: *B.allii*, *B. aclada*, and *B. squamosa*. *B. byssoidea* and *B. cinerea* PCR products had the same melting point. This work suggests applications for accurate and rapid detection and discrimination of closely related *Botrytis* species as well as in disease outbreaks, sanitation, and breeding programs. It can also be applied to develop similar assays for bacterial pathogens.

This work was supported by the National Science Foundation's REU Program in Plant Genomics and Biotechnology - Grant Number DBI-1156880, USDA-NIFA- SCRI Project No. 2010-01193, and the USDA-NIFA-WRIPM Project No. 2010-02955.

Development of an Inexpensive, Portable Seawater pCO_2 Analyzer for Estuarine Waters

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Christopher Hintz, Assistant Professor, Department of Marine Science, Savannah State University

Estuaries play an important role in the global carbon cycle by acting as sources of both organic and inorganic carbon to the coastal ocean. However the carbonate chemistry of these dynamic environments is understudied. Previous studies measuring partial pressure of CO_2 (pCO2) of seawater used membrane contactors to measure equilibrate gases in open ocean waters. The pCO_2 in these equilibrated gases was measured using very high precision, non-dispersive infrared (NDIR) absorption instrumentation. In contrast, estuarine CO_2 levels vary widely, and this high precision is not necessary. This study developed and tested a less expensive, lower precision NDIR pCO_2 sensor to approximately ± 20-50 ppm. Field testing conducted on the dock of Savannah State University during a three and one half hour flood tide recorded pCO_2 reducing from 3700 ppm to 2200 ppm. Given the magnitude of the variability in estuarine systems, the inexpensive sensors appear accurate enough to be used for monitoring estuarine environments. With some improvements such as a routine calibration procedure, this device will be able to take valuable carbonate data of the water a ship is traveling through, without the need for constant monitoring.

This work was funded, in part, by National Science Foundation's Division of Ocean Sciences to T. Cox and C. Hintz NSF-OCE [1156525]

Chinese Immigrant and European American Mothers' Parenting Beliefs: A Cultural Understanding of Parental Control

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Different approaches have been applied to the operationalization of parental control. Psychological control refers to parental behaviors that are intrusive and manipulate children's psychological development, whereas behavioral control refers to behaviors that aim to achieve child compliance. Chinese parents are often described as more controlling than European Americans (EAs), and inconsistent associations between parental control and child outcomes are found in the Chinese context. The present study aimed to assess and compare Chinese-American (CA) and EA mothers' conceptualizations of parental control strategies and specific situations in which they utilize control over their preschool-aged child. Semi-structured interviews were conducted with 55 CA and 55 EA mothers regarding their controlling practices and the specific situations that warrant control. Results revealed that CA mothers engaged in higher levels of psychological control, whereas EA mothers practiced higher levels of behavioral control. CA mothers were more strict in areas involving children's reluctance to follow parents' requests, moral conduct, and not being careless or wasteful than EA mothers, who were in turn more strict in areas involving children's safety, and interpersonal behaviors, such as respect, sharing, and manners. The significance and implications of understanding parental control in different cultural contexts through an emic approach will be discussed.

This work was funded in part by an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

The Role of Adiponectin in High-Fat Mediated Cardioprotective Programs

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W. Keith Jones, Professor, Department of Internal Medicine, Division of Cardiovascular Diseases, University of Cincinnati School of Medicine

The heart protects itself from injury through intrinsic mechanisms and understanding them is vital to limiting the damage caused by myocardial infarction. During infarction, there is ischemia (loss of oxygen) and reperfusion (return of oxygen), and these have adverse effects on the heart. The Jones Lab established that an acute high-fat diet elicits a cardioprotective effect in mice. Adiponectin may play a crucial role as it has been previously implicated as cardioprotective. This study will address the hypothesis that high-fat diet mediates cardioprotection through adiponectin acting through receptors in the heart that activate autophagic and anti-apoptotic programs. To address this hypothesis, an *in vitro* model was established by simulating Ischemia/Reperfusion in HL-1 cells, and a surgical model that utilizes 30-minute occlusion of the LAD (Left Anterior Descending Artery) to create infarct. Beclin-1 expression was assessed in mice after a 24-hour high fat diet through western blot analysis. From these results, we established that adiponectin elicits a cardioprotective effect. Furthermore, the effect of the high-fat diet is lost in adiponectin knockout mice, implicating adiponectin as a key player in high-fat mediated cardioprotection. The upregulation of Beclin-1 after a high-fat diet suggests that the cells are being primed for an autophagic state.

This work was funded by a Provost's Pilot Grant from the University of Cincinnati.

Student Learning Outcomes for the Social Studies Middle School Classroom

William Weeks
Linda Oliva, Assistant Professor, Department of Education

This research project measured student growth in social studies content and social studies literacy in a seventh grade middle school classroom. Students' growth in argumentative writing literacy skills and visual-source interpretation skills were measured. Writing an argument and supporting one's claims are vital life skills these students will need throughout their academic careers. Students also need to be able to interpret visual sources as our world continues to adapt visually. The students in this study are 25 seventh graders (aged 11-12) with ethnic and racial backgrounds including White, Hispanic, Middle-Eastern, and African-American. There were seven students with Individual Education Plans and seven students who were English Language Learners in this study as well. Students were given a pre-test, which included visual sources (maps and charts) and an essay prompt, to indicate the baseline measurement for data. To improve students' literacy and skills in this content, the teacher included direct instruction as well as guided practice for the visual source skills. Guided, modeled, and independent argumentative writing practice was also provided for students to increase their writing literacy skills.

Asymmetric Activation Patterns: The Impact of Extracellular Geometry on the Distribution of Signaling Molecules

Ann Marie K. Weideman, ***Bilal A. Moiz***, *Lathiena A. Manning*
Michelle A. Starz-Gaiano, Assistant Professor, Department of Biological Sciences; Bradford E. Peercy, Assistant Professor, Department of Mathematics and Statistics

Morphogens are diffusible signaling molecules that influence embryonic cell identity through concentration differences. The formation of molecular gradients by diffusion and uptake allows for differentiation among otherwise homogenous cells located in spatial proximity. The dynamic effects of morphogens can be studied in the ovarian tissue of *Drosophila melanogaster*, where epithelial cells must be precisely determined to be either static or motile. The fates of the epithelial cells depend on their proximity to two signaling cells, the polar cells, and their secretion of a morphogen. However, we found that this cell fate determination does not always occur in the radially symmetric pattern expected. To elucidate this, we investigated the asymmetrical recruitment of border cells by modeling the secretion, diffusion, and binding of morphogens in an extracellular space delimited by an irregular landscape of juxtaposing cells. Computational experiments indicate that the asymmetric activation patterns observed can be explained by the relative position of extracellular gaps and the polar cells. Through a combination of biological techniques, including imaging and mutant analysis, we are analyzing this further and relating *in vivo* cases to three-dimensional mathematical models. We anticipate that our work will provide a better understanding of cell fate decisions in animal development.

This work was funded through an Undergraduate Biology Mathematics (UBM) Research Award from the National Science Foundation under Grant No. DBI 1031420 and NSF Career Award1054422.

Do the Posters Match the Writings: Russian Civil War Leaders' Writings and Propaganda Posters

Paul Weisko
Kate Brown, Associate Professor, Department of History

The purpose of my project is to trace the ideas espoused by Red and White Russian Civil War leaders in their memoirs and political tracts to Red and White Russian Civil War propaganda posters. I am interested in seeing how the ideas of xenophobia and anti-Communism, which are two of the main ideologies of the 20th century, crystallized during the Russian Civil War. To do this, this project used the writings of important leaders on both sides of the Russian Civil War in an attempt to measure how consistent the propaganda posters from both sides are with the writings of each side's respective leaders. An example of an inconsistency would be Denikin's denials of anti-Semitism existing in the White Russian officer corps, yet Denikin's side produced anti-Semitic posters. The Red Russian leaders' writings and propaganda posters were more consistent. Trotsky's *Dictatorship vs. Democracy* makes the case for a dictatorship of the proletariat and that theme was present in some Bolshevik posters. Given the growing authoritarianism in Russia, and the rehabilitation of White and Red Russian leaders, it is important to see what their thoughts on certain issues were, as their ideas are going to influence Russian policy for the foreseeable future.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Are College Women's Perceptions of Women Influenced by Skin Tone and Body Size?

Bianca M. West
Mariano R. Sto. Domingo, Adjunct Professor, Department of Psychology

Some research has suggested that there is perceived preference for women with light skin tone and thin body size. The aim of my mixed-method research was to discover whether media representations of women influenced how women perceive other women based on their skin tone and body size. The participants were 24 undergraduate women who identified as White, Asian/Pacific Islander, Black/African American or Biracial. The experimental portion of the study used a 2X2 between-subjects factorial design. Participants were asked to evaluate a model using a scale. The independent variables were the skin colors and body sizes of women. The dependent variable was the participants' ratings of the women's characteristics (friendliness, employability, ability to lead, ability to date, and perceived self-esteem). Qualitative data were collected through open-ended questions about the current portrayal of women in the media. No significant preference was found relating to skin color and body size. However, participants noticed patterns in media portrayals of women, both negative and positive. The overall results reveal that despite the absence of significant experimental findings regarding the influence of media images among women, the media emerged to be an important source of influence as dominant themes in media representations of women were observed.

This work was funded by the UMBC McNair Scholars Summer Research Institute.

Determining Song Output in Song Birds

Charles White
Bernard Lohr, Assistant Professor, Department of Biological Sciences

In territorial songbirds, such as Grasshopper Sparrows, a number of song characteristics may be subject to sexual selection. A software algorithm designed for performing choice tests with female birds using a modified operant conditioning chamber and procedure is being used for conducting tests to study song choice in this context. The circuits facilitate operant conditioning of the subject by providing auditory "rewards" for the subject after a selection. The choice test circuit measures the type and number of selections made to activate the playback of specific songs, and uses these results to determine song preference. The initial choice test in this study focuses on how the song output of male Grasshopper Sparrows is selected for by females. Female preference for varying song outputs is measured by using rate as a laboratory proxy for output; a higher song rate serves as a proxy for higher song output while a lower song rate serves as a proxy for lower song output. Prior to beginning the choice test trials, the hardware and software components underwent thorough testing to ensure that the choice circuits and sensors were fully operational.

This research was funded by the UMBC Department of Biological Science and an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

A Regular Gig: Understanding the Benefits of Open Mic Performance

Jennie S. Williams
Michelle Stefano, Folklorist in Residence, Department of American Studies

An open mic night is a scheduled, often weekly, activity at a nightspot where musicians, poets, comedians and storytellers come in, sign up on a list, and perform without a formal booking. This research identifies the communal properties of the musical open mic night events in the Baltimore area and applies them to the greater theoretical discourse concerning understandings of "community." This research required my regular attendance at three distinct open mic night venues in order to become familiar with the regular attendees, and to understand the benefits of producing and participating in open mic nights. In-depth qualitative research methods were used, which included the collection of 1-15 semi-structured recorded interviews, as well as participant observation and detailed field notes. The interviews were conducted with performers, emcees, and the venue business owners. The questions focused on their individual experiences and reasons for attending, or hosting, their respective open mic nights. The result of this research addresses the commonly valued foundation of creative and artistic expression that open mic nights can provide support for the greater Baltimore network of amateur and professional musicians and poets.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

I'm Here

Caleb P. Williams, Hannah Korangkool
Doug Hamby, Professor, Department of Dance

In a society that often defines gender as a strict binary, individuals who express anything other than their biological sex may be considered "deviants." Starting with this concept, we explore gender expression in our society with a focus on the male gender. Men typically follow what is known as the "male code," a set of standards that society has placed on them that directly influences their behavior in everyday life. *I'm Here* is a contemporary dance and film collaboration that deconstructs society's definition of gender and sexuality. As a partnership consisting of a male and a female, we use this work to explore the middle ground between the two genders. Through choreography and film, we use aspects of portraiture, abstract imagery, and text composition to create an atmosphere which reflects the intense social pressure put on gender-fluid males in our society. *I'm Here* aims to educate the audience and shine a light on a highly unrepresented demographic of the population.

The Addy Walker Stories: Studies of Enslaved Black Girlhood

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Between the late 1980s and the 2000s, "The American Girl" series, historical fiction marketed to children ages eight to the preteens, gained a significant audience among preteen girls in the United States. These stories varied in historical timeframe and age of the main character, and by no means were these books meant to be taken as seriously as textbooks or primary sources. Yet the stories that focused on the slave and segregated lives of African American girls gave young readers a "peek into the past." I propose that the wave of young adult historical fiction novels in the 1990s came about as a result of the popularity of new social history and growing interest in African American women's history near the end of the 20th century. Overall, I detail how the Addy Walker books informed young readers about black culture and the realities of slave and freed life.

This work was funded by UMBC and the Department of History.

Mechanism of Post-Translational Modification of Glyceraldehyde-3-Phosphate-Dehydrogenase by Dithiolethione Compounds

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Dithiolethione compounds are known to possess chemopreventive, cytoprotective, and antimitogenic effects. We have shown with our collaborators that these compounds interact with glyceraldehyde-3-phosphate dehydrogenase (GAPDH), an abundant and multifaceted protein involved in glycolysis. One compound of interest is ACS-1, the chemopreventive effects of which are thought to be in part due to inhibition of glycolysis via inhibition of GAPDH. Previous studies have suggested that ACS-1 can form covalent adducts with cysteine residues in proteins or induce disulfide bond formation in proteins with neighboring cysteines. Human GAPDH contains three cysteine residues susceptible to ACS-1 modification, leading us to hypothesize that ACS-1 could modify these cysteines and ultimately inhibit the enzyme. Human wild-type and cysteine mutant GAPDH proteins were overexpressed in bacterial culture and purified by ion-exchange, affinity, and size-exclusion chromatography. These proteins were modified with ACS-1 and cleaved into peptides by trypsin for analysis using tandem mass-spectrometry. Preliminary data analysis suggested that ACS-1 forms covalent adducts with cysteine residues in both types of proteins, but could not confirm or deny the presence of disulfide bonds. We are currently exploring the presence of disulfide bonds via iodoacetamide modification. These results will allow us to propose a detailed molecular mechanism of GAPDH modification by ACS-1.

This work was funded, in part, through an Undergraduate Research Assistantship Support (URAS) Award from the UMBC Office of Research Administration.

Comprehension Monitoring of College Students Reading Inconsistent Texts in Think Aloud and Response Time Protocols

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Comprehension monitoring, the ability to evaluate a passage as one is reading it based on prior knowledge and experiences, is an invaluable metacognitive skill for college students. The present study tested comprehension monitoring in college students who evaluated passages for consistency. Each passage consisted of three sentences, with the second sentence containing one of three levels of consistency. The consistent, resolvable, and inconsistent passages were rated for clarity in two ways, while participants "thought aloud" as they read them or while participants read and responded to them on a computer. The think-aloud protocols provided insight into the participants' reasoning when detecting inconsistencies in passages. The computer task revealed the slowest response times and lowest accuracy levels on resolvable passages, as expected. Consistent passages had the fastest response times and highest accuracy, whereas inconsistent passages were intermediate to these types. The validated passages will be used in a functional MRI study of individual differences in brain activation during comprehension monitoring. The results will provide information about what should be targeted when educating students about reading critically, an essential skill for college and beyond.

This study was funded, in part, by the UMBC Office of Research Administration.

The Great Escape: The Effects of Medication and Age on Drosophila Strength

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This research focuses on two medications and their effects on weakness in Drosophila. Frailty is a condition in which particular physical abilities deteriorate with age. There are a number of factors that indicate frailty, but the factor the current experiments will focus on is strength, which will be assessed in a Drosophila model. We will look at the independent effects of age and the combined effects of age and medication in order to determine the age at onset of weakness and whether the medications delay this age at onset, using virgin male Drosophila. The medications used have been known to increase lifespan in mammals and therefore may directly influence strength. Strength will be assessed at ages one, three, five, seven, and nine weeks. Strength decline is assessed by timing Drosophila escape from a sticky substance. This will enable us to measure the effect of the drug on strength in age-matched flies at several time points during the life span of the fly. In advancing this study, males will be tested to determine if the drugs have sex-specific effects on weakness.

*This work was funded, in part, by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC and NIH grant R01 DK 084219 to JL.*

The Quantification of Phospholipids in Cell Growth Media

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Cell growth media (CGM) is a crucial component of a successful cell culture and gene expression in bioreactors. The composition of the CGM can greatly affect the overall production of a desired gene product as well as selectively growing only the cell of interest. With the importance of the composition of CGM comes the need to quantify the components of the media. Methods of quantification for phospholipids, which are added to some growth medias for the stimulation of cell growth, are limited. The goal of this project is to develop a method of separating and quantifying various phospholipids typically added to CGM using high-performance liquid chromatography (HPLC) coupled with mass spectrometry. HPLC will be used to separate components of the media while the mass detector will be used to quantitate and identify peaks. A triple quadrapole mass detector has been selected due to its high sensitivity which is needed for the detection of low phospholipid levels present within cell growth media. The validated method will ultimately allow for better quality control of CGM.

This project was funded, in part, by BD Biosciences.

Improving Scientific Writing through Basic Writing Skills and Scaffolding

Joyce Yoon
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The writing capability of middle school students has been lacking and students have not been able to successfully communicate their aptitude to think critically and their ability to problem solve. The students in the magnet program at a suburban middle school have had difficulty analyzing technical readings and struggled to share their understanding of the text. This research project was designed to improve the student's scientific writing ability and comprehension of scientific content. Our goal was to have student's complete constructed responses with accuracy and support, while utilizing both argumentative and analytical skills as they relate to the content and text of the assignment. Students were provided with writing from scholarly journals and scientific articles as a model of how their work should appear. Students were also provided with various resources and workshops to improve their writing ability. After each lesson, students completed a writing assignment that addressed both their aptitude to communicate along with their understanding of the material. The assessment was graded based on a scientific writing rubric.

Monitoring Cell Growth throughout the *Chlamydomonas reinhardtii* Cell Cycle

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The *rls* genes in *Chlamydomonas* are thought to regulate the cell cycle during the G1 to S transition because silencing the expression of the members of the gene family causes anomalies in cell growth and division that result in a change in cell size (S. Miller, unpublished data). We observed that the cell size distribution in an asynchronous population of the wild type was bimodal. Furthermore, the relative distribution of the two most abundant cell size populations was altered when the *rls4* gene was silenced. Based on these two observations we hypothesized that the *rls4* gene regulates the progression of the cell through two stages or spurts of growth. In order to test this hypothesis, we set up an experiment to monitor the changes in cell size of a synchronous culture over a 24 hour period. From these measurements we could calculate the derivative of cell size as a function of time, which would allow us to monitor the growth rate of *Chlamydomonas* as it progresses through the cell cycle. Our data indicated that silencing the expression of the *rls4* gene altered the cell cycle in two ways: by delaying the first division by four hours after the beginning of the night cycle, and by shortening the inter-division timer.

Student Learning Outcome: Communicating Engineering Design

Michael Zurkowski
Jonathan Singer, Associate Professor, Department of Education

The present study reports on the methods used to reinforce ability for students to apply the 'Engineering Design Process' to various problems and challenges and communicate their rationale. Students were taught to identify a problem, document brainstormed ideas, and give justification via multiple communicative processes for their chosen design. Effective communication was developed through the practice and application of oral, written, and non-verbal styles. Students were also taught effective listening skills. During the intervention, students communicated for different purposes, made use of media and technology communication tools, and adapted their communication strategies in diverse language settings. The sample consisted of 12 ninth-grade students enrolled in an Introduction to Engineering and Technology Concepts (IETC class).

This work was funded, in part, by the UMBC College of Engineering and Information Technology, INSPIRES Curriculum for Engineering Education.