The 19th Annual
Undergraduate Research and Creative Achievement Day
Wednesday, April 22, 2015

Occurrence and Distribution of Quinolone Resistance Genes in Baltimore Wastewater

Hollie Adejumo, *Ke He*
Lee Blaney, Assistant Professor, Chemical, Biochemical, and Environmental Engineering

Municipal wastewater contains a variety of contaminants, including antibiotics. The presence of fluoroquinolone antibiotics in wastewater may contribute to antimicrobial resistance and result in serious infections that are not treatable by conventional medicine. The purpose of this work is to understand and track antimicrobial-resistant bacteria in local wastewater. We hypothesized that the fluoroquinolone concentration found in wastewater correlates with the amount of antibiotic resistance genes detected. To test this hypothesis, water samples, varying in expected fluoroquinolone concentration, were collected from raw wastewater and wastewater effluent from a Maryland wastewater treatment plant; furthermore, surface water was collected from upstream and downstream of the wastewater effluent discharge site. Water samples were filtered; bacteria retained on the filter were subsequently grown in Müeller-Hinton broth media. Fluoroquinolone-resistant bacteria were isolated on agar plates using the Extended Spectrum β-lactamase (ESBL) method. Our findings indicate that ESBL-producing bacteria are present in wastewater where fluoroquinolone concentrations as high as 2000 ng/L have been measured. To verify the presence of fluoroquinolone-resistance genes (i.e., qnrA, qnrB, qnrS), polymerase chain reaction and gel electrophoresis techniques were employed. Fluoroquinolone antibiotics and resistance genes were detected concurrently, suggesting that the presence of antibiotics in wastewater and surface water affects the microbial community.

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

Tarantism

Heinz Adjakwah
Doug Hamby, Associate Professor, Dance

In fall 2015, *Tarantism* was presented in the UMBC Fall Dance Showcase.This artistic performance guides its audience through a story being told from the perspective of Charlotte Jackson, an alter ego, who is fun-loving and has little to no time to be consumed by stress. This alter ego came about as a result of me trying to navigate alternate ways to

express myself in my art. The piece is inspired by a series of personal struggles that I was going through at the time of choreographing this piece and how I wish to have handled it hence why the underlying message in the piece is told from the frame of mind of Charlotte. The choreography could be considered an adventure embarked on by the dancers without knowing exactly how the finished product would look like because I allowed myself to be "in the moment" when the movements were generated. One of the main challenges faced during the artistic process was being able to find other dancers that will embody the movements and the characters demonstrated in this piece, which then became the least of my worries after introducing an excerpt of the choreography during auditions.

The Expression and Role of Melanopsin in *Paralichthys dentatus*

***Ifeolu Akinnola**, Alexandra Kingston, Thomas Cronin*
Phyllis Robinson, Professor, Biological Sciences

Less than two decades ago a study on the light sensitive skin cells of the *Xenopus laevis* led to the discovery of the visual pigment known as melanopsin. Melanopsin is also expressed in the vertebrate retina as well as in the brain and skin of certain *species*. The *Paralichthys dentatus* (Summer flounder) is commonly found in the ocean waters off the coast of North America. The flounder can change its appearance in order to avoid predators. Since the flounder has light-sensitive tissue visual pigments, rhodopsin and cone opsin were previously researched within the flounder. Results show that rhodopsin and cone opsins are expressed in the dermal tissue of the flounder. The activation of cone opsin or rhodopsin within cells causes hyperpolarization. On the other hand the activation melanopsin causes cells to depolarize. We hypothesized that in addition to cone opsin and rhodopsin, melanopsin is used in a "push-pull" system to regulate the camouflage ability of the flounder. We hope to elucidate the melanopsin sequences using flounder transcriptome and discover whether or not melanopsin is expressed within dermal cells. Currently we have three predicted isoforms of melanopsin that we obtained from the transcriptome to begin designing specific primers and confirming expression.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Optimization of Finite-Bandwidth Pulse Sequences for Spin Qubits

Brandon Alexander
Jason Kestner, Assistant Professor, Physics

A quantum computer would be able to solve certain problems significantly faster than a classical computer. The quantum computer's power comes from properties of the qubit, or quantum bit, which can exist in one of infinite states, compared to two states for a classical bit. Unfortunately, quantum computers are highly susceptible to errors caused by the qubits

interacting with their environment. Our work focuses specifically on the singlet-triplet qubit and the effect of charge noise. Previous work has devised a method to produce self-correcting control protocols as a sequence of square pulses. While this form is elegant, it is not experimentally reproducible, due to the assumption of an infinite rate of change of the control parameter. We investigated the effects of introducing a finite rise time between pulse segments and performed a numerical search to produce a new control sequence that is both error-resistant and more realistic. As a result, we improved the error-resistance by several orders of magnitude compared to an unaltered pulse at the cost of changing the final evolution. Further work aims to generate these error-resistant control sequences for specified evolutions.

Structure Relationships of Small Molecules Targeting the Protein-protein Interactions of S100B

Ehson Aligholizadeh
David J. Weber, Professor, University of Maryland School of Medicine

S100 proteins are a family of proteins only expressed in vertebrates. These proteins form homodimers and are characterized by Ca^{2+} binding sites and helix-loop-helix domains. Of the S100 family, one particular protein of interest is S100B, which functions in the proliferation of malignant melanoma and is used as a biomarker for detection purposes. The overproduction of S100B has been shown to hinder cell regulatory processes. The pathway by which S100B affects the regulation of cell growth involves the tumor suppressor protein p53. There is a Ca^{2+}-dependent protein-protein interaction between S100B and p53. Increasing concentration of S100B inhibits p53 phosphorylation via protein kinase C, and subsequently the transcriptional activity of p53. Utilizing approaches such as x-ray crystallography and structure-based drug design, small molecular inhibitors were identified that function to inhibit the protein-protein interaction of S100B and p53, effectively allowing the tumor suppressor to perform its normal functions within the cell.

This work was supported by grants from the NIH (GM58888 and CA107331) to D.J.W.

Design of Bio-Inspired Morphing Wings for High Performance Lift

Theophilus Aluko*, Joe Zhu*[1]
[1]University of Virginia Mechanical and Aerospace Engineering
Haibo Dong, Associate Professor, University of Virginia Mechanical and Aerospace Engineering

The goal of this work was to build a high-performance morphing wing inspired by the high maneuverability, strength and agility of the barn swallow. The study was done by modeling and analyzing the swallow's wing morphing mechanism in order to see how this affects its flight characteristics like agility strength and high maneuverability. The latter is due to the

presence of leading-edge vortices (LEVs) on its wings. To make the model design for the study, certain geometrical specifications were adopted. These include bevel gears that simultaneously control the shoulder and elbow joints. The shoulder is controlled by a crank mechanism; the elbow is controlled by alternating string contortion on either side of the wing frame. The design was refined through a series of prototyping exercises and design tests to determine the feasibility of the various specifications and to meet the optimization requirements.

This work was funded by the Office of Naval Research and the National Science Foundation.

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

***Juan Alvarez**, Lucas A. Horn, Julie Wolf*
Suzanne Ostrand-Rosenberg, Professor, Biological Sciences

The immune system can reject tumor cells. However, tumors can escape immunity by expressing cell surface immunosuppressive ligands such as Programmed Death Ligand-1 (PD-L1), which acts as an "off signal" to cytotoxic T cells whose job it is to eliminate malignant cells. CD80, a costimulatory molecule with two Immunoglobulin-like extracellular domains (IgV and IgC), prevents this immune suppression by steric blocking PD-L1 and by binding to the activating receptor CD28 on T cells. As the IgV domain of CD80 is thought to bind to PD-L1 and CD28, we hypothesized that a recombinant CD80 with two IgV domains would bind PD-L1 and CD28 with enhanced affinity, and therefore would be a potential cancer therapeutic. As an initial step in testing this hypothesis, we produced a DNA construct consisting of two CD80 IgV domains, and inserted it into the pLHCX vector. The purified plasmid will then be transfected into PD-L1+ C8161 (melanoma) cells. The resulting cells will be tested by western blot, flow cytometry, and T cell activation assays for stability of the double IgV CD80, and for the ability of the double IgV to bind to PD-L1 and CD28 and prevent immune suppression.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

The Effects of Vascular Calcification on the Mechanical Properties of Elastin in Arteries

Roy Anderson
L.D. Timmie Topoleski, Professor, Mechanical Engineering

Vascular calcification is defined as progressively enlarging deposits of calcium-based mineral in the arteries. Elastin is one of the major insoluble extracellular matrix

components. Elastic fibers are located within blood vessels, lungs, and skin remain and intact for the lifetime of the organism to maintain the tissue structure. The purpose of this experiment was to provide information on the mechanical response to loading and deforming conditions with or without vascular calcification that can provide key information regarding the overall health of the cardiovascular system. Sections of the bovine thoracic aortas were cut into dog bone specimens after harvesting. Records of width, gauge length, and thickness of the isolated elastin specimens were recorded before testing. The elastin was then placed into the Biomaterials Testing Machine, with a phosphate buffered saline (PBS) solution to best represent *in vivo* results. A uni-axial tensile test, which provides loading on the elastin, determines the mechanical properties of arteries was initiated at rest and the force increased to a maximum load of 2200g. Engineering stress and strain values were then calculated using the raw data. Experiments with and without vascular calcification were then compared to study the relationship between elastic degradation and vascular calcification.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Investigating Reciprocal Regulation of the Circadian Clock by Plant Innate Immunity

William Angel
Hua Lu, Associate Professor, Biological Sciences

A thorough understanding of plant defense mechanisms is critical to the success of genetic engineering to enhance disease resistance. Recent studies have shown that the circadian clock regulates plant innate immunity. Data from our laboratory further indicate that flg22, a 22-amino acid peptide of the N-terminus of bacterial flagellin that is considered as a type of Pathogen Associated Molecular Patterns (PAMPs), not only activates basal defense but also influences clock activity. This leads to the hypothesis that components of PAMP signaling triggered by flg22 could regulate the circadian clock. To test the hypothesis, we determined whether mutants with defects in flg22 perception or in flg22-triggered signaling involving the key defense molecule salicylic acid (SA) showed altered clock activity. We generated homozygous mutants expressing the CCA1:LUC reporter in order to facilitate clock activity assays. Mutant seedlings were monitored for luciferase activity to gauge clock activity. Results indicated that the period of luciferase activity was shortened for many of the SA signaling mutants and for the mutated flg22 receptor when the mutants were treated with flg22.

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

Dialect Attitudes and Prestige Values amongst Korean dialects

Kelitah Armstrong
Kyung-eun Yoon, Lecturer, Modern Languages, Linguistics, and Intercultural Communication; Anna Shields, Associate Professor, Modern Languages, Linguistics, and Intercultural Communication

This project focused on the views of Korean speakers living in the United States regarding the Korean language. Within the Korean language there are different dialects corresponding to the provinces of the South Korean peninsula. This project aimed to discover whether there were prestige values and specific attitudes among South Korean speakers towards the various dialects within their language. The persons in this study were all born and raised in South Korea, and moved to the United States in the last five to 20 years. These people are still engulfed in their culture, so much so that many of them could not speak English. This was pivotal because this insured that the people who participated in the study were very familiar with the language, making them a good sample group. Participant responses were also studied as they related to age and gender. This was an attempt to figure out if there were latent feelings towards Korean dialects that were patterns among the age groups or the genders.

Clustering Text Data with BIRCH

Alvaro Arrospide Fletcher
Jacob Kogan, Professor, Mathematics and Statistics

The process of data clustering consists of grouping data such that elements in each group are more similar to each other than to those in other groups. Data clustering is used in a broad range of disciplines such as information retrieval, bioinformatics, very-large-scale integration, data mining, text mining and image analysis to name just a few. Text data is usually transformed in high dimensional and sparse vectors. High dimensional data clustering is a useful and practical approach for exploratory data mining. When clustering large data sets, limits in the amount of memory may bring about complications. We sought to determine the results of clustering a data set with the method Balanced Iterative Reducing and Clustering using Hierarchies (BIRCH) which is claimed to be suited for very large data sets. Our text data came from the publicly available IR test collections. We implemented BIRCH in Java and analyzed its performance in terms of the quality of the resulting clusters. We also constructed a confusion matrix to visualize the partitions generated by BIRCH. Our preliminary results suggest that BIRCH is efficient at generating partitions of very large data sets that could be a starting point for another clustering algorithm.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

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

Sara Arussy
Mark Marten, Professor, Chemical, Biochemical, and Environmental Engineering

Filamentous fungi are used prevalently in the biotechnology industry to produce both therapeutics and enzymes. In the bioprocess industry and during fungal pathogenesis, nutrient limitation plays a vital role. Thus, studying how fungi respond to nutrient limitation has the potential to improve beneficial bioprocess-related fungi or reduce the detrimental impact of pathogenic fungi. In the Marten Lab, we hypothesize that nutrient limitation, and subsequent induction of autophagy, leads to altered cellular morphology which leads to altered protein secretion capacity. To test this hypothesis we conducted a study on the function of putative autophagy gene atg13. Using DIC microscopy, I determined that although autophagy is not completely disrupted in an atg13 deletion mutant, as evident from increased vacuolation, the lack of vacuolar content suggests a defect in autophagosome formation or targeting. Based on previous proteomic analysis data from the atg13 deletion mutant, we hypothesized spermidine synthase regulation is mediated by autophagy protein, Atg13. To test this hypothesis the atg13 deletion mutant was grown in the presence of exogenous spermidine, and the autophagy phenotype was restored. This study advanced our understanding of the autophagy pathway in fungi, specifically the role of autophagy protein Atg13.

This work was funded, in part, through an Undergraduate Research Award from the UMBC Office of Undergraduate Education. Additional funding provided by the National Science Foundation (Awards 1159973 and 0519080).

Conflicts of Confucian Ideals and Pragmatic Battle Strategies in *Romance of the Three Kingdoms*

Christine Au
William Brown, Lecturer, Modern Languages, Linguistics, and Intercultural Communication

This research examined the full-length vernacular Chinese novel *Romance of the Three Kingdoms* written by a Neo-Confucian scholar, Luo Guanzhong (1330-1400), in the early period of the Ming Dynasty (1368-1644). Recognized as one of the six classic Chinese novels, the Romance of the Three Kingdoms is considered a masterpiece of historical fiction and it has had a profound impact on Chinese literature, politics, military strategy, society, and culture ever since its publication in the Ming Dynasty. The detailed examination of Confucian ideals of benevolence, the elevation of military heroes, and the depiction of political schemes and military strategies in the novel carried out in this study highlight the contradiction between the perception of ideology and the reality of human

ambition. Overall, this analysis revealed how the interpretation of Confucianism fluctuated over time in response to changes in history and public culture in China. Besides, the study has presented an in-depth critical analysis to reconcile the conflict by pointing out the socialization of Neo-Confucianism in the early Ming Dynasty. Through the depiction of military legends and villains in accordance with his Neo-Confucian moral judgment, Luo Guanzhong's didactic intention was revealed through the popular military stories.

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

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

Ifemayowa Aworanti*, Sevda Deldari*[1]*, Mayyada El-Sayed* [1]
[1]Chemical Engineering, American University in Cairo
Douglas Frey, Professor, 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 during the interaction between proteins and IEX/MM packings.Column experiments using 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 investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

The Study of *rbfA* Suppressor Mutations and the Contribution of RbfA to Ribosomal Biogenesis

Sara Azeem
Philip Farabaugh, Professor, Biological Sciences

Ribosomes are molecular machines that polymerize amino acids into polypeptide chains, which form proteins. The prokaryotic ribosome consists of a large subunit, 50S, and a small subunit, 30S. The small and large subunits bind together to form a very stable, long-lived, protein-RNA complex, and require specialized proteins for assembly. Ribosome assembly

has many steps and uses various assembly factors and enzymes that monitor the process. There are mutations that lack assembly factors and enzymes, causing improper assembly of the ribosome. Ribosome binding factor A, RbfA, is a cold shock protein that is involved in the maturation of a functional small subunit. When *rbfA* is deleted (*ΔrbfA),* the ribosome is not assembled properly, causing the cells to be cold sensitive and slow growing. Nord et al. (unpublished) found suppressor mutations that revert the cold-sensitive, slow-growing phenotype to the wild-type phenotype. Identification of the suppressors gives insight on the role of assembly factors and the process of ribosomal biogenesis. We will select for and isolate other suppressor mutations and sequence the entire genome to identify what genes can mutate to a suppressor.

Four Blue Skies

Ryan Bailey
Doug Hamby, Associate Professor, Dance

In fall 2014, I had the opportunity to choreograph my first undergraduate piece in the First Works dance concert. The First Works concert is one in which the choreographers can showcase their learned unique styles from outside sources in conjunction with their experiences in fundamental technique and workshop classes at UMBC. A compositional piano piece ignited my creative process. I was drawn to the high-pitched repetitive quality of the instrumental music which exuded a euphoric feeling. In addition to the music, I was inspired by my belief that life is what you make of it. This believe is tested by adversity. When facing personal challenges, I found encouragement and strength in my friends, family and all that surrounds me. The dancers are not sure when or how they will find blue skies, but that it may be easier with the accompaniment of people unwilling to see them fail.

Characterizing Urinary Dysfunction in an Inducible Mouse Model for Prostate Inflammation

Sagar Bajpai
Charles Bieberich, Professor, Biological Sciences

Abstract not available for publication.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Quantitative Analysis of Purine Nucleotide Pools Involved in an AMPK Regulatory Loop

***Gabriella Balaa**, Danielle Schmitt*
Songon An, Assistant Professor, Chemistry and Biochemistry

The purpose of this project is to quantitatively analyze purine nucleotide pools from whole cell lysates using high-performance liquid chromatography (HPLC). Human *de novo* purine biosynthesis is a ten-step pathway catalyzed by six cytoplasmic enzymes that coalesce to form the "purinosome," which converts phosphoribosyl pyrophosphate to inosine monophosphate under purine-depletion. An intermediate of purine biosynthesis, AICAR (5-aminoimidazole-4-carboxamide-1-β-D-ribofuranosyl 5´-monophosphate), is a well-characterized allosteric activator of AMP activated protein kinase (AMPK). Preliminary studies revealed that when HeLa cells expressing a purinosome marker were treated with small-molecular AMPK activators, purinosome formation was observed. We hypothesize that AMPK leads to formation of purinosomes that are deficient of the enzyme that catalyzes the last two steps of purine biosynthesis, leading to increased AICAR levels. To assess our hypothesis, we developed a HPLC method to quantify purine nucleotides in whole cell lysates. Currently, we are treating lawns of HeLa cells with the AMPK activators, and characterizing their effects on the purine nucleotide pools. Collectively, our work in understanding a regulatory loop between AMPK and *de novo* purine biosynthesis will lead to a greater understanding of the highly interconnected nature of the cell and potentially lead to improvements in cancer chemotherapeutics.

This was funded, in part, by the Department of Chemistry and Biochemistry and the University of Maryland, Baltimore County.

Do Couples Experience Disparities in Subjective Well-being based on SES or Ethnicity and are they Buffered by Support?

Eileen Barden
Robin Barry, Assistant Professor, Psychology

The present study examined the associations among socioeconomic status (SES), race/ethnicity, and social support adequacy (e.g., receiving the support one wants) from one's spouse on subjective well-being (SWB) in 114 heterosexual newlywed couples using actor-partner interdependence modeling. Previous research has demonstrated disparities in experience of socioeconomic disadvantage and stress between African-Americans (i.e., Blacks) compared to Caucasians/non-Hispanics (i.e., Whites). Given these disparities, Blacks may be expected to experience lower SWB than Whites. However, previous research has found inconsistent evidence of this hypothesis. This study examines whether Blacks and Whites have different levels of SWB; whether differences depend upon SES and whether support adequacy buffers these possible disparities on SWB. For race, only Black (e.g. 39.9 percent) and White (e.g. 46.1 percent) participant data was used for the scope of this study. Demographic characteristics of participants were not equivalent. Self-report measures with demonstrated evidence of validity and reliability were used to assess

SWB and support adequacy. Results suggested SES, support adequacy but not race were associated with SWB. Unexpectedly, support adequacy buffered the link between lower SES and lower SWB for Whites, but not Blacks. In addition, interactions with gender and actor-partner effects of support adequacy types were found associated with SWB.

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

The Representation of Clytemnestra and Hecuba in Fifth-Century Ancient Athenian Tragedy and Pottery

Amber Barnett
David Rosenbloom, Associate Professor, Ancient Studies

I wanted to examine the hypothesis that Clytemnestra in Aeschylus' *Oresteia* and Hecuba in Euripides' *Hecuba*are more than monsters created out of fifth-century Athenian misogyny. I chose these two tragic female characters because they are often considered transgressive or degraded for inflicting violence on men. Scholars have traditionally seen them as figures of misogyny: Clytemnestra is the masculine, domineering murderess, and Hecuba the terrifying *mater dolorosa* ("grieving mother"), whose anguish warps her into a bloodthirsty avenger. I compared the portrayals of these women in tragedy with their depictions in contemporary Athenian pottery in order to gain a broader understanding of them in the cultural context. I found the explanatory power of misogyny and female helplessness adequate for a rudimentary understanding of the images on vase painting, but insufficient as an explanation the women's depiction in tragedy. Aeschylus and Euripides construct these two women as justified (at least partially) in their acts because of violence done to them by men—Clytemnestra avenges her sacrificed daughter and Hecuba her children lost at impious hands. Both women are defenders of fundamental moral and religious laws broken by male aggression.

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

Healthcare Mediation by a Community-based Organization for Gender and Sexual Minorities in Udupi, India

Robert Barrett
Sarah Chard, Associate Professor, Sociology and Anthropology

This qualitative study investigated the health care system experiences of sexual and gender minority individuals within Udupi, India. Previous studies have revealed information on how sexual and gender minorities struggle against poverty and a politicized healthcare system heavily reliant on non-governmental organization (NGO) participation. Data were

collected through conversations with staff members of Ashraya, a local community-based organization (CBO), document analysis, and 12 semi-structured interviews with self-identified non-heterosexual individuals. This study analyzed the role that a CBO has in moderating the relationships between MTH (men-who-have-sex-with-men, transgender, and hijra) communities, healthcare providers, and objective-oriented NGOs (focused on achieving specific targets for an issue such as HIV prevention). It explored individuals' experiences with stigma and healthcare access through stories about denial of treatment, current services rendered by the CBO, and legal barriers. Results show the powerful role that the CBO plays in improving access to care and addressing larger healthcare system inequities. Findings support increasing involvement of CBOs in defining approaches to improve the health of sexual and gender minorities at national and international levels, and demonstrate the pitfalls of non-contextualized funding guidelines.

Dance and Movement Therapy Techniques as a Mode of Choreographic Exploration

Rebecca Behnke
Doug Hamby, Associate Professor, Dance

This project considers dance and movement therapy (DMT) and movement analysis techniques as modes for choreographic exploration. This work is the result of information gathered at the 2014 Dance and Movement Therapy Summer Intensive at Antioch University. Specifically, this piece focuses on Kestenburg Movement Profiles (KMP), a form of movement analysis, and other DMT techniques, to create movement and choreographic structure. KMP Movement Analysis is the comprehensive system for identifying psychological, developmental, emotional, and cognitive imbalances through movement observation, notation and interpretation. These techniques were used to create a new choreographic work. This work investigates the connection between mind and body and the effect of past experiences on current movement patterns. In a collaborate process, new movement was created using the dancers' personal experiences and movement patterns.

This work was funded by the Dance Department Summer Study award.

A Study in the Visual Culture of Cosplay

Lucinda Bennett
Preminda Jacob, Associate Professor, Visual Arts

Cosplay, a shortened term for "costume-play," the practice of dressing as characters from anime, video-games and comic books at international, national and regional conventions, has been a growing phenomenon in the United States since the first cosplay event held in New York City in 1939. I studied cosplayers as talented and skilled artists who translate two-dimensional figures into three-dimensional costumes. As artists of imitation, they take

their own unique place in the world of performance artistry by using their skills in the mediums of painting, sculpture, sewing and acting to faithfully duplicate and even improve upon existing designs. In August 2014 and February 2015 I attended two major anime conventions, Otakon and Katsucon, in the Baltimore-Washington D.C. area. At these conventions I interviewed and photographed a total of eighteen cosplayers among whom I found a wide range of ages, professions, skill levels and motivations. Combining these interviews with research on the history and theory of subcultures, I propose viewing cosplay as a legitimate and important visual art subculture of the twenty-first century.

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

Fragments of the Past: Pagan Iconography in Synagogues

Sierra Benson-Brown
Esther Doyle Read, Adjunct Professor, Ancient Studies

In the ancient world, mosaics were not only revered for their aesthetics but also for the meaning they were made to convey. The mosaic fragments donated to the University and housed in the Spiro Collection lacked provenience in all but location which prompted research using only the given aesthetic value and possible time periods. Originally, the research focused on the composition of mosaics and was expanded to include cultural, social, and religious interpretations. By comparing motifs, composition, and style found in the mosaics, conclusions can be drawn in regard their purpose, time periods, and significance. The location was confirmed as Caesarea Maritima, Israel and the motif shown in the fragments fit the suspected time periods of fifth and sixth centuries. After verifying that the depiction was of Gemini through comparative analysis, the remaining question was why pagan iconography would be found during the Christian era of Roman rule in a field with multiple synagogues superimposed. The fragments may be a unique example of Roman and Jewish syncretism of the fifth and sixth centuries that may point to a mystical Jewish tradition.

Determination of Essential Xylanases in *Cellvibrio japonicus*

Nina Beri*, Hadassa Guttman*
Jeffrey Gardner, Assistant Professor, Biological Sciences

This project seeks to understand the mechanisms and regulation of lignocellulose degradation by bacteria. Lignocellulose, the material that makes up plant cell walls, is composed of a mixture of polysaccharides including cellulose, hemicellulose and pectin. Cellulose degradation has been an active area of research, but less attention has been directed towards the degradation of other cell wall components. Xylan, a type of hemicellulose, is comprised of β-1,4-linked xylopyranose residues with substituted side

chains of other sugars. The importance of lignocellulose degradation is three-fold. First, in nature, bacterial degradation of plant matter is an integral part of the carbon cycle. Second, in the human gut, bacterial digestion of plant matter contributes 10 percent of total daily caloric intake. Finally, lignocellulosic biomass provides a valuable alternative source of renewable energy. Currently, little is known about how bacteria sense these polysaccharides in the environment and degrade them into component sugars. In our laboratory, the saprophytic bacterium *Cellvibrio japonicus* is used to investigate lignocellulose degradation. Using heterologous gene expression and mutational analysis, our work has uncovered several genes required for the degradation of xylan. Overall, our work will enhance the current model for hemicellulose degradation by environmental bacteria.

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

Analytic Thermal Design of Bitter-Type Solenoids

William Birmingham
Carlos Romero-Talamàs, Assistant Professor, Mechanical Engineering

The objective of my research was to derive an analytic method for designing the cooling system of water-cooled Bitter-type electromagnets. Bitter magnets are solenoids composed of helically stacked conducting disks that are perforated with cooling holes. My research focused on defining the geometry and placement of these cooling holes such that a manageable temperature is maintained within the magnet as electrical current flows through the disks. The analytic expressions I derived approximate the volumetric joule heating profile in the stacked disks with a smooth, continuous profile. The required heat removal rate at each cooling hole can be found by integrating this profile over the volume of the solenoid. The heating profile predictions as well as the heat removal rate determination have both been verified with Finite Element Analysis and will be used to design a 10 T Bitter magnet at the Dusty Plasma Laboratory. Bitter magnets are capable of generating sustained magnetic fields of up to 37 Tesla, and consequently provide a unique tool for studying phenomena in plasma physics, fundamental properties of matter, and nuclear energy.

This work was funded, in part, by the the Special Research Assistantship/Initiative Support.

A Program that Illuminates the Mathematical Foundations of Neuron Resting and Action Potentials

Tiana Boardley
Mauricio Bustos, Professor, Biological Sciences

Cognitive functions depend on neurons communicating with one another via action potential--propagating waves of membrane depolarization and repolarization--that involve electrochemical gradients of sodium (Na^+), potassium (K^+) and chloride (Cl^-) ions, and opening and closing of voltage-gated Na^+ and K^+ channels. A deficiency in the K^+ channels is harmful to the body and can lead to diseases, such as multiple sclerosis (MS) and even sudden death. Questions such as why different types of neurons have different action potentials, or what happens when the concentrations of K^+ or Na^+ change arise. A mathematical model was designed to help shed light on these unanswered questions. The model calculates and visually demonstrates how ionic conductance and capacitive currents give rise to neural resting and action potentials. The model was implemented in a MATLAB program that displays graphs and visual representations of the mathematical expression and its implications. This tool will be valuable to illustrate the physical meaning of classical equations such as the Nernst and the Goldman-Hodgkin-Katz equations. Students will benefit from visual representations of key ideas (e.g., equilibrium and rate of change) about the mathematical foundations of neuron resting and action potentials, which hopefully, will enhance understanding of basic neurotransmission.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Student Learning Objective Regarding Graph Interpretation

Jeffrey Bowman
Jonathan Singer, Associate Professor, Education

The ability to interpret data presented in graphical form is a valuable skill necessary for a student's achievement in college and his or her career. Interpreting graphs is also a skill required for successful completion on the required Maryland biology high school assessment (HSA). The objective of this study was to increase students' ability to attain and understand information presented in the form of graphs, tables, and charts. The study population was selected through various baseline measures that identified 15 students who struggled with interpretation of scientific concepts presented in tables, graphs, and charts. Methods used to improve student's ability included direct instruction, warm-ups, quizzes, review of labs, HSA-style questions, and regular practice problems. Students were assessed on their ability to identify independent and dependent variables, use of appropriate titles, and their ability to analyze the graphs to detect trends. Post-test data will be compared to baseline data and the target for improvement includes every student demonstrating at least a 25 percent score increase.

Subcellular Localization of Glucose-6-Phosphatase and Phosphofructokinase in Glucose Metabolism

***Syrena Bracey**, Casey Kohnhorst, Danielle Schmitt*
Songon An, Assistant Professor, Chemistry and Biochemistry

Spatiotemporal co-localization of metabolic enzymes has been proposed to increase metabolic flux through cluster-mediated channeling. We hypothesized that co-localization of the enzymes in glucose metabolism may indicate a functional multi-enzyme compartment that regulates the direction and magnitude of glucose-derived carbon flux in a cell. We have aimed to investigate every enzyme involved in glucose metabolism to gather enough evidence to support our hypothesis. Glucose metabolism involves two reciprocal processes: glycolysis, which converts glucose into pyruvate within ten steps and gluconeogenesis, which converts pyruvate to glucose in eleven steps. To date, we have focused on glucose-6-phosphatase (G6Pase), which catalyzes the last step of gluconeogenesis, and phosphofructokinase (PFK), which catalyzes the third step of glycolysis. Each enzyme was tagged with a green fluorescent protein via molecular cloning, transfected into cancer cells, and studied under fluorescence live-cell microscopy. PFK formed cytoplasmic clusters in various cancer cells, whereas G6Pase was localized in the membrane of the endoplasmic reticulum, as we expected based on its subcellular function. Functional relevance of PFK-mediated co-localization events with the other enzymes are under investigation. Collectively, successful execution of this project will bring the scientific community closer to understanding the regulation of glucose metabolism and its link to metabolic diseases.

This work was funded, in part, by the University of Maryland, Baltimore County, the Meyerhoff Scholars Program, the Howard Hughes Medical Institute (HHMI) Undergraduate Scholars Program at UMBC, and the Howard Hughes Medical Institute.

Acknowledgement as a Literary Trope in the African American Literary Canon

Nina Burgess
Lindsay DiCuirci, Assistant Professor, English

My research centers on the uses of the term “acknowledgement” in African American literature and the uneven acknowledgement of the African American literary canon by its critics throughout the 20th century. Acknowledgement, in the selected literature I study, refers to the legitimization of the identity of black characters created by African American authors as well as the recognition of the black author within the literary canon. This research also evaluates two overlapping spheres of acknowledgement: how the act of acknowledging has developed into a literary trope in African American literature and how black authors who recognize race in their writing are acknowledged by literary critics. My research focuses on works from the late 19th century’s Realist movement into the Black Arts Movement in the 1960s with emphasis on the work of Charles Chesnutt, Zora Neale Hurston, and Alice Walker. These selected authors investigate forms of acknowledgement in their work both as a way to address and expose social inequities and white privilege

and to explore the literary market's biases. The writers I've selected all wrote about their own literary aesthetic and goals, contributing to the discourse of African American literature before it was conceived as a field of study.

This work was funded, in part, by the UMBC Department of English Honors Program.

A Meta-cognitive Approach to Cultivating Writing in Context

Nina Burgess
Cheryl North, Assistant Professor, Education

Students in this 12th grade English honors classroom in a highly populated urban community struggled to write arguments that supported claims with clear reasons and relevant evidence. To improve their writing skills, the researcher employed a meta-cognitive instructional approach. This approach was intended to facilitate students to better evaluate their personal needs as writers and builds interest in writing by allowing them to monitor their progress. During the intervention phase students completed multiple essay drafts on a self-selected topic that focused on one particular weakness such as using too many simple sentences and writing without an intended audience or purpose in mind. Each draft iteration was completed weekly until the end of the marking period when they published their work. The researcher assessed student growth on the specific identified weakness on a weekly basis by ensuring that students were aware of the specific weakness, and that they would focus on its improvement for the week. The researcher used the end product of this workshop, the portfolio, to measure students' growth as writers. This research will evaluate what techniques helped students become better writers.

True Greens: Creating a Community-based Food System

Andres Camacho, Jack Neumeier*, Thomas Eliason, Lydia Russell, Erik Schwarzenberg, Nusrat Zaman*
Jill Wrigley, Adjunct Professor, Interdisciplinary Studies

"How can students shape the food system on the UMBC campus?". True Greens represents a civic and entrepreneurial response to this question.We have analyzed to models of urban agriculture in Baltimore, such as Big City Farms, and determined that the construction of hoop houses on UMBC's campus would allow for the greatest impact on the campus food system. Hoop houses are a lynchpin of urban agriculture, and could provide substantial amounts of leafy greens to dining services year-round. To reach this goal, True Greens has borrowed from the methodologies of technology entrepreneurship, and during the Spring of 2015, True Greens has worked on the execution of a minimum viable product (MVP) to test underlying questions and address challenges behind creating an on campus enterprise that sells produce to dining services. As a project based learning module in INDS 430: Creating Food System Justice course, students have been growing microgreens in

the UMBC Biology Greenhouse in order to legitimize an on campus business model, and build the professional relationships required to put campus grown produce on the menu at Wild Greens. The data collected from the microgreens MVP (costs, profits, etc.) will illustrate the financial feasibility of growing produce on campus.

This work was funded, in part, by the Alex. Brown Center for Entrepreneurship Idea Competition.

The Economics and Politics of Non-Contributory Pensions in Argentina

Mbalou Camara
T.H. (Tim) Gindling, Professor, Economics; Cynthia Hody, Associate Professor, Political Science

After rising for nearly three decades, recent studies suggest that income inequality in Argentina has fallen since the 2002 economic depression and that greater coverage of non-contributory pensions (NCPs) played a significant role in this trend. NCPs offer monetary transfers to poor elderly, disabled, and mothers of seven or more children who do not qualify for Social Security pensions because they did not contribute to Social Security schemes while working. Last summer, I explored the literature that suggests a negative effect of NCPs on Argentina's economic growth by reducing labor force participation and discouraging formality in the labor market. The purpose of this study is to build upon existing literature by illuminating the economic and political interaction of NCPs in Argentina, and to demonstrate why its implementation has produced a favorable and sustainable trade-off. During the fall of 2014, I studied abroad in Cordoba, Argentina and observed that many political newspapers framed NCPs positively and as socially imperative. The results of an in-depth literature review and content analyses bring to light the importance of tackling income inequality in Argentina through NCPs and reveal how the "political economy" of the program suggests that it is likely to expand in the future.

Joyce Jeffries: A Female Moneylender in 17th-Century England

Audra Campbell
Amy Froide, Associate Professor, History

This research project examined the life of Joyce Jeffreys (Jeffries) (c. 1570-1650) who was a single female moneylender in seventeenth-century England. Her life illustrates how a woman who never married could support herself in early modern England. She is relevant to the public because she gives them a glimpse into the realities of women's lives in the past. Unlike many jobs in that time, which were very gender specific, moneylending was a job that was gender neutral and both men and women could engage in the occupation. She gained a lot of her clientele through various family connections. Jeffreys was a wealthy woman and maintained a household of several servants and maids as well as owning

multiple properties and commissioning someone to build her a house. For a spinster to become wealthy by her own means was not common in seventeenth-century England. Both primary and secondary historical sources were used to research this topic and provide a clear understanding of Jeffrey's life. In fact, one of her account books has survived and this gives us direct insight into her moneylending and consumer practices. It shows that she was meticulous and vigilant about her book keeping for her moneylending business.

Documentation of Female Song in a Newly Recognized Species, the Puerto Rican Oriole (*Icterus portoricensis*)

Susanna Campbell
Kevin Omland, Professor, Biological Sciences

Evolutionary biologists often assume that male competition for females is the root of the evolution of elaborate coloration and song. However, recent findings show that likely both males and females sang in the ancestor of all song birds; but no data exists on female song which suggest that both males and females sang in the ancestor of many species of song birds. We investigated whether Puerto Rican Oriole (*Icterus portoricensis*), a tropical songbird, exhibits both male and female song. For this project, we initially determined sex using size dimorphism and marked individuals with sex-specific color bands. We later confirmed sex using a universal genetic sexing protocol for birds. We repeatedly recorded both male and female Puerto Rican Oriole song. We are the first to document female and male song of this species. Furthermore, female Puerto Rican Oriole song appears to be similar to male song, with no obvious differences in structure. Our study provides further evidence of the ubiquity of female song in tropical songbirds. Finally, our findings provide additional support that female song is ancestral in orioles, and that song dimorphism in temperate breeding species is a result of a loss of female song.

*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.*

Advances in Training of Video Game Development Teams

Eliot Carney-Seim, Austin Pagano, Michael Leung, Andrea Wozniak, Zach Holtzman
Marc Olano, Associate Professor, Computer Science and Electrical Engineering

The Game Developer's Club has created five projects, started several weeks into last semester, which will be reaching completion by the end of the spring semester. *Revolve Online* is a 3D online multi-player shooter where the winner can make a change to any aspect of the game, forever! *Rolling Thunder* is a 3D tactical flight simulator, where big guns and reckless commands win the day, that's where you come in. Fly tactically, protect

the bombers and command your wing men to victory. Are you up for the challenge, pilot? *Hue Bots* is a 2D top-down puzzle game where you can build and control little multicolored robots, which you must use to solve increasingly complicated puzzles. The goal of each level is to get your special white robot to the finish. *Second Hand* is a 2D puzzle horror game where a disease is unleashed upon a derelict cruise ship. When the vessel's mechanical servants begin a fatal quarantining, it's up to Henrietta, the ship's mechanic to save whoever she can.*Inheritance* is a 2D dungeon crawler where you can level up your parent characters to make a strong new class child who receives the inheritance of the past characters you controlled.

Touched

Stephanie Castner
Douglas Hamby, Associate Professor, Dance

In summer 2014, I attended the Broadway Dance Center (BDC) Summer Professional Semester, an eight-week dance-training program located in New York City, offering instruction from a variety of world-renowned professional teachers and mentors. Using knowledge of modern dance that I gained while studying at UMBC, along with the new skills and insights I learned while at BDC, I explored the contrast between partnering in modern and jazz dance. Following the completion of my training program, I returned to UMBC to create a dance performance piece that investigates partnering, explores the contrast between jazz and modern dance, and utilizes the variety of new choreographic methods and rehearsal modes I experienced. Through the creation of my piece, *Touched*, I was able to explore how to abandon traditional, stylistic conformity and integrate technique, partnering, and choreographic elements of both modern and jazz dance. *Touched* was presented in the fall 2014 First Works Dance Showcase.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education and the UMBC Dance Department Summer Research and Study award.

Understanding the Role of Passenger Genes in the HoxB13/Myc/T-Cre Prostate Cancer Model

Haneet Chadha
Charles Bieberich, Professor, Biological Sciences

Abstract not available for publication.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

A Mouse Model of Kabuki Syndrome Shows Evidence of Deficient Neurogenesis

Sheetal Chopra
Jill Fahrner, Assistant Professor, McKusick-Nathans Institute of Genetic Medicine, Johns Hopkins University; Hans Bjornsson, Assistant Professor, McKusick-Nathans Institute of Genetic Medicine, Johns Hopkins University

Kabuki Syndrome is a Mendelian genetic disorder characterized by intellectual disability, growth retardation, and a range of physical features, which includes a flat facial profile with depressed nasal tip, long palpebral fissures, and arched eyebrows. Our lab previously characterized a mouse model of Kabuki syndrome ($KMT2D^{+/-}$) and demonstrated a deficiency of neurogenesis in the granule cell layer of the dentate gyrus of the hippocampus and neurological dysfunction (hippocampal memory defects) in this mouse model. We have extended the analysis to a second mouse model of Kabuki syndrome ($KDM6A^{+/-}$). Interestingly, KDM6A is on the X chromosome and is known to escape X inactivation. We have used fluorescence microscopy to measure the granule cell layer and to quantify neurogenesis in mutant and wild type mouse hippocampus. Immunofluorescence with an antibody to doublecortin, a marker of neurogenesis, and incorporation of EdU, a marker of cell proliferation, revealed a deficiency of hippocampal neurogenesis in mutant mice. The neurogenesis defect was more pronounced in males compared to females, suggesting sex differences may exist. When combined with published results from our laboratory, our studies suggest that hippocampal neurogenesis defects provide a common pathogenic mechanism to explain intellectual disability in Kabuki syndrome.

This work was funded, in part by the NIH Director's Early Independence Award (DP5OD017877).

Application of Human Glucokinase to Measure Glucose Levels *in vitro*

Tobias Clevinger
Elsa Garcin, Assistant Professor, Chemistry and Biochemistry

A rudimentary fluorescence-based glucose detector has been designed which is constructed using a sol-gel with encapsulated human glucokinase. Glucokinase is an enzyme with a significant role in glycolysis, initiating the glycolytic pathway. The enzyme binds glucose and adenosine tri-phosphate (ATP), and then undergoes a conformational change, allowing the reaction to occur. Glucokinase's affinity for glucose increases with an increasing concentration of glucose, and the associated conformational change causes a notable change in the fluorescence of bound Bis-ANS, an ATP analog. These phenomena allow for the concentration of glucose to be measured with fluorescence detection. By exposing this sol-gel to various concentrations of glucose, the change in Bis-ANS fluorescent properties can be used to determine glucose concentration. Glucokinase is readily overexpressed in bacterial cells and purified, which makes this sensor relatively easy to produce. The

feasibility of this sensor is currently being tested as a function of enzyme and glucose concentration. This method could, if proven effective, act as an alternative to current amperometric blood-sugar detectors, which rely on the glucose oxidase enzyme. Since detection by fluorescence does not require physical contact with the sample, this alternative method could potentially result in a blood sugar detector which does not draw blood.

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

Is Sexual Satisfaction a Buffer for Relational Satisfaction When There is Religious Tension?

NaQuita Coates
Robin Barry, Assistant Professor, Psychology

Relationship satisfaction predicts personal well-being and health. Low relationship satisfaction predicts relationship dissolution. Marital research has found a strong positive relationship between sexual satisfaction and romantic relational satisfaction. One proposed explanation for this relationship is that sexual satisfaction serves as a buffer that maintains relatively higher relational satisfaction when couples experience difficulties in their relationship such as poor communication. The current study applied this hypothesis to two different areas of relational functioning, namely sexual frequency and tension regarding religion. Self-report questionnaires were administered to 114 newlywed couples from the Baltimore area. Spouses self-identified their racial status and religious background. We proposed that sexual satisfaction could buffer the influence of higher levels of tension regarding religion on relational satisfaction. We also proposed that relational satisfaction would buffer the effects of low sexual frequency on sexual satisfaction. We found support for our second hypothesis, but not our first. Relationship satisfaction was more strongly associated with sexual satisfaction when sexual frequency was low compared to when sexual frequency was high. Sexual satisfaction did not buffer relational satisfaction when there was religious tension. Instead, the association between sexual and relational satisfaction was stronger when religious tension was low compared to when tensions were high.

This work was funded, in part, by the UMBC Couples and Family Research Lab.

Anticipating Future Ethical Issues with Prosthetic Devices

Niara Comrie, Emily Canapp, Lailynn Reyes
Richard Wilson, Lecturer, Philosophy

A substantial number of prosthetic users experience difficulties with the payment for and then use of prosthetics. Through research, Insurance companies have been found to be

reluctant to cover costs related to prosthetics. The cost of prosthesis ranges from $30,000-$50,000, while an average American household makes $69,000 a year. It is unquestionable that there are ethical issues and violations of the Code of Ethics when insurance companies deny coverage for prosthetics. Without an insurance company's assistance, an amputee would not be able to receive and then use a prosthetic device. The objective of this research is to inform the public about the ethical issues including violations of insurance companies' codes of conduct when denying coverage for those who need prosthetics. An ethical analysis of these concerns will be followed by an anticipatory ethical analysis of difficulties prosthetic users may face in the future. The ethical analysis will be used to develop recommendations that anticipate ethical issues that may arise for both current prosthetic patients and future prosthetics users.

Population Genetics of the American Redstart: Locating the Winter Sites

Eileen Connell
Colin Studds, Assistant Professor, Geography and Environmental Systems

Setophaga ruticilla, the American Redstart, is a long distance migratory bird which contains distinct populations. Within breeding range the American Redstart has populations in Nova Scotia and New Brunswick that differ genetically from the rest. Although the American Redstart migrates to the Caribbean for the winter, it has yet to be determined whether these specific populations intermix with other American Redstarts. In order to ascertain the location of these breeding populations from blood samples collected across the Caribbean, mitochondrial DNA was isolated through using DNA extraction, gel electrophoresis, and polymerase chain reaction. By combining these techniques with DNA restriction, ligation, and computer programs PAUP, STRUCTURE, and ArcGIS, the unique DNA sequence has been identified in the Caribbean. The DNA sequencing of individuals throughout the Caribbean will improve knowledge about the connectivity of the breeding and winter seasons for the genetically distinct populations.

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

Old Italian Singing as an Alternative to Modern Vocal Pedagogy

Melissa Crowhurst
Joseph Morin, Lecturer, Music; Janice Jackson, Music

This research investigated Old Italian Singing ("OIS") and its pedagogy as a teaching method for choral students. In contrast to the modern vocal instruction, which tends to sculpt the voice into a preconceived categories, OIS is a nineteenth-century Italian method of singing that develops the natural and most efficient vocal qualities that are unique to an individual's voice, focusing on such aspects as agility, vocal color, texture, and emotion.

Given its non-stressful approach toward developing the voice, it seems an ideal vocal method for the instruction of young singers. During the summer of 2014, I began my research in Florence, Italy, where, through daily private voice lessons at Florence University of the Arts, I studied OIS with Ms. Susanna Piccardi. Following that study, I implemented the OIS pedagogy in my internship with Anne Arundel County Public Schools and at UMBC for the beginning vocal class and UMBC Music Education students. Based on the observational data gathered, OIS appears to be very beneficial in the classroom. Among the most valuable aspects of OIS is the attention to proper Italian vowel sounds, pure vocal tone and supported vocal breathing, which makes OIS an ideal method for beginning singers.

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

Sight Reading Skills in a Music Classroom

Melissa Crowhurst
Jonathan Singer, Associate Professor, Education

Sight reading develops the musician's rhythmic and melodic skills and is a key component of the Maryland State Music Curriculum. This research targets seventh-grade vocal students in an urban middle school. In order to measure student growth of sight reading skills, a four-measure sight-reading pre-assessment was administered to 22 students. The students were evaluated on correct pitches and rhythms. The target group was created, consisting of 15 students who scored less than 85% on the pre-assessment. Administering a pre-assessment identified which skills the students needed additional practice on. During each class, the teacher presented a melodic and rhythmic sight reading example of similar difficulty to the pre-assessment. By modeling how to clap, speak, and sing these examples, the students had the opportunity to practice their sight reading skills. The students had a post assessment during February of 2015, with a goal that 73 percent of students in the target group would increase their sight reading score by three points or more. This goal was met, with data yielding that 12 students or 80% of the target group increased their score by at least 3 points or more.

Analyzing the Mechanism of Allosteric Inhibitor AG6 on Hepatitis C Viral Polymerase

Daniel Dagenhart
Ian Thorpe, Assistant Professor, Chemistry and Biochemistry; Ester Sesmero, Chemistry and Biochemistry

About 150-200 million people in the world are infected with Hepatitis C (HCV), a virus that leads to cirrhosis of the liver as well as hepatocellular carcinoma. In the United States,

an estimated 3.2 million people are infected with this virus. There is no vaccine currently available, and current treatments are not completely effective. The RNA-dependent RNA-polymerase of HCV, NS5B, has a “right-handed” globular shape that includes finger, thumb, and palm domains. In the last 20 years, researchers have investigated two different kinds of inhibitors for NS5B: nucleoside and non-nucleoside inhibitors. Nucleoside inhibitors bind in the active site and are chain terminators. Non-nucleoside inhibitors work allosterically by binding to locations separate from the active site. AG6 belongs to the latter category. Our goal is to investigate the mechanism of allosteric inhibition of ligand AG6 when bound to the template channel of NS5B. For this study, we used Molecular Dynamics simulations with explicit solvent, as well as analysis tools such as root-mean-squared deviation and free energy landscape plots. Our results showed specific structural and dynamic changes caused by AG6 that affect the replication process. The new insights obtained may lead to development of enhanced and novel anti-viral treatments for HCV.

The hardware used in the computational studies is part of the UMBC High Performance Computing Facility (HPCF).

Heterologous Expression of Monooxygenase AA9 from *Aspergillus nidulans*

Raissa Dantas
Mark Marten, Professor, Chemical, Biochemical, and Environmental Engineering; Liliane Ribeiro, Chemical, Biochemical, and Environmental Engineering

Filamentous fungi are used prevalently in the biotech industry for expression of various products including food, therapeutics, and specialty chemicals. Filamentous fungi are also capable of expressing tremendously high titers of recombinant protein. The goal in this project is the expression of a *Malbranchea pulchella* protein from*Aspergillus nidulans* (both species are filamentous fungi). The protein of interest is GH61, also known as monooxygenase AA9, which is a member of the lytic polysaccharide mono-oxygenase family of proteins. GH61 has been shown to have an oxidative mechanism, and thus is able to break-down recalcitrant polysaccharides. For example, GH61 has the potential to degrade lignocellulose, a major biomass resource which has traditionally been challenging to break-down because of its complex branching and acetylation patterns. Our proposed experimental method is to use a bacterial vector to transform *Escherichia coli* with GH61, then harvest the successful transformants and transform *A. nidulans*. Once the GH61 protein is expressed, we plan to do further biochemical characterization with the enzyme by testing for lignocellulotic degradation in biomass as a cocktail mixture with cellulase. The preliminary results are still under way, as we are currently working in order to successfully clone our gene.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Pre-pregnancy Obesity and its Correlation with Singleton Preterm Birth

Suravi Das
Michael Nolin, Professor, Deputy Director, The Hilltop Institute; Katie Birger, Health Administration and Policy Program

The United States has one of the highest infant mortality rates among developed nations, 18 percent of which is caused by preterm births. Following a comprehensive and systematic literature review of epidemiological studies from multiple countries, this meta-analysis investigated the effect of pre-pregnancy obesity on singleton preterm births by applying the inverse variance heterogeneity (IVhet) model. This provided increased statistical power by pooling results, thereby removing the ambiguity created by past studies. The results were highly heterogeneous, noted by an I2 value of 82 percent, thereby validating the use of the IVhet model over the random effects model. Overall, there was no statistically significant correlation between pre-pregnancy obesity and singleton preterm birth after adjusting for confounders. Obesity class I (BMI 30-34.9) and class III (BMI 40+) had a protective effect on spontaneous preterm birth, with a 20 percent and 16 percent lower probability, respectively. While these results did not find a direct link between pre-pregnancy obesity and the increased presentation of preterm birth, they suggest that common comorbidities, such as hypertension and diabetes, are more strongly correlated. Public health programs aimed at reducing the level of obesity in reproductive aged women may yield fruitful results by reducing these comorbidities.

This work was supported by the UMBC Scholars Program and the UMBC Department of Health Administration and Policy, Public Health.

Automated Solution to Overhead Crane Runway Surveying

Aaron David, Paul Giro, Andrew Duhan, Leah Mason, Alfred Yeager
E.F. Charles LaBerge, Professor of the Practice, Computer Science and Electrical Engineering

Determining the rail span of top running overhead cranes is a time-intensive and inaccurate process. The cranes ride along steel rails, called the runway, which are mounted high above the work area of manufacturing buildings. The rails have up to 100 foot spans and 300 foot lengths. The span must be accurate and consistent to ensure the proper operation and lifespan of the crane. In current practice, a rail span survey requires surveyors to climb up to the crane rails and stretch a measuring tape between them, pulling the measuring tape as taut as possible to minimize error. Current practice is limited to measuring the span at only three to four locations on the rail due to limited accessibility to the full length of the rails. We have developed an automated solution to accurately survey the rail span for cranes of various sizes. Our system is capable of completing the survey in less time, with fewer individuals, with greater accuracy, and with more data points than the current method.

This project was supported by a grant from Reading Crane and Engineering Co., and by the UMBC Department of Computer Science and Electrical Engineering.

Lithium Nickel Borate as a Cathode Material for Lithium-Ion Batteries

William Dean
Mark Allen, Assistant Professor, Chemistry and Biochemistry

Lithium-ion batteries have been made using a variety of cathode materials, and optimizing these materials for their ability to reliably intercalate and deintercalate lithium ions during the battery's discharge and charge cycles is essential to improving lithium-ion battery technology. One emerging family of battery materials is the metal borates, which have the general formula $LiMBO_3$, where M is any metal ion. They are mainly notable for their theoretical gravimetric energy density related to the relative lightness of their borate polyanion group. These compounds have a higher theoretical energy density than other high potential electrode materials. This research analyzes the novel material lithium nickel borate (LNB), and presents an optimized aqueous synthesis strategy at room temperature. The structure and elemental composition of the synthesis product was determined using transmission electron microscopy (TEM) and inductively-coupled plasma mass spectroscopy (ICP-MS) respectively. Data were collected on the cyclability, power performance, and capacity of LNB within galvanostatic testing cells. The results show that LNB has promise as a useable cathode material, though more work will be required in order to improve cycling performance and bring its actual energy density closer to the theoretical maximum.

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

Design of a Real-Time Digital Guitar Pitch Shifter

Vignesh Dhanasekaran, Daniel Abid, Joshua Lay, Keiran Holmes
E.F. Charles LaBerge, Professor of the Practice, Computer Science and Electrical Engineering

A pitch shifter is a device that allows a guitarist to alter the tuning of his or her electric guitar in real time, without making any adjustments to the instrument itself. The goal of this project was to design such a device. The pitch shifter has several modes that allowed the user to change the pitch of the guitar strings by a variable amount. Our solution received an audio signal from the output of an electric guitar. A digital processor, digitized and buffered the input signal. The time domain audio signals were transformed into the frequency domain to analyze their spectral content. Using an audio feature extraction algorithm, the shifter analyzed the signal and determined which notes the guitar had played. Finally, using a phase vocoder, the frequency content of each string was altered. Since

human perception of pitch is a group of frequencies, altering the frequency content of the audio signal altered the perceived pitch. This process allowed the guitar to be effectively retuned in a digital manner. Different techniques were used in this research to determine which notes are being played on the guitar, alter the frequency content, and resynthesize the audio signal.

This project was funded by the UMBC Department of Computer Science and Engineering.

Effect of Accessible Language on Students' Ability to Create Mathematical Models of Real-World Scenarios

Chinwe Di-ibor
Christopher Rakes, Assistant Professor, Education

This study addressed the ability of 52 eighth grade students, in an economically disadvantaged urban school, to use mathematics to model real-life scenarios. The study focused on the Common Core standard of mathematical practice of making sense of problems and persevering in solving them. A review of the students' classwork, homework, quizzes and district assessments revealed that approximately 60 percent of the students were unable to correctly create and solve a linear model from a word problem, but demonstrated an ability to solve linear equations if the models were supplied to them. The purpose of this study is to determine if using language more accessible to the students will improve the students' ability to understand the written scenario and create an accurate mathematical model. The data collected from the students' classwork, homework, quizzes and tests will be analyzed to determine if the modification in the language used resulted in an increase in student achievement.

Simulated and Experimental Effects of RNA Interference on Cell Motility

Dominick DiMercurio
Michelle Starz-Gaiano, Assistant Professor, Biological Sciences; Bradford Peercy, Assistant Professor, Mathematics and Statistics

Cell motility is common in animal biology and is a key phenomenon in wound healing, immune function, and embryo development. We study *Drosophila melanogaster* to identify highly conserved genes important in cell migration. In particular, we focus on the border cells, which arise at one end of the developing egg and move toward the other. A key molecular pathway in this process involves the molecule Signal Transducer and Activator of Transcription (STAT). When we reduced gene expression via RNA interference (RNAi), we reproduced STAT-pathway mutant phenotypes of partially or completely inhibited migratory behaviors compared to controls. In qRT-PCR experiments, we quantified mRNA concentrations to investigate how these related to the phenotypes. Our results provide experimental data for comparison with the predictions of the Ge-Stonko model, a system of

differential equations that represent the pathway of interest. This research will help biologists obtain a better understanding of the molecular mechanisms controlling cell migration, which may lead to insights on the metastasis of cancer and the occurrence of birth defects.

This work was funded, in part, through an Undergraduate Biology Mathematics (UBM) Award from the National Science Foundation under Grant No. DBI 1031420, PIs Drs. Leips and Neerchal.

Eating Habits of College Students at UMBC

Kelsey Donnellan
Jill Wrigley, Adjunct Professor, Interdisciplinary Studies

At the University of Maryland, Baltimore County, the transition for students involves a diet low in vegetable and fruit (v/f), which contain valuable nutrients. To address these habits, I produced a nutrition and garden guide designed to promote increased v/f consumption. Participants were randomly placed in 4-week intervention groups. Garden 1 participants received my guide and experienced the informal social interactions The Garden provided. Garden 2 only experienced social interactions gardening and did not receive my guide. Non-Garden 1 received my guide but did not participate in The Garden. Non-Garden 2 had neither my guide nor affiliation with The Garden. The effectiveness of the interventions was measured by data obtained from pre- and post-assessment food journals, where participants totaled their consumption of the food groups: fruits, vegetables, grains, protein, and dairy. The pre-assessment food journals were completed before the first harvest in The Garden, and post-assessments four weeks later. At the onset both Garden groups had higher v/f consumption than either Non-Garden group. Information received through the post-assessment journal demonstrated an increased v/f consumption by 1.28 v/f per day in Garden 1, while all other groups showed a decrease.

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

Future Children

Emily Eaglin
Vin Grabill, Associate Professor, Visual Arts

In the spring semester of 2014 I submitted the film *Future Children,* that I wrote and directed, to Campus MovieFest, a film competition held on campus. I won the Best Director and Best Actor awards, and I was selected to screen this film in Universal Studios Hollywood at the Campus MovieFest National Conference.The inspiration behind *Future Children* can be traced to one simple question that I began to hear frequently, “What are

you?" After noticing that I, myself, have never asked a person this and that I was being asked this before being asked my name, I ventured deeper behind the underlying messages of the question. This presentation will include a screening of *Future Children*. I will also speak briefly about my creative and social justice inspirations as well as my involvement with the greater UMBC community in this regard. Through this presentation I hope to inspire others to look critically and analyze the identity-related questions that they are being asked/asking everyday and to encourage them to make creative and positive solutions to solving any issues they may face because of said questions.

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

A Community-based Approach to Translational Research Addressing Breast Cancer Disparities in Baltimore City

Nnamdi Edokobi
Laundette Jones, Assistant Professor, Department of Pharmacology, University of Maryland School of Medicine

According to 2013 Cancer Data Report form the Maryland Department of Health and Mental Hygiene, mortality rates for breast cancer are significantly higher among ethnic minority (34.1%) than the general United States population (21.9%). Reasons for these gaps are not well understood, but socio-economic status, barriers to health care services, and biologic differences in tumors are among the contributing factors. There is a growing recognition that traditional research approaches seeking to reduce complex health disparities would benefit from actively engaging community residents in the full spectrum of research from conception to interpretation of results. This project takes the first step toward a Community-Based Participatory Research (CBPR) project. Our objectives are to (1) become familiar with the built-environment and resources available within of the local community to determine potential risk factors that may contribute to health disparity in Baltimore City, and (2) develop an agenda for a meeting with a local breast cancer survivor organization to explore developing a partnership that equitably involves the community in the research process. We anticipate that combining the knowledge of researchers and community members in partnerships to improve community health will lead to reductions in breast cancer disparities.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Dental Health of the Delmarva Adena Native Americans

Erin Edwards
Michael Lane, Assistant Professor, Ancient Studies; Esther Read, Lecturer, Ancient Studies

I examined the dental health of Delmarva Adena-Hopewell Native Americans from a mortuary ossuary pit at the Pig Point site in Lothian, Maryland. I looked for indications of dental health through the frequency of cavities and linear enamel hypoplasia observed macroscopically. The Pig Point site is unique in that its impressive ritual mortuary features indicate that this was an area of significance to local prehistoric populations. Dr. Douglas Owsley of the Smithsonian Institution carefully examined the human remains from the first burial ossuary pit, and I compared Dr. Owsley's analyses of the dental remains of the first burial pit with the dental remains of the fourth burial pit. I established the minimum number of individuals (MNI) represented in the ossuaries and assessed the occurrences of dental diseases by looking for dental caries and linear enamel hypoplasia. In most prehistoric forager societies, the frequency of dental caries is low, while the frequency of linear enamel hypoplasia is high. I hope the results will contribute towards a further understanding of the subsistence practices of local Delmarva peoples and ultimately contribute to scholarly hypotheses about the prehistoric lifestyles and lifeways of the Delmarva Adena-Hopewell based on anthropological dental analysis.

Quantum Mechanics in Curved Spacetime

Alex Eftimiades
James Franson, Professor, Physics

The equivalence principle is a basic postulate of Einstein's theory of general relativity. It states that gravity causes all (small) free-falling objects to accelerate at the same rate, regardless of their constitution. Electrons are known to have a property called spin that causes them to behave as though they precess either clockwise or counterclockwise with respect to their direction of motion. Recent publications suggest that gravity causes electrons with different spins to fall at different rates. I have explored the relative merits of using customized finite difference approximations and Mathematica's NDSolve to test this theory via computer simulation. I found that Mathematica's NDSolve was capable of producing useful results while customized finite difference approximations were generally too complicated to implement by hand. Specifically, NDSolve routines demonstrated that the standard vierbein formalism of quantum mechanics in curved spacetime lead to results in which electrons with different spins do fall at different rates. Hand crafted finite difference approximations may still hold some potential for testing alternative hypotheses, but more time would be needed to design the appropriate algorithms.

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

Examining the Intersections of Bildungsroman and Immigration Narratives in Contemporary United States Fiction

Arielle Erenrich
Jessica Berman, Professor, English

The purpose of my research and literary analysis is to see how the dual narratives of Bildungsroman, or coming-of-age novel, and immigration intertwine in contemporary U.S. fiction. Through analyzing the novels *How the García Girls Lost Their Accents*, by Julia Álvarez, *When I was Puerto Rican*, by Esmeralda Santiago, and *The Brief Wondrous Life of Oscar Wao*, by Junot Díaz I show the relationship between Bildunsroman and immigration narratives. These three novels simultaneously represent the themes of immigration to the U.S. and maturation. Like the Bildungsroman, narratives of immigration focus on characters' struggles to find their identity within society. Bildungsroman traits such as characters' physical journeys and identity formations are transformed by the addition of other elements, such as the influence of family/community and non-linear narrative structure. Immigration narratives change how we understand these elements of the Bildungsroman. I will synthesize literary criticism of the texts themselves, as well as literary theory from the feminist, Latin American/Caribbean studies, immigrant studies, and Bildungsroman perspectives. I will argue that our understanding of the Bildungsroman genre should expand to include novels that reflect the diverse experiences of coming of age in society today and particularly to account for narratives of immigration.

Understanding Allosteric Inhibition of the Hepatitis C Virus Polymerase Using Non-Nucleoside Inhibitors

Marie Espiritu
Ian Thorpe, Assistant Professor, Chemistry and Biochemistry; Ester Sesmero, Chemistry and Biochemistry

The Hepatitis C Virus (HCV) is a global epidemic, affecting three percent of the world's population. It is a blood-borne virus that ultimately leads to cirrhosis and liver cancer. HCV evades the body's natural defenses by mutating itself during the replication process. The HCV polymerase, NS5B, is critical to replication and is, therefore, a target to treat HCV. Non-nucleoside inhibitors (NNIs) have been shown to be very good candidates for HCV treatment. These inhibitors bind allosterically, outside the active site of the NS5B enzyme. Two such NNIs are the ligands AG0 and AG6 that bind to the thumb and finger domain respectively. In our study, we utilized Molecular Dynamics (MD) simulations of AG0 and AG6 bound simultaneously to NS5B. Our goal was to analyze the effects of AG0 and AG6 on the polymerase's structure, dynamics and function. For this purpose, we used common computational analysis tools such as root mean square deviation and free energy calculations. Elucidating the mechanism of inhibition of these ligands may provide information that could be key in finding more effective treatments for HCV.

The hardware used in the computational studies is part of the UMBC High Performance Computing Facility (HPCF).

Mohawk and Cherokee Language Revitalization: Overview, Assessment, and Challenges

Sierra Francis
Omar Ka, Associate Professor, Modern Languages, Linguistics, and Intercultural Communication; James Thomas, Adjunct Professor, Interdisciplinary Studies; Marie DeVerneil, Senior Lecturer, Modern Languages, Linguistics, and Intercultural Communication; Anna Shields, Associate Professor, Modern Languages, Linguistics, and Intercultural Communication

Linguistic diversity is the key to maintaining historical, ecological, scientific, and cultural knowledge about our planet. Unfortunately, the colonization of North America resulted in the loss of nearly half of the indigenous languages that were spoken on the continent, and those remaining today are undergoing a process of language shift. This research seeks to assess the status of two Iroquoian languages with fairly limited scholarship, Mohawk and Cherokee, as well as emphasize the role education plays in their revitalization initiatives. Each assessment was organized according to UNESCO's 2003 *Language Vitality and Endangerment* document. The document outlines nine factors of language vitality, and acts as a set of guidelines to identify the immediate needs of language communities through the evaluation of intergenerational transmission, speaker population, language attitudes, domain use, educational materials, and language policies. My findings indicated the need for teacher training programs, linguistics education, increased community involvement in and outside of schools, and means to address the negative language attitudes held by various Mohawk and Cherokee youth. Luckily, the establishment of locally controlled immersion schools, increased parental involvement, and adaption to new domains of use have prevented both languages from further declining, and given hope to each community.

Song Repertoire of the Marsh Wren (*Cistothorus palustris*) on the Gulf Coast: Implications for Sexual Selection

Megan Gallagher*, Sarah Luttrell*
Bernard Lohr, Assistant Professor, Biological Sciences

Populations of birds that have unique song patterns may mate assortatively, and could become genetically isolated depending on their song preferences. Marsh Wrens (*Cistothorus palustris*) have a diverse song repertoire consisting of many different song types. Eastern and western populations of Marsh Wrens have dissimilar repertoire sizes with western populations having repertoires upwards of 100 songs, while eastern populations have repertoires of 50-60 songs. In areas where these populations are found together, they mate assortatively based on repertoire size and song delivery style. Our study focuses on a non-migratory population of the eastern group in the Gulf Coast (subspecies *C.p.thryophilus*). This population has as yet undescribed singing behavior, and shares its wintering ground with a migratory population from the Great Lakes region

(subspecies *C.p. dissaeptus*) whose singing behavior has already been described. We recorded male Marsh Wrens in Chambers County, Texas in May 2014. We found that Marsh Wrens from the Gulf Coast population have a repertoire similar to the migratory eastern population of Marsh Wren. We found no evidence that repertoire size or song-delivery style is a mechanism for sexual selection between the non-migratory Gulf Coast and migratory Great Lakes populations.

CPSF30: A Novel Zinc-Finger Protein with Therapeutic Value

***Sanchari Ghosh**, Geoffrey Shimberg*[1]
[1]University of Maryland, Baltimore
Sarah Michel, Associate Professor, Department of Pharmaceutical Sciences, School of Pharmacy, University of Maryland, Baltimore

Zinc-finger (ZF) proteins are a class of proteins that use coordination of zinc ions with cysteine (Cys) and histidine (His) residues to achieve their structural and functional properties, which are typically related to gene regulation. Cleavage and Poly-adenylation Specificity Factor 30 (CPSF30), is a novel annotated ZF-protein that plays a critical role in pre-mRNA processing. It contains five Cys_3His ZF domains and one $Cys_2HisCys$ ZF domain, and is a virulence target for influenza. Our laboratory has discovered that in addition to the zinc sites, CPSF30 contains an iron-binding site (a 2 iron-2 sulfur site). The role of the iron site is not known. I have over-expressed a construct of CPSF30 that contains the iron site and five ZF domains linked to a hexa-histidine 'tag' in order to purify CPSF30 for metal binding and function studies. The goal is to understand how the availability of metal ions (iron and zinc) affects the metal binding capacity, or metal loading, of the protein and how metal loading affects protein function. Protein expression, purification and metal analysis data (via Inductively Coupled Plasma Mass Spectometry, or ICP-MS) along with RNA binding studies will be presented.

*This work was funded, in part, by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC and NSF CHE1306208.*

Using Biocompatible Hydrogels to Protect Electrochemical RNA Aptamer-Based Sensors for Continuous Drug Load Monitoring

***Ethan Glaser**, Lauren Schoukroun-Barnes*
Ryan White, Assistant Professor, Chemistry and Biochemistry

Electrochemical RNA aptamer-based sensors are nucleic acid oligomers which can be used to specifically and sensitively determine the concentration of small analytes in diverse situations. By attaching the RNA strand to an electrode and a redox molecule at opposite ends we can quantify the change in shape that the strand undergoes during its binding event by measuring the electron transfer between the two ends. The RNA aptamers used in this

experiment are specific to aminoglycoside antibiotics such as tobramycin. When taking antibiotics, the dosing must be exact because over dosage could lead to organ damage while under dosage could promote the growth of antibiotic-resistant bacteria. Current testing methods do not offer the continuous monitoring of antibiotic concentration necessary for dosage management. In order to determine the concentration of drug in a patient's blood, the highly unstable RNA aptamers must be protected from nuclease activity. We show that by enveloping the RNA aptamers in a biocompatible hydrogel coating we can prevent enzymes from degrading the aptamers during the continuous monitoring of the drug concentration. By varying the crosslinking density and thickness of the hydrogel, we can vary the response time and the degree of protection.

Protracted Social Conflict Theory and Hamas-Israeli Tensions

Zachary Goldberg
Brigid Starkey, Senior Lecturer, Political Science

This research looked at the notion of a high conflict normal relations range (NRR) in protracted social conflict (PSC) situations and the compulsion of domestic stakeholders to perpetuate such conflicts for their own purposes. The project focused on Hamas, the Gaza-based, militant Islamic organization that periodically engages with the Israeli Defense Forces (IDF). Some of these conflicts have come to be recognized as "mini-wars" (2009, 2012, and 2014). The hypothesis was that Hamas would seek out open conflict with Israel to shore up sagging public support from within the Palestinian constituency. The research matched public opinion data collected by An-Najah National University and The Palestinian Center for Policy and Survey Research with event data on the trigger points and cease-fires of the mini-wars. The findings point to a bump in public support for Hamas after it engages in violent conflict with Israel. The findings support the work of PSC theorist Edward Azar, who wrote that groups on both sides of the conflict divide would perpetuate violence indefinitely because they have no interest in peace or settlement.

Sex Differences in the Relationship Between Pain Catastrophizing and Laboratory Pain

Shelby Goodwin, Robin Arnold
Raimi Quiton, Assistant Professor, Psychology; Eryka Boyd, Psychology

Cognitive factors (e.g., catastrophizing) are known to influence people's pain experiences. Sex differences in pain and pain catstrophizing have been reported, with women generally showing greater pain sensitivity and catastrophizing than men. We hypothesized that higher levels of pain catastrophizing would be associated with lower pain thresholds, lower pain tolerances and reduced endogenous pain inhibition. This study included 34 healthy adults (mean age=23.7 [SD=7.1]; 58% male; 36% White, 31% Asian, 17% Black). Participants completed the Pain Catastrophizing Scale and participated in sensory tests to measure heat

pain threshold, heat pain tolerance, and magnitude of conditioned pain modulation (CPM), a measure of the activation of endogenous pain modulatory systems. Pain catastrophizing did not differ between men and women, $p > .05$, and was not significantly correlated with pain threshold or tolerance. In men but not women, catastrophizing was significantly correlated with CPM magnitude $r(18) = -.49$, $p < .05$, such that greater catastrophizing was associated with greater activation of endogenous pain inhibitory systems. These results indicate that some psychosocial factors contributing to endogenous pain modulatory mechanisms differ by sex and suggest that sex is an important variable to consider when developing and selecting interventions for pain conditions.

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

Relation Between Anxiety and Pain in Healthy Children

Nicole Gosnell
Lynnda Dahlquist, Professor, Psychology

This study examined the relation between perceived pain intensity, pain tolerance, and anxiety in healthy children exposed to experimentally-induced cold pressor pain (hand submergence in very cold water). Fifty-eight children aged 6-14 years completed the Revised Children's Manifest Anxiety Scale (a self-report, dispositional anxiety questionnaire) and also rated their anticipatory anxiety before undergoing a cold pressor trial. Post cold pressor trial, each child provided a pain intensity rating. Pain tolerance was measured by the amount of time (in seconds) the child was able to keep his/her hand in the water. The relation between dispositional anxiety scores and pain tolerance was moderated by age, it was positively correlated in younger children (ages 6-9) and negatively correlated in older children (ages 10-14). There was not a significant relation between anticipatory anxiety and pain intensity ratings or pain tolerance. Results suggest the relation between anxiety and pain in children may be different than in adults. Further research is necessary to demonstrate whether these results could be replicated in a larger healthy, clinically anxious, or chronic illness pediatric sample. Such insight may be useful in attempts to understand anxiety in pediatric patients undergoing painful procedures ranging from vaccinations to oncology treatments.

Investigation of Histone Methyltransferases Set1 and Set5 to Identify Mechanisms of ncRNA at Transposable Elements

Andrew Graham-Yooll
Erin Green, Assistant Professor, Biological Sciences

Histone methylating enzymes Set1 and Set5 have been implicated in the regulation of transposable elements (*Ty*) of *Saccharomyces cerevisiae*. The sense strand is transcribed along with the anti-sense transcript to regulate the rate of transposition. This anti-sense

strand is degraded rapidly by the 5'-3' exonuclease Xrn1 shortly after transcription. Deletion of XRN1 helps to stabilize ncRNA that would otherwise be degraded and allows the determination of genetic interaction between SET1, SET5, and XRN1. Generating double and triple mutants of XRN1, SET1 and SET5, we conducted a series of experiments to test the hypothesis of SET5 cooperating with SET1 in regulating ncRNAs at Ty elements. We have identified a synthetic genetic interaction between XRN1, SET1, and SET5. To investigate this genetic interaction, we are performing analysis of transcription and transposition rates from *Ty* elements. Our preliminary results suggest that Set1 and Set5 genetically interact with Xrn1, indicating that these histone methyltransferases may play a role in Xrn1 mediated regulation of transposable elements. Additionally, we provide evidence that Set1 and Set5 regulate transposition rate independently.

On the Precipice of Life: A Contractarian Analysis of Suspended Animation with Biomedical and Engineering Implications

Zane Gray, Jaskeerat Singh
Richard Wilson, Lecturer, Philosophy

Suspended animation (SA) is the process of reducing core body temperature by transfusing an individual's blood with a cold saline solution, effectively slowing metabolism to rates near to those of a legally dead person. This affords physicians upwards of an hour of operating time before further risk of anoxic brain injury occurs. Because of its potential significance in medicine and recent approval for human testing, suspended animation has attracted considerable attention and criticism. For these reasons, an anticipatory ethical analysis of suspended animation is important. Anticipatory ethical analysis includes the discussion of the emerging technology and the impact it may have upon being accepted and used, future applications and social consequences. To better understand the scope of SA, the analysis will be performed from the perspectives of three stakeholders: doctors, engineers, and patients. Potential issues regarding the distribution of SA, informed consent at time of intervention, and future applications in space travel will be discussed. Solutions to such concerns will be hypothesized using both AMA and NSPE code of ethics, Rawl's Theory of Justice and concepts of social contracts. This serves to grant the public insight on this groundbreaking and potentially life-saving methodology, before it emerges as common medical practice.

Defining a Role of *BRCA1* in the Differential Susceptibility to Obesity Between Male and Female Mice

Shana Gregory*, Titilola Akintola*[1]
[1]University of Maryland School of Medicine
Laundette Jones, Assistant Professor, University of Maryland School of Medicine

Obesity is a worldwide epidemic. Genetics is thought to contribute to obesity, yet the genes involved are not entirely clear. Characterization of genetically obese mouse models may aid in defining mechanisms responsible for the accumulation of excess fat. We found that adult male mice with a mutation in Breast Cancer gene 1*(BRCA1*) gain 40 to 50 percent more weight when fed a normal diet compared to female littermates. *In vitro*studies have shown that down-regulation of BRCA1 increases in lipogenesis. Thus, mutations in *BRCA1* could possibly lead to the accumulation of excess fat. However, it is unclear why male *BRCA1* mutant mice accumulate excess fat as adults, but not females. We hypothesize that the predisposition to obesity observed in male *BRCA1* mutant mice is due to some inherent biologic variation. We are currently comparing in male and female *BRCA1* mutant mice the levels of *BRCA1* homologs and other genes associated with lipogenesis in various tissues by RT-PCR analysis. Studies are also underway to establish the role of hormones, food intake, weight gain, and blood lipid profiles. Understanding molecular links to obesity may provide avenues for preventive and treatment strategies for obesity and associated diseases such as cancer.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Microcylinder Sensors for the Extracellular Microenvironment

Brenda Gutierrez
Ryan White, Assistant Professor, Chemistry and Biochemistry

Abnormal astrocytic ATP release has been proposed as a potential astrocyte dysfunction in neurodegenerative diseases. However, the roles of astrocytic ATP release are not fully understood due to the lack of analytical tools. Electrochemical aptamer-based (E-AB) sensors can be used to measure the concentration of ATP released by astrocytes, providing further insight into its function in the brain. E-AB sensors use aptamers, or oligonucleotides, that bind a specific target such as ATP. Target binding causes an aptamer conformation change resulting in an increase in current that is quantitatively related to ATP concentration. The goal of this project was to develop an ATP E-AB sensor suitable for analysis of ATP in the extracellular environment. First, sensor signaling was optimized using a new “antisense” aptamer sequence and optimal electrochemical parameters to produce sensors that exhibit a three-fold increase in signal gain over existing sensors. The sensors were then transitioned to microcylinder electrodes for cellular measurements. The poor signal-to-noise ratio of the microcylinder electrodes was overcome by electrodepositing gold nanoparticles onto the surface of the electrode, which significantly increased the signal change. Overall, ATP E-AB sensors were fabricated and optimized and are now ready to make ATP measurements with astrocytes.

This work was funded, in part, by NIH (R21MH101692).

Algonquian Pre-Contact Settlement Patterns and Practices of the Chesapeake Bay Watershed

Andrew Gwynn
Esther Read, Adjunct Professor, Ancient Studies

Within the Chesapeake Bay watershed, evidence of variety among Algonquian dwellings comes from archaeological sites along (but not limited to) the watersheds of the Potomac, Patuxent, and Susquehanna Rivers. To examine potential dwellings and associated features (such as trash pits and hearths) connected to sites inhabited by the Algonquian peoples, aspects of Algonquian life were considered in terms of their association with architectural preferences. Prime among these were migratory vs. sedentary lifestyle patterns dating from the Archaic, Transitional, and Woodland Periods, as well as Algonquian populations at the time of contact with Europeans. These patterns were examined through archaeological data from sites in Maryland and Virginia. The objective was to show how the Algonquian created housing, the sources of their materials, for whom it was built (e.g., tribesmen and chieftains), and whether it was intended for religious, social and/or political purposes. An attempt was made to demonstrate continuity and change in housing patterns through time.

Student Attitudes Toward English Language Variation in Education

Aureanna Hakenson
Thomas Field, Professor, Modern Languages, Linguistics, and Intercultural Communication; Christine Mallinson, Associate Professor, Language, Literacy, and Culture

This project explores students' attitudes toward language variation in education, how they take shape, and their effects. These attitudes influence the linguistic climate of an educational institution, particularly its acceptance of linguistic diversity. For this project, I created a web application that uses a social media-like platform to allow UMBC students to post short personal linguistic narratives and language experiences. Students were also able to categorize and comment on posts. Experiences shared within the site fostered a dialogue about linguistic diversity and were used to analyze students' attitudes toward language in education and how they affect the educational environment. Results showed that student language identity is closely tied to students' origins, and the language use and backgrounds of family members. Post-categorization showed that students are more aware of their experiences with language than of their language attitudes and identity. Finally, students frequently demonstrated self-consciousness with respect to their language use and expressed frustration with negative language attitudes and with the resulting lack of awareness of and accommodation for language differences.

A Comparison of Mothers' Expressions of Warmth towards their Young Children: Does Culture Matter?

***Nickolette Hanzigiannis**, Nan Zhou*
Charissa Cheah, Associate Professor, Psychology

The present study examined and compared the conceptualizations and expressions of warmth of Chinese immigrant (CI), Korean immigrant (KI), and European American (EA) mothers towards their preschoolers through a semi-structured interview. Mothers were compared on their (1) ratings of the importance of expressing warmth towards their children, (2) reasons for expressing warmth, and (3) specific practices of warmth. Forty mothers of preschoolers in each group participated (Mage = 37.14, SD = 4.18). Mothers' responses were reliably coded by three teams of native Chinese-, Korean-, and English-speaking researchers. Results revealed that EA and KI mothers significantly rated expressing warmth to be more important than CI mothers. All mothers believed that expressing warmth was important for similar reasons. However, CI mothers cited meeting children's fundamental needs as a more important reason for warmth than KI and EA mothers. Although all mothers utilized similar practices to express warmth, cultural-specific socialization priorities were also revealed. Specifically, KI and EA mothers used more physical and verbal expressions of warmth (e.g., hugging, kissing) than CI mothers, whereas CI mothers used more instrumental support (e.g., cooking for child) and guidance than two other groups. Our findings have important implications for promoting positive parenting across these cultural groups.

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

The Effect of a Combined High Intensity Training Program on Gait Velocity and Balance in Older Adults

Jichele Harris
Mark Rogers, Professor, UMB Physical Therapy and Rehabilitation Science

Falls and their consequences are major medical problems in aging. Lower extremity muscle weakness and power as well as balance impairments in protective stepping are major fall risk factors and can be improved with rehabilitation. This study tested whether a combined high intensity induced training and muscle-strengthening program can change gait velocity and improve measures of balance among healthy community-dwelling adults age 65 and older. Participants were randomized into four groups: (a) induced step training using a robotic waist pull, (b) hip muscle strengthening, (c) combined induced step training and muscle strengthening, and (d) a control group. At post-test the exercisers demonstrated an increase in balance, needing fewer steps to regain stability, and increase in initial step speed. Conclusive data will be used to underpin the continual 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.*

Regulating Chemical Access to Mouse Vomeronasal Organ by Solitary Chemosensory Cells

Natalie Harris, Olubukola Abiona
Weihong Lin, Associate Professor, Biological Sciences; Tatsuya Ogura, Research Assistant Professor, Biological Sciences

The vomeronasal organ (VNO), located in the mammalian nose is the sensory organ of the accessory olfactory system. Chemical detection in the VNO provides sensory information to regulate innate social and sexual behaviors. The VNO takes up chemical stimuli through its anterior entry duct. In the duct epithelium, there are numerous solitary chemosensory cells (SCCs), which respond to chemical irritants and bitter-taste compounds. We investigate the regulatory role of SCCs in limiting potential harmful chemicals from accessing the VNO. We performed a quantitative VNO chemical access assay in wild type (WT) mice and Skn-1a knockout mice in which SCCs are genetically ablated. Following the assay, we performed data acquisition and analysis to determine the amount of chemical solution entering the VNO in these mice. We also compared dye intensity in the duct to the posterior VNO lumen. Preliminary results show that Skn-1a knockout exhibits a diminished regulatory response in comparison to WT with respect to the access of bitter compounds (denatonium benzoate and cycloheximide) and the irritant zinc sulfate. Future directions will focus on studying the long-term effect of irritant exposure on chemical regulation in the duct.

This work is supported by NIH/NIDCD research grant to DC012831.

The Significance of Ribosomal Protein Paralogs in *Saccharomyces cerevisiae*

Shahzeb Hassan
Philip Farabaugh, Professor, Biological Sciences

In the yeast *Saccharomyces cerevisiae* (*S. cervisiae*), paralogous genes are the result of whole genome duplication events that occurred millions of years ago. Most of the duplicated genes were eventually lost but a significant amount of duplicated ribosomal protein genes were retained. Previous studies have demonstrated that these genes escaped gene loss by either experiencing a dosage benefit (gene dosage model) or developing distinct functions (neo-functionalization model). To further investigate these two models, we have tested additional ribosomal proteins by comparing the effects of their deletions on transposition of the Ty1 retrotransposon in yeast cells. The plasmid we have used has a TY1 transposable element, and a *HIS3* gene that is separated by an artificial intron. Once

the Ty1 element is transcribed, the artificial intron is spliced, resulting in the transcription and translation of the *HIS3* gene. In this way, the *HIS3* marker on the plasmid has served as a positive selection for transposition of the Ty1 element. Through a comparison of the transposition phenotype of the mutants (paralog deletion) to the wild type, we have further quantified our results by measuring the frequency of transposition in the yeast cells.

Improving Student Problem Solving Using Reflective Math Tasks

Sarah Hayman
Christopher Rakes, Assistant Professor, Education

The purpose of this study was to examine the effect of reflection in improving a student's ability to solve mathematics problems and evaluate their answers. The test group contained 21 students in an Algebra II course at a suburban high school. Students completed bi-weekly mathematics tasks, each of which contained a challenging math problem alongside reflective questions completed during and after arriving at a solution. Each task was graded on a ten-point scale, quantifying the solution process in terms of how much each student did to prove their answer, and whether their solution was reasonable given their own parameters as well as the problem. Successful students were able to think about reasonable solutions to each problem within the context and evaluate their answer based on these self-set parameters. The target was to have 90 percent of students improve by two points on the scale by the end of the intervention period.

Social-Emotional Skills of Young Latino English Learners: The Influence of the Classroom Context

Claire Hempel*, Tymofey Wowk, May F. Chung*
Claudia Galindo, Associate Professor, Language, Literacy, and Culture

This research examines the social-emotional skills of Latino English Learners (ELs). We also analyze whether classroom context (e.g., classroom composition, support for EL students) and teacher practices (e.g., readiness beliefs, pedagogical support for EL instruction) facilitate student growth in social-emotional skills (e.g., approaches to learning, attentional focus, inhibitory control). Quantitative analyses with nationally representative data from the Early Childhood Longitudinal Study-Kindergarten Cohort (2010-2011) will identify large patterns of influence. Teachers' reports of their perceptions (four kindergarten teachers of Latino ELs will be interviewed) about Latino ELs and the influence of the classroom context will complement the statistical analyses, and will provide detailed and rich interpretations of larger patterns. Preliminary results indicate that teachers reported higher levels of approaches to learning, attentional focus, and inhibitory control for Latino ELs than for native-English Latinos, Whites, and Black children after controlling for socioeconomic status. There were also important differences in the classroom context of Latino ELs, when compared with other subgroups. The results from

this study will be useful in developing a better understanding of Latino English Learners and may help to facilitate their success.

This research was supported by a grant from the American Educational Research Association.

Sicario

Christopher Hogue*, Dillon DiSalvo, Frank DiSalvo Jr. , Thomas DiSalvo, Kevin Glotfelty*
Cathy Cook, Professor, Visual Arts

Sicario is an experimental, narrative short HD video depicting a hired gun and his victim. The creative process for the video required the creative partners to complete their work in only two hours. We arrived without any prior planning, only the props and equipment we thought we may potentially use. We made it up as we went along. This video is creativity in its most basic form. The creative process can be interpreted to the creation of dreams. The brain simultaneously creates and watches the dream, where the end is not known until it is reached. For *Sicario*, we created the video without knowing where the story would take us. The primary inspiration was to use a newly bought prop pistol, and to use a wheelbarrow to create a make-shift dolly shot, similar to those used in *The West Wing* (Aaron Sorkin, 1999-2006), a technique we have not used before. The acting resembles the past videos that we produced, improvisational comedy. For the post-production, I was heavily influenced by the film *Enemy* (Denis Villeneuve, 2013), with the editing, color-grading, and the original scoring.

Synthesis of Allenes for Photochemical Devices

Donald Hong
Paul Smith, Associate Professor, Chemistry and Biochemistry

Allenes that have electron donating groups and electron withdrawing groups held orthogonal to each other are expected to display an efficient electroluminescence. This unique structure can be utilized in modern day semiconductors such as organic light-emitting diodes (OLEDs). Traditionally the production of these semiconductors relied on heavy metals, such as platinum, to generate efficient electroluminescence. This and manufacturing limitations drive up the cost of LEDs/OLEDs. In an effort to address these limitations, four allenes are to be synthesized with unique chemical structures allowing an electron to be photochemically excited from the donor group to the acceptor group, producing light. Established methods were adapted to the synthesis of theses allenes which involved a Grignard reaction to create one half, the synthesis of a boronate ester for the other half, and then a palladium-catalyzed coupling to combine both halves. NMR spectroscopy was used at each step to confirm the synthesis of each part and the combined product. The synthesized allenes are to be studied photochemically in collaboration with

Dr. Bradley Arnold's lab, focusing on emission spectra (fluorescence/phosphorescence) and quantum yield determination. Structural modifications can then be made to increase electroluminescence in future generations of allenes.

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

Art Installations as a Means of Increasing Scientific Awareness: The Haber Process

Chana R. Honick
Stephen Freeland, Associate Professor, Interdisciplinary Studies

This is an interdisciplinary studies project with the goal of starting conversations about science by representing that science as art. The project uses an interactive visual arts installation to illustrate the Haber Process, the chemical process by which hydrogen gas and nitrogen gas are combined to form ammonia. I chose this process to model my research, because it is one of the most impactful scientific discoveries of the twentieth century, feeding the world and yet contributing to weapons development. The project displays visually important elements of the process, such as physical representational structures of the molecules and compounds involved, housed within a rotating wooden frame. Other visual elements of the project address the history of the process and its uses in food production as well as in explosives. Current work involves generating QR codes, which link the project to relevant web sources. This includes an online survey, which will be used to assess the project's effectiveness. I hope this will increase the interactivity of the piece. I plan to display the project in the Fine Arts building in the Interdisciplinary Studies Department where people can see it.

This work was funded by the UMBC Honors College Special Sessions Scholarship.

A Portable Detection Platform for Hypochlorite via Chemiluminescence

Chana R. Honick, Brian K.Gibson, Jr.
Lisa Kelly, Associate Professor, Chemistry and Biochemistry; Stephen Mang, Lecturer, Chemistry and Biochemistry

When the organic compound luminol reacts with specific ions, such as hypochlorite (OCl^-), the resulting oxidation reaction produces chemiluminescence. When luminol is in excess, the chemiluminescence intensity is linearly dependent on the ion concentration. For this reason luminol can be used to detect quantities of OCl^- in water solutions. This has significant world health implications, because household bleach (active ingredient NaOCl) can be used to purify water. Because of the high toxicity of NaOCl at high concentrations and its ineffectiveness at low concentrations, a method of quantitatively analyzing a solution is highly useful. A prototype of a cost-effective and portable detection platform for

OCl^-, via chemiluminescence, has been built. The basic design includes a mixing cell, an optical detection system, and an amplification circuit, all housed within a light-proof box. The detection platform is controlled using a low-cost, portable microcontroller (BeagleBone Black). Preliminary calibration of the first-generation prototype indicates that the device can detect amounts of OCl^- as small as 0.58 mg/ml. Current efforts seek to modify the photodiode and optical detection layout to improve sensitivity in a second-generation prototype.

This work was funded by the UMBC Department of Chemistry and Biochemistry teaching labs.

Mitochondrial Biogenesis and Function are Decreased with HIV-1-Associated Kidney Damage

Atizaz Hussain
Tapas Makar, Assistant Professor, Department of Neurology, University of Maryland School of Medicine

HIV-1-associated nephropathy (HIVAN) is a progressive form of focal segmental glomerulosclerosis. HIV transgenic mice (HIV-Tg) can develop a HIVAN-like renal disease which causes renal dysfunction that mimics human HIVAN. Mitochondrial dysfunction is involved in acute and chronic kidney diseases. Inhibition of mitochondrial biogenesis (MB) has been shown to cause mitochondrial dysfunction. We hypothesized that decrease in mitochondrial biogensis and function is responsible for kidney damage in HIVAN. The purpose of this study was to estimate and compare the incidence rate of mitochondrial dysfunction associated with MB and characterize the occurrence of subsequent renal dysfunction among HIV-Tg and wild type (WT) mice. Kidneys from HIV-Tg and WT mice were harvested at time when protein level in the urine was increased in HIV-Tg mice (100 mg/ml and above, indicating kidney damage). We determined renal functional markers (nephrin, creatinine, urea level), MB markers (PGC1-alpha, NRF-2, TFAM, SIRT-3), and mitochondrial functional markers (Citrate synthetase, Cytochrome C) using Immunohistochemical, RT-PCR and Western blot analysis. We found that decreased mitochondrial biogenesis and function caused kidney damage in HIV-tg mice. Results suggest that MB and mitochondrial function are critical for kidney function, which is affected in HIVAN.

Unit Conversion

Noah Hutton
Jonathan Singer, Associate Professor, Education

Using mathematical processes is a fundamental skill needed for learning chemistry. One way that the Maryland Chemistry standards measure student understand of mathematical

processes is by requiring students to demonstrate how to properly convert between different units. During the fall 2014 semester, a baseline assessment on performing unit conversions was given to 110 chemistry students from an urban high school. Results from this measure demonstrated that over 50 percent of the students scored below the recognized 80 percent mastery benchmark. The low-performing students were targeted with research-based intervention strategies such as scaffolding, guided problems, and tutoring after school and through multiple means of representation to improve their scores. The goal was for 80 percent of the low-achieving student population to improve to 80 percent mastery level on the post-intervention test. The students will be given necessary unit conversions, instruments, and charts as needed while being assessed.

Decorated Kamares Ware from the Middle Minoan Period

Barbara Israel
Esther Doyle Read, Adjunct Professor, Ancient Studies

UMBC Spiro Collection specimen #287 is a beaked spout with an open roof. When the collection arrived at UMBC there was very little information concerning this piece. My research focused on establishing what type of ceramic the piece is, its temporal provenance, and its possible point of origin. I began my research by consulting with Dr. Michael Lane, of the Ancient Studies Department who suggested Crete as the place of origin. During a departmental trip to Greece, I studied the ceramics of the Cyclades at the National Archaeology Museum in Athens and at the Knossos Museum on Crete. Library research yielded descriptions of Middle Minoan Period ceramics with similar designs and spout shapes. Additional research considered the type of clay and pigments, and the firing techniques and temperatures needed to create the vessel. My research established the identity of the ceramic as Kamares Ware, and the vessel type as a decorated Prochus, or water ewer, from the Elegant Period of the Early Middle Minoan Palace culture (circa 1800 BCE). It may be associated with the Middle Minoan palace culture at Phaistos.

Understandings of Sexual Identity from a Person-Centered Interview Approach

Hanna Jardel
Sarah Chard, Associate Professor, Sociology and Anthropology; Bambi Chapin, Sociology and Anthropology

This study utilized person-centered interviews to illuminate how non-heterosexual people think about and experience their sexual identities. Person-centered interviews use an open-ended, participant-led approach, focusing on the personal experiences of participants to reveal, in this case, how participants make sense of their sexual identities and experiences. The sample consisted of seven self-identified non-heterosexual participants, each of whom completed a single one-hour audio-recorded interview investigating personal experiences of sexuality. During the interviews participants were asked to determine their own definitions

of sexual identity and sexual orientation. Interview recordings were transcribed and coded to extract key themes surrounding sexual identity and sexual orientation. Findings suggest that participants' understanding and expression of their sexual identity is tied to their relationships with stereotypes. Additionally, while participants do not equate sexual identity and their sexual orientation, they do link them, drawing a connection between behavior and identity which reinforces assumptions about general sexuality. A person-centered interview approach in which participants determine the direction of the interview can be valuable in elucidating the range of models that individuals develop in understanding and experiencing their sexual identity.

Physician-Patient Relationships: Understanding Physicians' Perspectives

Maniraj Jeyaraju
Sarah Chard, Associate Professor, Sociology and Anthropology

A successful patient-doctor relationship is instrumental in providing quality care for patients. Although considerable research has focused on the factors influencing patients' perspectives of the patient-doctor relationship, there is a need for further research on doctors' perceptions of the relationship. Particularly important is research on the influence of residency programs and clinical experience on physician communication strategies. To investigate this gap, this study involved a semi-structured interview with three medical doctors and one fifth year medical resident representing a range of specialties, including psychiatry, internal medicine, and emergency medicine. The interviews explored participants' experiences as residents learning to communicate with patients, and the communication strategies they have developed as practitioners. The data indicate that while residency programs do address the doctor-patient relationship, practitioners' interaction styles develop largely through experience. Physicians also differentiate objective versus subjective communication and note technology's complicating influence on their relationships with patients. Together, the data suggest communication strategies vary by specialty, but physicians feel that fundamental communication courses and active discussions during residency training would be helpful.

Investigating the Role of HIF1-α in Anoxia Tolerance in Zebrafish Embryos

Catrina Johnson
Rachel Brewster, Associate Professor, Biological Sciences

Anoxia tolerance is a survival mechanism in an environment lacking oxygen. Zebrafish embryos undergo suspended animation, which temporarily halts development and movement. To understand mechanisms underlying anoxia tolerance, we are exploring the role of *hypoxia-inducible factor 1α* (*hif1-α*). This transcription factor is stabilized under anoxic/hypoxic conditions and regulates the transcription of genes that promote survival in low-oxygen conditions. However, we hypothesize that *hif1-α* may not be required for

anoxia tolerance in zebrafish, as transcription of *hif1-α* target genes is ATP demanding. To test this, we will analyze the expression of the *hif1-α* downstream targets i*nsulin-like growth factor binding protein 1α* (*igfbp1-α*) and *vascular endothelial growth factor* (*vegf*) that are subjected to anoxia and control embryos that were maintained under normoxic conditions. Whole-mount *in situ* hybridization of control and anoxia-treated embryos will be performed to reveal the distribution and levels of candidate gene expression following 1 or 2 hours of anoxia. Lack of transcriptional up-regulation of *hif* targets would confirm our hypothesis and prompt the investigation of *hif*-independent mechanisms of anoxia survival. Findings stemming from this research are relevant to stroke and ischemic injury, which have in common damage associated with anoxia and the sharp onset of re-oxygenation.

This work was supported by the National Institute of General Medical Sciences grant 5R01-GM085290.

Philanthropy and Reputation in the Lives of Joseph Townsend and Baltimore's "public-spirited citizens"

Hannah Jones
Marjoleine Kars, Associate Professor, History

The city of Baltimore at the turn of the nineteenth century was a place rife with opportunity, as the economic ramifications of the Revolutionary War opened up possibilities for enterprising merchants and businessmen to make a fortune without ties to the traditional aristocracy. Rooted in the life story of one such figure, Joseph Townsend, my research examines the role of reputation in the creation and maintenance of this new elite's power during this crucial moment of explosive growth in the city of Baltimore and the country at large. Using city records from the Baltimore City Archives and company records from the Baltimore Equitable Collection of the Maryland Historical Society, as well as numerous scholarly sources, I have studied Townsend's rise to public prominence and chosen to highlight one particular episode - the yellow fever epidemic of 1800 and the Polly Elliot scandal - which illustrated Townsend's reliance on a saintly persona to justify and defend that prominence, which extended into areas well outside his expertise. By revealing the rhetorical and concrete role of philanthropic reputation in these men's lives, I encourage the public to challenge the often idealized legacy of these men, which is still evident in the present day.

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

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

Michaela Jones
Michelle Starz-Gaiano, Assistant Professor, 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 investigating cell movements is the study of border cells in *Drosophila melanogaster*. The border-cell migration process is a powerful system to study. Because of advances in genetics techniques and the ability to observe the migration in real time, it offers a unique perspective beyond tissue culture. The fly genome has a unique advantage in that similar genes are conserved in humans as well, which allows for better understanding of human development. We have identified a novel gene,*alan shepard (shep*), that is expressed in border cells. Preliminary data suggests that the *shep* gene is required in cell migration, which we are investigating further. To do so, we will knockdown (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 in how this may function. 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.

East-Asian American Student Perspectives on Romantic Relationships and Violence

Yoo-Jin Kang
Bambi Chapin, Associate Professor, Sociology and Anthropology

This presentation will outline key findings and insights gained from six qualitative interviews of East-Asian American undergraduate students at UMBC. Subjects were students raised by parents who were grew up in an East-Asian country, such as Korea, Vietnam, Japan and China, and were current UMBC undergraduates, ages 18 and older. The purpose of this project was to explore East-Asian students' perspectives on romantic relationships, relationship violence, and viewpoints on seeking help and resources during relationship violence situations. Topics included what constituted a healthy and unhealthy relationship, characteristics of an ideal partner, and whom students would turn to in the event of emotional and physical relationship violence. The findings of this project aim to identify and explore student experiences in the university system and to connect student responses about intimate partner violence to the available literature on intimate partner violence in East Asian communities. Further, this analysis will be used to assess the presence of culturally-appropriate and relevant violence-prevention outreach on UMBC's campus.

Simple Sensor Box

Kit Kearney, Andrew Comer, Marcus Flores, Lewis Gould, Daniel Zuckerbrod
E. F. Charles LaBerge, Professor of the Practice, Computer Science and Electrical Engineering

Students, researchers, and developers looking to simultaneously collect several types of data are often confronted with purchasing and programming multiple measuring devices. This research project developed a universal device with the ability to collect a broad range of sensory input while simplifying operation, optimizing portability, and expanding file format compatibility. By combining a collection of ten sensor types into a single, encapsulated, portable device we provided a stand-alone means of collecting independent types of data sets. The array of sensors detected movement and local environmental data. Movement was measured with an accelerometer and gyroscope, while with barometric pressure, light, humidity, and temperature sensors measured the local environment. An embedded microcontroller stored the collected data to a non-volatile memory source in real time. A companion computer application allowed the user to download and format the collected data for use with third-party analysis tools such as MATLAB and Excel. Compatibility with outside analysis tools made the device ubiquitous for a variety of applications.

This project was supported by a grant from Advanced Circuits, and by the UMBC Department of Computer Science and Electrical Engineering.

The Perils and Promise of Localizing National Politics: A Case Study of the 2014 Maryland Gubernatorial Election

Aaron Kennet, Benjamin Straube, Philip Swanson
Tyson King-Meadows, Associate Professor, Africana Studies

Although previous studies document the influence of state and national sociopolitical climates on the success of black federal candidates, less is known about the extent to which national climates mitigate state conditions favorable to the election of black gubernatorial candidates. To investigate how interactions between national and state climates can affect black statewide candidates, we examine county-level election results, racial demography, and local newspaper coverage of the 2014 Maryland gubernatorial contest between two-term Democratic Lt. Governor Anthony Brown, who sought to become Maryland's first black governor, and Republican business leader Larry Hogan, a cabinet secretary under former Governor Robert Ehrlich. Hogan defeated the frontrunner despite having a significant deficit in pre-election polls and despite the Democratic Party's nearly 2:1 advantage in registration numbers. Our analyses show that Brown garnered significantly fewer votes than did Democratic candidates in six previous statewide elections. A content analysis of The Baltimore Sun and The Washington Post revealed citizen disapproval of Brown's campaign style and commercials. We conclude that negative assessments of the candidate and the economy mixed with racial demography to erode the Democratic coalition. Our results suggest black candidates may be more vulnerable to the localization of national politics than previously thought.

Inhibition of AQP4 Causing Renal Failure Mediated Through Endoplasmic Reticulum Stress in HIV Transgenic Mice

Omar Khalid
Tapas Makar, Assistant Professor, UMSM Department of Neurology

HIV-1 associated nephropathy (HIVAN) is a leading cause of progressive kidney disease in HIV-1 positive patients. Renal studies have been conducted using HIV transgenic mice (HIV-tg mice) which show renal dysfunction that mimics human HIVAN. The loss of Aquaporin 4 (AQP4) has been proven to exacerbate stress-induced renal impairment. Previous studies have shown that endoplasmic reticulum (ER) stress exacerbates renal failure. It is unclear if ER stress and AQP4 are involved in the renal dysfunction of HIVAN. Therefore, we measured oxidative stress, ER stress, AQP4 expression, SIRT1 and endothelin-1 (ET-1) levels from the kidneys of HIV-tg-mice and wild-type (WT) mice. to find out the mechanism involved between the molecules. We applied Immunohistochemical, RT-PCR, and western blot techniques to determine the parameters. We found AQP4 expression and renal function were significantly decreased. On the other hand an increase of oxidative stress, ER stress and Endothelin-1 level were found in the HIV-tg mice compared to WT mice. We show that renal dysfunction in HIV-tg mice, which mimics HIVAN, is mediated by ET-1/SIRT1 signaling leading to oxidative stress, ER stress and AQP4 inhibition. This study demonstrates the importance of AQP4 in the pathogenesis of HIVAN and highlights new potential therapeutic targets.

Do Parenting Styles and Practices Interact to Predict Chinese-American Children's Adjustment?

Ahmna Khan*, Kathy Vu*
Charissa Cheah, Associate Professor, Psychology

Although some research suggests that the authoritarian (coercive and hostile) parenting style and psychologically controlling practices that intrude and manipulate children's psychological and emotional world are not detrimental to Chinese and Chinese-American children's adjustment, other research suggests that these coercive styles and practices are associated with negative effects for these children, similar to their Western peers. In addition to these inconsistent findings, whether different parenting styles may interact with specific parenting practices has not received sufficient attention. Thus, the present study examined the moderating roles of authoritarian and authoritative (warm, democratic and autonomy-supporting) parenting styles on the association between psychologically controlling practices and child outcomes in Chinese-American families. Chinese-American mothers with preschool-aged children (N = 136) completed questionnaires assessing their parenting styles and psychologically controlling practices. Teachers reported on children's social adjustment. Preliminary analyses revealed that psychological control was positively

correlated with the authoritarian parenting style, but negatively correlated with the authoritative parenting style. Moreover, the authoritative parenting style was negatively associated with child peer problems, whereas the authoritarian parenting style was positively associated with child peer problems. Moderation analyses will be conducted and the significance and implications of these findings for Chinese-American families will be discussed.

This work was funded by the Foundation for Child Development and NICHD (1R03HD052827-01).

SOCS3 Deletion Decreases the Capacity of NG2 Cells to Differentiate into Oligodendrocytes in the Uninjured Brain

Alicia Khan
Jae Lee, Assistant Professor, The Miami Project to Cure Paralysis

The differentiation and proliferation capacity of NG2 oligodendrocyte progenitor cells (OPCs) is not fully understood. CNTF (ciliary neurotrophic factor), a ligand for the STAT3 pathway, has been shown to promote OPC differentiation *in vitro*, but fails to *in vivo* after demyelination. *SOCS3* is a STAT pathway inhibitor. We hypothesized that upregulated *SOCS3* plays a role in the reduced capacity of NG2 cells to differentiate into oligodendrocytes. To address this question, we used NG2 cell type specific inducible Cre recombination to fluorescently label and specifically delete *SOCS3* from NG2 cells. As an outcome measure, we compared their differentiation capacity into mature oligodendrocytes in the corpus callosum (CC) to that of wild-type mice. Promoting differentiation of NG2 cells into mature oligodendrocytes could be a possible avenue for enhancing endogenous myelination. This could offer some insight on the processes occurring in demyelinating diseases. We demonstrated that deletion of the *SOCS3* gene shows a significant decrease in the number of NG2 cells differentiating into oligodendrocytes. A possible explanation for these results is that *SOCS3* could increase the proliferation of NG2 cells, thus reducing the number of differentiating cells. In conclusion, differentiation of OPCs into mature oligodendrocytes in the adult corpus callosum requires *SOCS3*.

*This work was funded, in part through the Department of Neurological Surgery, The Miami Project to Cure Paralysis, University of Miami Miller School of Medicine, Miami Project Summer Research Program, Neuroscience Graduate Program, University of Miami Miller School of Medicine, and NIH/NIGMS MARC U*STAR T34 08663 National Research Service Award to UMBC.*

Improving Student Performance on Dimensional Analysis in Stoichiometry

Seema Khandagle
Jonathan Singer, Professor, Education

This study focuses on student understanding of dimensional analysis when using mole relationships (stoichiometry). The ability of students to demonstrate a strong understanding of dimensional analysis is a critical standard in the Next Generation Science Standards. Dimensional analysis is a mathematical system using conversion factors to move from one unit of measurement to a different unit of measurement. Thirty-one 10^{th} grade chemistry students were pre-assessed in which 16 percent passed, showing proficient prior knowledge. They then participated in student-centered learning activities through lesson plans that provided multiple means of representation. Through teacher modeling and student practice, student growth in comprehension was recorded. Students were given multiple formal and informal formative assessments that gauged their progress. After the unit was complete, students were given a summative post assessment. The target result is that 70 percent of the study group will pass the unit post assessment.

Speciation Reversal: The Case of the Common Raven

Jin Kim
Kevin Omland, Professor, Biological Sciences; Matthias Gobbert, Professor, Mathematics and Statistics

Speciation reversal results when two or more distinct species interbreed to form one species. This phenomenon is seen in many organisms, including fish, birds and humans, noted during human evolution where up to four separate lineages were reduced to a single species. We focus on the Common Raven (*Corvus corax*) which spans most of the northern hemisphere. Two mitochondrial lineages exist; the California clade and the Holarctic clade. We hypothesize that the overlapping ranges of Holarctic and California alleles will result in the merging of the two lineages. To test this hypothesis, we sequenced a nuclear intron to evaluate genetic variances (haplotypes) present in our raven sample and mapped these data. Preliminary results depict two distinct haplotypes that differ by one base pair with a majority of a specific lineage belonging to one haplotype. These results support our hypothesis of speciation reversal, depicting two genetically distinct groups interbreeding and beginning to share alleles. This is the first step in understanding the evolutionary history of the Common Raven and elucidating the process of speciation reversal.

This work was funded, in part, by and Undergraduate Research Award from the UMBC Office of Undergraduate Eduacation and the UMBC Undergraduate Training in Biology and Mathematics (UBM).

Reducing Test Anxiety to Improve Students' Learning

Steven Klement
Linda Oliva, Professor, Education

Students in my lower-performing sixth grade World History class exhibited signs of anxiety when given multiple choice and short answer exams. Research has shown that test anxiety can negatively affect students' performance and self-esteem. However, a variety of treatments have been shown to be effective in reducing test anxiety, such as "test-wise" learning strategies. My student-learning-outcome project examined the effect of "test-wise" learning strategies on reducing test anxiety and improving the test performance of the targeted sixth grade class. Prior to the intervention, I administered a short survey to measure students' attitudes toward tests and also calculated an average of students' three most recent test scores. I then developed and taught four mini-lessons on four separate research-based test-wise strategies. After the intervention, I re-administered the attitude survey and calculated an average of students' post-intervention test scores. The data were then analyzed using descriptive statistics to examine the impact of the intervention on students' attitudes toward test and test performance. Implications of the project for advancing adolescents' academic success and my professional practice are discussed.

Arroy: The Thai Food Cart

Hannah Korangkool
Stephen Bradley, Associate Professor, Visual Arts

Arroy: The Thai Food Cart documents street vendors and market spaces in the central region of Thailand. Cuisine is a complex, multi-faceted feature of Thai culture and goes far beyond the Western perception of "Thai Food." This video documentation captures food being prepared, sold, packaged, displayed, and eaten by both residents and tourists. The tourist perspective contrasts greatly with Thai natives' communal rituals, traditional dishes, and religious practice. The visual "leitmotifs" highlight various actions done by hands, such as exchanging currency and goods, cooking, handling utensils, offerings into alms bowls, etc. The resulting film demonstrates the cultural significance of Thai cuisine as a communal medium for the people of Thailand.

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

Increasing Student Successes with Challenging Unfamiliar Problems through Exposure

Benjamin Korbelak
Christopher Rakes, Assistant Professor, Education

The present study investigated the degree of correlation between an increased exposure to challenging mathematical problems in unfamiliar situations and higher mathematical problem solving success rates. Data for the study were collected from four International Baccalaureate (IB) Middle Years Program (MYP) Algebra I classes within an inner-city IB

high school. Correctly solving complex unfamiliar problems is vital to aid students in their ability to make sense of problems and persevere in solving them, as referenced in the first Common Core Standard of Mathematical Practice. The study compared individual student progress both before and after an increased exposure to unfamiliar problems through pre-assessments, post-assessments, and weekly intervention tasks during a six-week unit of linear equations, inequalities and systems of linear equations. Such intervention tasks were interwoven into normal classroom instruction aligned to each day's lesson. Evidence of increased success will be determined by an analysis of the differences between the pre- and post-assessments.

Participatory Mapping as a Means of Ground-truthing Habitat Loss in Costa Rican Biological Corridors

Samuel Kraft, Labeeb Ahmed, Jason Chang
Margaret Holland, Assistant Professor, Geography and Environmental Systems

Habitat loss as a result of deforestation is a critical issue in the tropics where species biodiversity is highest. Costa Rica has been at the forefront of conservation policy since the 1990s, designating conservation corridors between protected areas to engage the communities in conservation and sustainable development projects aimed at reducing habitat loss. In summer 2014, a group of undergraduate students and faculty from the Department of Geography and Environmental Systems conducted a series of participatory mapping interviews with stakeholder groups from two conservation corridors in Costa Rica. Through these mapping exercises, stakeholders indicated specific forested regions within each corridor that they perceived as actively under threat or recovery, and provided contextual explanations for observed forest dynamics. The analysis we present here compares these stakeholder maps of forest pressure and recovery with a forest change product derived from satellite imagery across the past decade. We identify areas of spatial agreement between significant clusters of forest change and stakeholder observations, and explore areas where there is a lack of alignment. The results from this analysis will be published in an online map and used by the Costa Rican Corridor Commission in setting priorities for future forest conservation projects.

Evaluating Techniques Used to Enhance Middle School Writing

Hollie Kuhn
Cheryl North, Assistant Professor, Education

This study focused on developing students' formal writing abilities to help them produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. The study took place with 21 seventh graders at a suburban working-class school. Using an initial diagnostic essay as a baseline, students' writing skills in one class period were measured and documented throughout the academic

school year using a rubric that evaluated students on form and writing quality. These targeted middle school students struggled with writing skills necessary for idea development and written composition. Baseline findings indicated students had difficulty using supporting details from various sources, paragraph organization, and basic grammar conventions. To address the issues and strengthen students' writing, different instructional strategies were implemented for each of the writing assignments. These strategies included implementing a variety of prompts, using graphic organizers to format writing, and engaging in peer revision and editing. Following the interventions students completed Performance Based Assessments mandated by Maryland to track writing development. These assessments were scored using the Partnership for Assessment of Readiness for College and Careers (PARCC) rubric. The data were examined to see what instructional techniques helped students become better writers.

Analyze Cell Fate Determination in Arabidopsis with *Erwinia amylovora* Infection

Ashley Kwon
Hua Lu, Associate Professor, Biological Sciences; Safae Hamdoun, UMBC

Erwinia amylovora is a bacterial pathogen that causes fire-blight disease in the Rosaceae family. Arabidopsis is a non-host to *E. amylovora* and shows resistance to the pathogen. Previous studies from our laboratory demonstrated that besides inducing cell death, wild-type *E. amylovora* induced tumor-like growths in Arabidopsis leaves. The results suggested that *E. amylovora* could upsurp host cell-cycle machinery to affect cell ploidy and subsequently the fate of some host cells. This research investigates what factors from the pathogen or from the host are important for *E. amylovora*-induced cell fate change in Arabidopsis. We used two mutant *E. amylovora* strains, dspE and hrpN, that express various bacterial effector genes to infect Arabidopsis. Our results showed that, compared with the wild-type strain, the two mutant *E. amylovora* strains induced similar number of tumor like growths, suggesting that the bacterial effectors dspE and hrpN are not necessary for cell-fate determination in the host. We further found that tumor-like growths were drastically reduced in Arabidopsis mutants defective in synthesizing and/or signaling salicylic acid (SA), a critical defense molecule. Thus our results revealed that host defense signaling mediated by SA is important for *E. amylovora*-induced cell-fate change in arabidopsis.

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

Interracial Romantic Relationships, Attachment Style and Relationship Stability

Andrew Lee
Robin Barry, Assistant Professor, Psychology

Attachment theory suggests individuals develop relatively stylistic expectations for whether or not romantic partners can be counted on. Individuals with a more secure attachment style tend to expect romantic partners can be counted on whereas individuals with insecure attachment styles do not. In addition to adult attachment style, being in an interracial romantic relationship may also reduce relationship stability. Individuals in interracial relationships may experience greater stress or challenge due to differences in the level of support for the relationship from family and friends and differences in backgrounds. Despite data suggesting that the frequency of interracial romantic relationships are more frequent in the US, perceptions of relationship stability in interracial relationships remains an understudied topic. Thus, based on attachment theory, we hypothesized that individuals in interracial relationships, and that the link between attachment style and relationship insecurity would be stronger for individuals in interracial relationships.Eighty-three cohabiting heterosexual couples (37% interracial) described their racial/ethnic demographics, and completed self-report assessments of attachment and romantic relationship security. Results supported hypotheses: Individuals with more insecure attachment styles experienced greater relationship instability and this association was stronger for individuals in interracial relationships compared to individuals not in interracial relationships.

Absorbance of Pharmaceuticals Exposed to Ultraviolet (UV) Light as a Function of pH, Treatment Level, and Wavelength

Jessica Lee
Lee Blaney, Assistant Professor, Chemical, Biochemical, and Environmental Engineering

The chronic presence of antibiotics in natural and domestic waters accelerates the development of antibiotic-resistant bacteria. The increasing use of ultraviolet (UV) radiation (254 nm) as a tertiary treatment process at wastewater plants raises concerns about how antibiotics degrade under UV light, as well as about the characteristics of the corresponding breakdown products. The compounds of interest were nitarsone, oxytetracycline, and moxifloxacin, which are antibiotics commonly given to livestock, used in veterinary practices, and administered to humans. In this study, the UV absorbance signatures of antibiotic solutions were monitored as they degraded under UV 254 nm. The treatment level of each solution was tracked in terms of fluence, or UV dose over a given time period, which allows for practical comparisons to other UV systems. The absorbance of the pharmaceutical solutions during UV exposure was measured with a UV-visible spectrophotometer. The resulting data was analyzed and compiled into four-dimensional (i.e., absorbance vs. wavelength vs. pH vs. fluence) plots in Excel and/or Matlab. Based on the absorbance peaks of the degrading solutions, the effectiveness of UV 254 nm was qualitatively analyzed, and an effective range of wavelengths for degradation is proposed.

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

Subclinical Symptoms of Post-Traumatic Stress Disorder are not Associated with MRI Assessed Brain Volumes

Alina Lightchaser, *Jason Kisser, Michele K. Evans*[1], *Alan B. Zonderman*[1]
[1]Intramural Research Program, National Institute on Aging
Shari Waldstein, Professor, Psychology

Clinical diagnosis of Post-Traumatic Stress Disorder (PTSD) has been associated with smaller brain volumes in cortical and subcortical regions known to be negatively influenced by stress. Here, we used data from the Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) SCAN study to examine (a) whether global and regional brain volumes differed as a function of subclinical PTSD symptoms: and (b) whether these associations varied by sex and race. HANDLS is an epidemiological study of adults from a probability sample of Baltimore, MD. One-hundred-thirty-seven HANDLS SCAN participants (36.1 percent African-American, 41.6 percent female, age 30-64 years) completed a PTSD Checklist – Civilian version and underwent magnetic resonance imaging (MRI) on a Siemens Tim-Trio 3.0 Tesla unit. Multiple regression analyses assessed relations of PTSD symptoms to total gray and white matter volumes in addition to left and right hippocampus, amygdala, and anterior cingulate cortex. Adjustment variables were age, sex, race, poverty status, substance use, and depression symptoms. Interactions of PTSD symptoms with sex and race were explored. Results revealed no significant association of PTSD symptoms with global or regional brain volumes. These findings suggest that brain volumes are only affected when a clinical diagnosis of PTSD is present.

Comparative Composing: a String Trio and *a cappella* Choral Music

Lucas Link
Linda Dusman, Professor, Music

This research on my creative process examines my experiences as a choral musician composing a string trio and an a cappella piece, ultimately drawing conclusions about aspects of the process. Composing my string trio took place over several years. It began with a point of inspiration, progressed by creating sketches, received reviews from mentors and peers, at which point the piece underwent revision, wherein I compared my work to string trios by professional composers, noting instrumental interaction. The string trio will be performed by professionals to provide feedback on the success of my work. Working within the a cappella form allowed me to examine this process at an accelerated rate. All of the above steps occurred over eight days in a composition program at Lehigh University. Sketches were inspired by a text and reflection upon my experiences with choral repertoire. Then my music was mentored and rehearsed by two seasoned composers. Finally, it was performed by a professional choir. Despite the excellence of the choir, the performance was poor. I conclude that the process of composing my string trio in a highly structured fashion was preferable, as an aspect of my process, to the “fast” composition of my choral piece.

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

Translating Primary and Secondary Sources Into an Argument: Using Historical Evidence in Writing

Andy Little
Linda Oliva, Assistant Professor, Education

Historical artifacts, whether personal or on a macro level, remainrelevant to our lives in the present, yet students struggle with integrating these sources into their writing. This study investigated the effectiveness of scaffolded instruction to support students' ability to use historical evidence in writing in a Social Studies class, specifically establishing a connection, providing evidence for conclusions, and listing appropriate citations. The subjects were twenty-five 11th graders in Standard U.S. History who have had minimal classroom experience with such writing assignments. Students often are insightful, but lack the final push to link the source with analysis, and those who do frequently neglect to explain why and how (evidence) they came to their conclusion. Students will be given more writing activities overall, with targeted lessons throughout the semester that hone the aforementioned skills. The goal of this intervention is to improve overall writing and analysis skills for these students. The data included baseline Document-Based Question response samples, individual lesson documents that highlight student learning in targeted areas, and a final Document-Based Question response.

Estimating the Timing of a Major Geological Event using Sequence Divergence of Freshwater Fishes

Michael Lopresti
Tamra Mendelson, Associate Professor, Biological Sciences

The Hangay Plateau is a mountain range in Western Mongolia. The timing of the plateau's uplift was investigated with an interdisciplinary approach, using geological and biological data to estimate the timing. As the Hangay Plateau rose, it separated the rivers and the fish populations in them. As a result, we used the genetic relationships of the fish species across the Hangay range to determine the time of their most recent common ancestor, who would have lived before the plateau had risen. Samples of *Barbatula*, *Oreoleuciscus*,*Triplophysa*, and *Thymallus*, multiple genera of freshwater fish, were collected from both sides of the plateau, and the *cytochrome b* and *cytochrome oxidase 1* genes were sequenced and the sequences were compared using the BEAST program. The BEAST program compares gene sequences to estimate how long ago, in real time, populations diverged from each other. Using these techniques, we estimated the timing of the uplift of the Hangay Plateau based on biological data. Ultimately, these biological data will be compared with geological data to determine if the two sources provide similar timing estimates.

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

The First Electrochemical, Aptamer-Based Sensor on a Carbon Surface

Justine Lottermoser
Ryan White, Assistant Professor, Chemistry and Biochemistry

The most common hereditary mental developmental disorder, Fragile X Syndrome (FXS), is one of the few known genetic causes of autism. A recent study suggests FXS neurons can be rescued by interactions with healthy astrocytes, integral cells in the central nervous system, thus opening a potential new therapeutic strategy. Unfortunately, little is known about astrocyte-neuron interactions as there are no proper tools available to gain further insight. Adenosine triphosphate (ATP) is a molecular messenger utilized by astrocytes and is thus presumably an integral component in astrocyte-neuron interactions. Consequently, gaining information about the mechanism and spatial location of ATP release will advance our understanding of the role of astrocytes in FXS and autism. Our project is aimed at developing a tool capable of single-cell monitoring by fabricating an electrochemical, aptamer-based biosensor on carbon fibers. Aptamers are short DNA or RNA sequences selective for target analytes and translate binding into an electric signal. Carbon fiber represents a material suitable for single cell and *in vivo* analyses. Additionally, it has favorable electrochemical characteristics enabling high signal-to-noise measurements not achievable with current sensors. As such, we are developing a strategy for covalently linking aptamers to carbon electrode surfaces.

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

Computer Interface for Optical Studies of Single Nanoparticles

James Loy
Matthew Pelton, Assistant Professor, Physics

This research project has produced a computer interface to control the instruments of a microscopy unit for general optical research of single nanoparticles. Making optical measurements on nanoparticles individually removes the effects of variations in nanoparticle shape and size that are unavoidable when many nanoparticles are measured simultaneously. Single-particle measurements, however, are more challenging, and require multiple instruments to be controlled concurrently. The researcher must locate individual particles in a sample, and then operate instruments to collect data of interest, such as emitted frequencies or intensities over time. Individual control of the required instruments is time consuming and inefficient. My interface controls the software of the necessary instruments and allows the recording and examination of optical data within one platform.

With improved efficiency, the microscopy unit can collect a statistically significant quantity of data and allow the researcher to determine whether observed behaviors are indeed characteristic of the ensemble of particles or are simply due to variations in individual particles. Upcoming applications of this interface will be to study the effect of proximal metal nanoparticles on the excitation of semiconductor nanoparticles, and the transfer of electrons from semiconductor nanoparticles to molecules (a model for novel solar-energy conversion systems).

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

Choreographed Dance Routines, Student Learning Outcome

Corinne Luetje
Christopher Rakes, Assistant Professor, Education

The present study examined the degree to which a choreographed routine is improved through an instructional focus on three principles: rhythm, spatial awareness, and teacher-directed movements. Approximately 24 fourth-grade students were instructed on the three principles of a choreographed routine. Student progress was assessed over the course of two units; students were evaluated three times during a six-week period. A rubric was developed to score student progress on each of the three principles as well as the overall choreographed routines. The rubric was approved by an experienced dance teacher. Students could score a total of one point for each principle and four points for the overall choreographed routine. Successful improvement during the intervention period was defined as improving one point on a principle and/or one point for the overall choreographed routine. Initial analysis based on in-class questioning and observation indicates that explicit focus on the three principles of choreography may provide a strong conceptual framework for students, thereby improving their ability to perform the prescribed dance movements.

Articulating Space

Rachel Lum
Doug Hamby, Associate Professor, Dance

During summer 2014, I attended the Steps on Broadway Contemporary Dance Intensive for one month. The intensive consisted of technique, style, choreographic, and performance skills classes. We also had the opportunity to see two dance concerts, talk with professional dancers about how they made a living in New York, and end the program with a showcase presented by both faculty and participants. I was surrounded by professional dancers who studied and practiced their art every day, and in this environment, I better understood the dedication and determination it takes to be immersed in the dance world. With this, I was inspired to choreograph a piece of my own, which is currently a work in progress. I chose

to focus on choreographic tools that we had learned from four different professional choreographers, as well as the importance of focus in performance. These tools extend beyond borders of contemporary technique and emphasize how one can manipulate and articulate space with movement and vision. This research is combined with different compositional methods and contemporary/modern techniques I have learned at UMBC.

This work was funded by the Linehan Summer Study and Research Award.

Developing Algorithms for Structure Elucidation of Biomolecules

Gaurav Luthria
Bruce Johnson, Research Professor, CUNY Advanced Science Research Center

Ribonucleic acids (RNA) play a vital role in virtually all cellular processes. Therefore, understanding the structure of RNA is important in investigating both gene expression and cellular functions. We are investigating approaches for RNA structure determination using modern energy optimizers such as CM-AES (Covariance Matrix – Adaptation Evolution Strategy) in conjunction with gradient-based minimization and molecular dynamics simulations. The goal is to develop an algorithm to efficiently and accurately compute stable RNA configurations. This approach utilizes a coarse-grain model, previously determined properties of RNA structures including pseudo rotation phase angles and planar base structure, and torsion angle probabilities from other known and previously elucidated RNA structures. We use multiple energy minimization methods to compute stable configurations of RNA. In the present study, we have used NMR data to determine torsion angle and atom distance constraints used by these optimizers. Derived structures and minimized energies for particular RNA molecules are compared to the previously determined structures by another modeling software. The superimposition of our derived RNA structures to the known structure showed nearly identical resemblance in configuration. These results reveal applications of NMRViewJ for structural elucidation of RNA and other biomolecules.

This work was funded by NIH grant P50GM103297,.

Reconstructing Music for the Ancient Greek Lyre

Daniel Mackey
David Rosenbloom, Associate Professor, Ancient Studies

As an exercise in experimental archaeology, I set out to recreate a piece of music from Classical Greece in order to shed light on the techniques used by ancient Greek lyre players in performance. I first had to acquire an historically accurate replica of an ancient Greek *chelys* or tortoise-shell lyre. We designed the instrument to be as historically accurate as possible. We made modernizing adjustments to it by using wood for the

body instead of a real tortoise shell, by installing violin-style pegs, and by using nylgut strings instead of animal gut, since all of these elements enhance the tonal stability of the instrument. I then immersed myself in ancient Greek music theory and the ancient Greek modes. The musical pieces which I've selected for performance - the *Seikilos Epitaph* (ca. 1st century CE) and Mesomedes' *Invocation of the Muse* (ca. 130 CE) - demonstrate both the emotional dynamism of the instrument and the precision and agility required of the ancient lyre player.

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

Optimization of Nanospheres for Drug Delivery Circumventing the Blood Brain Barrier

Vanessa Mackley, Vani Ravichandran
Jennie Leach, Associate Professor, Chemical, Biochemical, and Environmental Engineering

Many neurodegenerative diseases, such as Parkinson's disease, have no cure and current treatments only address symptoms caused by these diseases. Since systemically-delivered drugs would have to cross the blood brain barrier to enter the affected regions of the central nervous system, many drug treatments do not use this delivery route. Current treatments involve injection to the site of injury, causing damage to surrounding healthy tissue in the process. One potential noninvasive method is the use of nanospheres in a nasal spray that can circumvent the blood-brain barrier and deliver a therapeutic to the site of injury. One obstacle with this method is the movement of nanospheres through the mucus barrier produced in the nasal cavity. Our nanospheres are designed so that they penetrate this barrier, travel through the brain extracellular space, reach the target brain region, and deliver the drug. We are using poly(lactic-co-glycolic acid) (PGLA) nanospheres with polyethylene glycol (PEG) as the surface-level chemical modification to pass through the mucus layer. The nanospheres are made using a two-phase emulsion that contains an aqueous and organic phase. Finally, a Bovine Serum Albumen (BSA) protein-release study was conducted to evaluate the spheres' potential to deliver drugs.

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

Generation and Characterization of a Stable Inducible O-GlcNAcase Cell Line

Austin Maduka
Natasha Zachara, Assistant Professor, Johns Hopkins University School of Medicine; Jennifer Groves, Johns Hopkins University School of Medicine

Cardiovascular disease, including ischemia-reperfusion injury (from heart attacks), is a leading cause of death worldwide. Recent studies of the endogenous protective mechanisms of the heart provide insight into the pathophysiology of heart attacks and highlight possible new directions for the development of innovative cardioprotective therapeutics. O-linked-β-N-acetylglucosamine (O-GlcNAc) is a protective post-translational modification of nuclear, cytoplasmic, and mitochondrial proteins that regulates the cell's response to stress including ischemia-reperfusion injury. The O-GlcNAc transferase (OGT) and the O-GlcNAcase (OGA) enzymes are responsible for adding and removing the O-GlcNAc sugar modification from proteins, respectively. The goal is to understand how cells regulate OGT and OGA in response to stress to promote cell survival and cardioprotection. This project focuses on identifying proteins that interact with and regulate OGA in response to oxidative stress. To make future identifications, validations and functional studies more feasible, a stable-inducible cell line was generated and characterized to express His6-OGA. As constitutive over-expression of OGA is toxic, OGA expression will be induced in a time and dose-dependent manner using a doxycycline-inducible system. Nickel resin and anti-His dynabeads will be used to pull-down His6-OGA and its binding partners. Furthermore, the co-localization of His6-OGA and its binding partners will be determined by immunofluorescence.

This research was supported in part by a training grant from the National Heart, Lung, and Blood Institute (NHLBI) to the Zachara Lab at the Johns Hopkins University School of Medicine (P01 HL107153).

How do ΔL24 Ribosomes Differ from Wild Type?

Oleg Makarevich*, Jesse Fox*
Lasse Lindahl, Professor, Biological Sciences

The components of eukaryotic ribosomes (4 rRNA molecules and 79-80 ribosomal proteins) are well conserved between yeast and humans. However, ribosomal protein L24 in *Saccharomyces cerevisiae* is dispensable for growth, and strains lacking L24 grow only 30 percent slower than wild type. The goal of this project is to investigate how the loss of non-essential ribosomal protein L24 affects the structure and function of the yeast ribosomes. To that end, we created a new strain of yeast, changing both chromosomal copies of L24. One copy, L24A, was replaced with an HA-tagged version of L24 under a promoter inducible by β-estradiol. The other copy, L24B, has had a DNA sequence "knocked-in," disrupting its ability to produce L24 transcripts. This strain will be used to provide ribosomes with and without L24 that can be compared by (i) by sucrose gradient centrifugation to determine the effect on the assembly pathway, (ii) sedimentation velocity to determine change in ribosome shape, (iii) by two-dimensional gel electrophoresis to determine if the loss of L24 leads to loss or change of additional ribosomal proteins, and (iv) mapping of the ends of the rRNA. This will constitute the first comparison of eukaryotic ribosomes with different protein compositions.

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.

Exploring Poorly Understood Psychosocial Factors for HIV Prevention and Treatment Among Urban African American Women

Olufunmilayo Makinde
Andrea Kalfoglou, Associate Professor, Health Administration and Policy

Today, African American women make up 71 percent of all women living with HIV in the United States. There is much research that has been done to better understand how to communicate HIV risk and prevention techniques to African American women. To enhance our understanding of underlying psychosocial factors that are influencing HIV prevention and treatment behaviors in this high-risk population, six African American women involved in sex trafficking were recruited to participate in qualitative interviews. Interviews were analyzed and coded for key concepts and common themes around barriers and facilitators to HIV prevention and treatment. Psychosocial factors such as mental stability, self-esteem, and community support were identified as playing a role in women's motivation to prevent and treat HIV infection. Our findings serve as preliminary information to help design future research projects with larger samples.

Is the Endangered Norfolk Island Robin a Distinct Species?

John Malloy*, Anna Kearns[1], Matthias Gobbert, Amy Driskell[2], Jeremy Austin[3]*
[1]Natural History Museum, University of Oslo, Norway, [2]National Museum of Natural History, Smithsonian Institution, [3]Australian Centre for Ancient DNA, School of Earth and Environmental Sciences and Environment Institute, University of Adelaide
Kevin Omland, Professor, Biological Sciences

The Australasian robin genus Petroica is commonly used as a textbook example of island speciation due to radiation outward from the Australian mainland. Recently, the mainland Scarlet Robin (Petroica boodang), previously considered a subspecies of the Pacific Robin (P. multicolor), was raised to a full species. However, the morphologically distinct Norfolk Island (NI) Robin (P. multicolor multicolor) remains a subspecies within the Pacific Robin. The NI Robin is currently considered endangered, and thus establishing whether it is a distinct species could be critical for its conservation. We used two data sets, one of mitochondrial and nuclear genes and one of only mitochondrial DNA, to analyze the placement of the NI Robin. Our species tree of mitochondrial and nuclear genes, obtained using modern tissue samples and coalescent species tree analyses, conclusively shows that Pacific and Scarlet Robins are not sister species. In addition, DNA sequences from mitochondrial DNA, including ancient DNA from the NI Robin, were obtained from a sampling of Australian Robins to build a gene tree of the Petroica genus. This gene tree

disproves the commonly held hypothesis that Pacific Robins and NI Robins are one species. Therefore, we conclude NI robins are a distinct, endangered species.

This project was funded, in part, through an Undergraduate Research Award from the UMBC Office of Undergraduate Education, by the UBM program at UMBC, an interdisciplinary biology and math training grant funded by the National Science Foundation (NSF) as well as by an NSF grant to Dr. Kevin Omland and a Churchill Fellowship to Dr. Anna Kearns. Results were obtained with the use of UMBC High Performance Computing Facility, supported by NSF with additional substantial support by UMBC.

The Effects of the Little Ice Age on Native American and European Relations from 1300 to 1850

Margaret Marzolf
Esther Doyle Read, Adjunct Professor, Ancient Studies

This poster will examine the effects of the Little Ice Age on Native Americans and early European colonists living in Chesapeake Bay region during the period 1300 to 1850. I consulted several different sources including archaeological site reports, scholarly journal articles, and recent publications, which detail the period climate both globally and locally. The Little Ice Age was a global phenomenon that lowered world temperatures by interrupting Atlantic Ocean currents. The European continent, affected by the Little Ice Age, experienced periods of famine because of crop failures. Early expeditions to the Chesapeake region were efforts to locate areas with arable lands in good climate that could support populations. Native Americans of the Chesapeake region also experienced problems with agricultural stability due to the global nature of the Little Ice Age. European arrival exacerbated the problem leading to strained relations as competition for food drove the groups into conflict with one another. These conflicts set a precedent of European acquisition of Native American lands and resources rather than establishing mutual cooperation and cohabitation. To conclude, the Little Ice Age should not be ignored as a factor affecting the impact of European colonization on Native American civilizations in the Chesapeake Region.

Synthesis of N-Substituted Benzoperylene Monoimide Fluorophores for Incorporation in Polyacrylamide Nanogels

Jeremy Mattison
Lisa Kelly, Associate Professor, Chemistry and Biochemistry

A solvatochromic fluorophore emits photons of different wavelengths as a function of solvent polarity. This research examines the synthesis, purification and characterization of the N-substituted benzoperylene monoimide fluorophore dye, BPI-13C, as well as stimuli-

responsive Poly(N-isopropylacrylamide) (pNIPAM) nanogels. BPI-13C precursors benzo(GHI)perylene-1,2-dicarboxylic anhydride (BPA), a swallowtail amine (13B) and BPI-13B were synthesized and, their identities were confirmed with Fourier transform infrared spectroscopy, carbon nuclear magnetic resonance spectroscopy (NMR) and proton NMR spectroscopy, respectively. BPI-13C was incorporated into the stimuli responsive pNIPAM nanogels to determine if the fluorophore would exhibit solvatochromism upon nanogel collapse. The pNIPAM nanogels were found to collapse above their lower critical solution temperature (LCST) of 32 degrees Celcius; when the nanogels collapsed from a swollen to a globular state, they expelled solvent, and altered the local polarity, as indicated by the shift in BPI-13C's emission wavelength. Fluorescence spectrometry trials provided sufficient evidence for BPI-13C's solvatochromism. The results of this study reveal BPI-13C's suitability for remote temperature sensing. Given the fluorophore's successful incorporation into pNIPAM nanogels, further studies that examine BPI-13C's photophysical interaction with other fluorophores, including naphthalimide derivatives, are warranted.

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

Effect of Student Self-Assessment of Solutions on Math Assessment Scores

Jennifer Mayrovitz
Christopher Rakes, Assistant Professor, Education

The purpose of this intervention was to improve the math assessment scores for a group of 22 ninth grade Algebra I students in a large suburban Maryland high school by having them check their answers for accuracy. During an analysis of the students' baseline classwork, homework, tests and quizzes, it was found that approximately 50 percent of the students who had correctly set up a problem failed to arrive at the correct solution. Additionally, there was no evidence that the students had attempted to verify that their solutions were accurate. The intervention consisted of a focus on modeling appropriate problem solving strategies, setting explicit expectations and providing positive reinforcement for students to use appropriate problem solving strategies. The data, in the form of student homework, classwork, and other assessments (e.g., unit exams) will be analyzed to determine if the rate of students checking their solutions has increased and if there is a correlated increase in their overall score.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Student Learning Objective: Citations and Bias

Conner McIntyre
Linda Oliva, Professor, Education

When reading, understanding, and writing history as well as other subjects, citation is crucial. History students are often looking at both primary and secondary sources, and citing these sources in the proper format is the baseline of being a historian. When studying history, students need to be able decipher between reliable and unreliable sources. The only way to be sure that what is being read or written is authentic and not biased is to go through the citation for that source. Because of the great importance for citations in essays, papers, and articles, it is equally important that these citation are written correctly so that the reader can correctly find the source if need be. Students will learn the importance of correct and proper citation in MLA format while also learning about the different forms of citation that can be used in different areas. By the end of instruction, students should be able to properly cite a primary or secondary source.

Bootstrapping for Text Extraction in Cyber Security

Nikki McNeil*, Michael D. Iannacone[1], Bogdan Czedjo[2], Nicolas Perez[3], John R. Goodall[1], Robert A. Bridges[4]*
[1]Computational Sciences and Engineering Division, Oak Ridge National Laboratory, [2]Department of Computer Science, Fayetteville State University, [3]Department of Computer Science, North Carolina State University,[4]Computational Sciences and Engineering, Oak Ridge National Laboratory
Robert Bridges, Oak Ridge National Laboratory

Public disclosure of important security information, such as knowledge of vulnerabilities or exploits, often occurs in blogs, tweets, mailing lists, and other online sources months before proper classification into structured databases. In order to facilitate timely discovery of such knowledge, we propose a novel semi-supervised machine learning algorithm, PACE, for identifying and classifying relevant entities in text sources. The main contribution of this research is an enhancement of the traditional bootstrapping method for entity extraction by employing a time-memory trade-off that simultaneously circumvents a costly corpus search while strengthening pattern nomination, which should increase accuracy. It extracts longer, more complex phrases instead of simple nouns and utilizes the Basilisk scoring method. An implementation in the cyber-security domain is discussed as well as challenges to Natural Language Processing imposed by the security domain.

This research was performed under an appointment to the U.S. Department of Homeland Security (DHS) Science & Technology (S&T) Directorate Office of University Programs HS-STEM Summer Internship Program, administered by the Oak Ridge Institute for Science and Education (ORISE) through an interagency agreement between the U.S. Department of Energy (DOE) and DHS. ORISE is managed by Oak Ridge Associated Universities (ORAU) under DOE contract number DE-AC05-06OR23100.

Toward a Transformative Epistemology: Personal Experience as Public Knowledge

Amelia Meman
Megan Tagle Adams, Women's Center

A great amount of feminist scholarship is rooted in the exploration of personal experience. In my research, I set out to understand the relationship between feminist epistemology and personal experience, so that I could demonstrate new ways of making knowledge that open the field to marginalized voices. I surveyed feminist theories that challenged traditional epistemic standards in order to frame my research and justify the value of meaning-making grounded in personal narratives. The analysis portion of the research was comprised of a close reading of both my own creative non-fiction writing and the foundational feminist anthology *This Bridge Called My Back: Writings by Radical Women of Color* edited by Cherríe Moraga and Gloria Anzaldúa, which pushed the boundaries of dominant knowledge-making standards in feminist scholarship. By exploring feminist methods for knowledge-making, as well as the subsequent analysis of *This Bridge Called My Back* and my own writing, I examined the impact, implications, and limitations of the unique paradigm shift inherent in using personal experience as the basis of knowledge creation. By challenging dominant standards on what makes "good knowledge" and operationalizing this feminist epistemological framework, my research explored a creative approach to expanding access to knowledge-making.

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

Geographically Skewed News: A Trayvon Martin Case Study

Shannon Mitchell
Kathy Bryan, Senior Lecturer, American Studies

News often serves as the lens through which we understand the world around us. But what if our lens is out of focus? Historically, newspapers in the northern and southern U.S. depicted racially charged events much differently. This project explores whether coverage of such issues is still skewed geographically. This content analysis of *The New York Times*, *The Orlando Sentinel* and *The Christian Science Monito*r reveals geographic differences in the way the 2012 Trayvon Martin case was covered. The news sources were selected based on readership representing geographically different markets (northern, southern, and national). This project maps articles in these three sources onto a timeline of Trayvon Martin's case. Following the method of Stephen J. Farnsworth and S. Robert Lichter's 2012 study of front-page presidential coverage, language describing George Zimmerman and Trayvon Martin that "[conveyed] an unambiguous assessment or judgment concerning an individual, institution or action," was scored as positive or negative. The study applies qualitative content analysis to explore the geographic differences in coverage revealed by

this scoring and discusses the implications for the national conversation on race. If local, national and digital media portray facts about racial issues differently, effective public discourse about race is stifled.

Main Street and Wall Street: Gauging Recovery after the Great Recession

Vivek Moorthy
Douglas Lamdin, Professor, Economics

The "Great Recession" of 2007-2009 was the longest and deepest economic downturn faced by the United States since the Great Depression. The recession was sparked by the collapse of the real estate market, leading to both a significant loss in consumer wealth and a precipitous devaluation of mortgage-backed securities that threatened the solvency of major financial institutions. Consequently, consumer spending and business investment plummeted, resulting in soaring unemployment, diminishing corporate profits, and a falling stock market. Policymakers, in particular the Federal Reserve, took aggressive measures to stabilize the economy. To the average American, the recovery may seem sluggish and, to some, nonexistent. However, during the same recovery period corporate profits and the stock market recovered quickly, causing concern with this seemingly disproportionate recovery. Using macroeconomic data I analyze indicators of what happened in the labor market ("Main Street") and in the corporate sector ("Wall Street") to compare how each has fared in the wake of the Great Recession.

How Does a Religious Upbringing Limit, Prevent, and/or Influence the Manifestation of Celebrity and Pop Cultural Fandom?

Mercedes Morina
Donald Snyder, Senior Lecturer, Media and Communication Studies

An anonymous question posted to Yahoo Answers asks, "Can you be a vampire fan and still be a Christian?" This question, which reflects the focus of this research project, exposes a central tension between individuals raised with strong religious convictions and the larger popular culture. The examination of fan discourse, religious doctrine, and published texts—by way of Christian news publications—provides an investigation into the relationship between pop cultural fandom and fans with strong ties to religion. This tension, in part connected to the Christian tenant against the worshiping of false gods, forms the foundation of the administering of attitude assessment surveys, using a Likert scale. The survey asks participants to reflect on the influence their Christian upbringing has on their relationships with the larger secular media culture. In supplement to the survey, the research will include several ethnographic interviews to better uncover how devout Christians practice media fandom.

High Density Neural Probe Design for Chemical Sensing

***Larry Morton**, Deepa Gupta*
Gymama Slaughter, Assistant Professor, 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 serious symptoms. An example would be mapping brain activity prior to and during a stroke, or monitoring dopamine levels for someone at risk of developing Parkinson's disease. However, this detection mechanism is limited by the size and weight of current probe technologies. We have therefore designed a high-density probe that can reach deep brain tissue. The probe has eight recording sites per shank. The width of the shank is 40 microns and this width minimizes the damage done to the brain during insertion. There are four shanks per probe, so there are 32 independent recording sites per probe. The width between the shanks are 250 microns to minimize tissue damage. Future work will focus on the realization of the probe using micro-fabrication technology.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

A Low-Cost, Sensitive Visual Spectrophotometer for Teaching Laboratories

Michael Moubarek, Quoc Bui
Stephen Mang, Lecturer, Chemistry and Biochemistry

Funding for enriching education opportunities is a continual issue for many institutions. Today, STEM education initiatives are near the forefront of national policy which has placed high expectations on institutions of higher education to do more, often with less. Low-cost laboratory equipment is one way that teaching laboratories could reduce their costs, but very often the quality of the instrumentation lacks and the experimental results suffer. We developed a modification of a published design for a low-cost visual spectrophotometer that offers high quality results. We used our instrument to carry out absorbance measurements with colorimetric tests for inorganic water pollutants. We were able to construct a standard curve and find the concentration of pollutants in samples from local waterways. The instrument that we built displayed a good linear range of detection, $R2 = 0.997$, and it was also more sensitive than the widely used Spectronic 20 spectrophotometer. Furthermore, we integrated our instrument with the BeagleBone Black computer for automated data collection. This instrument has the potential to be widely used in teaching laboratories. During assembly, students will have an augmented educational opportunity as they learn concepts behind spectrophotometry, coding, electronics, circuitry, and the properties and behavior of light.

This work was funded by UMBC Department of Chemistry and Biochemistry and the Alex. Brown Center for Entrepreneurship.

Bartleby 2015: A Collaborative Creation

Daniela Mujica-Martorell, Stephen Kelley
Sally Shivnan, Senior Lecturer, English; Guenet Abraham, Visual Arts

Many would agree that the writing and art that appears in UMBC's creative arts journal *Bartleby* is remarkable, accomplished creative work, but many don't realize that producing the journal is also a powerful creative act in itself. Unlike the solitary nature of creating poetry, prose, or art, creating *Bartleby* involves an intense, collaborative process that requires a complex level of cooperation. *Bartleby*'s large staff involves a wide variety of roles — editors, staff, copy-editors, a designer, a web director, a publicity manager, a managing editor — all who have to communicate constantly. The process begins with reaching out to students for submissions, leading to weeks and months of reviews, discussions, design decisions, negotiations with the authors and the printers — a lengthy, dynamic, interactive creative dance. This is even more impressive because the staff is so diverse, coming from a huge variety of majors and different backgrounds. At URCAD, *Bartleby* will present a short film that will reveal the creative process behind the scenes, featuring not only *Bartleby* staff, but the student writers and artists in the 2015 issue. The video will have an interactive component that will allow people to engage with*Bartleby* and its journey toward publication.

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

Bridging the Achievement Gap in Middle School English

Sameera Mukhtar
Cheryl North, Professor, Education

This study examines the performance of students at an eighth grade regular English class with a view to bridge the gap between the highest and lowest performing subgroups of students at a suburban middle school. Previous investigations determined that students do not produce qualitatively adequate writing as measured by performance on holistic and analytical rubrics. The aim of this study is to determine if explicit instruction in the writing process, in the different rhetorical modes of writing, and in synthesizing texts would enhance student performance in demonstrating growth toward mastery of elaboration of evidence in writing. The researcher assessed students' long-term performance through the Writers' Workshop, and weekly gains through the implementation of specific instructional strategies meant to engage students and increase rigor. This research will evaluate the effectiveness of classroom instruction through student participation and student work measured for following writing conventions, containing sufficiency of detail and relevance to the topic.

Using Mathematical Modeling to Predict Calcium Wave Behavior in Neuronal Dendrites

Danya Murali
Bradford Peercy, Associate Professor, Mathematics and Statistics

We present and analyze a mathematical model of calcium waves in the neuronal dendrite controlled by the spatiotemporal distribution of the second messenger IP3 (inositol 1,4,5-trisphosphate). 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 IP3, and further simulate this behavior using the mathematical computational package MATLAB. Specifically we investigate how dynamic IP3 affects calcium wave speed, and use this to predict the movement and behavior of the calcium wave. We also consider a resurgent calcium wave and seek a range of parameters that account for this phenomenon. We hypothesize that IP3 diffusion is limiting to autocatalytic calcium propagation, forcing a pause and decline in calcium that recovers with IP3 spread. This study of calcium within neuronal dendrites can also be extended to understanding calcium's contribution to neuroplasticity. Neuroplasticity refers to the change in neural pathways and synapses in response to certain stimuli, and is a fundamental component of the cellular mechanism for memory development.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Disenchanted

Matthew Myslinski
Cathy Cook, Associate Professor, Visual Arts

This short documentary charts the history and legacy of the once proud Enchanted Forest Amusement Park of Howard County, Maryland. The documentary takes a look back on what made this park have such an impact on so many families, how it eventually became abandoned and derelict, and what is being done today to preserve it. This film was produced in collaboration with former employees of the park, the Howard County Historical Society, and Martha Clark, one of the most prominent volunteers currently working hard to revive what remains of the attractions. The filmmaker shot original interviews and searched to find archival imagery and media regarding this very important part of local Maryland history. This park holds a special place in the hearts of people everywhere who have visited it since its opening in 1955.

Samhain

Matthew Myslinski
Cathy Cook, Associate Professor, Visual Arts

This short narrative film by Matthew Myslinski follows friends Bridget, portrayed by Kristen Adornato, and Chris, portrayed by Josh Kradz, who attend a costume party on Halloween, when things take an unexpected turn for the supernatural. The filmmaker explored unique filmmaking techniques to bring to life a story that is very much in line with the spirit of the holiday season. Researching methods such as blacklight grip and electric, glide cam cinematography, and non-linear editing, Matthew, and his team of highly skilled crew members in camera, art, grip, sound, and makeup departments, worked together to push the possibilities of what can be accomplished in filmmaking on a college level. This collaboration was made even more invaluable as each individual who took part in the production had a chance to gain new knowledge about each of their individual crafts and what they contributed to the film as a whole.

All's Fair: A Campus MovieFest Experience

Matthew Myslinski
Vin Grabill, Associate Professor, Visual Arts

This presentation by filmmaker Matthew Myslinski will provide the audience with a first-hand look at what goes into the production of a film for the prestigious Campus MovieFest, as well as insight as to what the national competition is like in the movie capital of America: Los Angeles, California. I will talk about the timeline my team and I went through during pre-production of the film; including how we contacted actors, booked locations, and carried out our complex production design.I will also discuss how we worked very closely as a team during the week of the actual competition and how we pushed the boundaries of the level of filmmaking that can be accomplished on a college level. Insight about the subsequent trip to the national competition my team and I took will be included as well; what we learned at conference workshops, in meetings with industry professionals, and through networking with fellow aspiring filmmakers from across the country

Electromagnetic Energy Generator in Total Knee Replacement Unit for Self-Powering *in-vivo* Sensor

Yves Nazon II
Soobum Lee, Assistant Professor, Mechanical Engineering

As the average age of those who need knee surgery is decreasing, the number of total knee revision (TKR) replacement surgeries is increasing. A potential way to decrease the likelihood of revision surgery would be to implant a sensor inside the knee implant to check patient posture so that postures that correspond to increased knee joint wear could be

detected and avoided; however, to implement this plan a longstanding power supply is needed. This work provides a potential answer to the power source problem by utilizing human motion and a charged magnetic coil system that can generate voltage to be stored and used to power an embedded sensor. The tests were done on a likeness of the human knee in order to investigate the feasibility of this system. The two different scenarios were tested— walking and running — and the voltage generation level was compared. Promising results were achieved from these tests and can validate further research into exploration of this method as a viable embedded sensor power source.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Cannabis Use in Relation to GABA and Glutamate Levels in Schizophrenia

Nkemdilim Ndubuizu, *Benjamin Krause[1], S. Andrea Wijtenburg[1], Frank Gaston[1], Stephanie Korenic[1], Sarah Nisonger[1], Joshua Chiappelli[1], Elliot Hong[1], Peter Kochunov[1]*
[1]Department of Psychiatry, University of Maryland School of Medicine
Laura Rowland, Associate Professor, Department of Psychiatry, University of Maryland School of Medicine

Heavy cannabis use can lead to brain alterations and early adolescent use is a risk factor for schizophrenia. The purpose of this ongoing project is to investigate the relationship between marijuana use and gamma-aminobutyric acid (GABA) and glutamate levels, major neurotransmitters involved in the pathophysiology of schizophrenia. One hundred and four subjects were recruited in this study. Magnetic Resonance Spectroscopy was used to determine anterior cingulate neurotransmitter concentrations during rest. Marijuana use history, working memory, processing speed, and functional capacity were obtained on all subjects. Subjects with schizophrenia were assessed for psychiatric symptom severity. Three main findings emerged from these preliminary results. First, GABA levels were shown to be higher in healthy persons who had never tried marijuana, possibly reflecting personality traits of greater inhibition and less risk-taking behavior. Second, the younger the age of first marijuana use, the lower the GABA levels in persons with schizophrenia. This relationship will be explored in future studies. Third, glutamine levels were higher in those who have used marijuana across diagnosis group but highest in the schizophrenia group, consistent with previous research. These results raise the question if marijuana use further impacts the glutamatergic system resulting in an illness+marijuana use summation effect.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Kinetic Sculpture Race

Jack Neumeier, Jasper Dudley, Mai Huynh
Steven McAlpine, Interdisciplinary Studies

Inclusiveness is the foundation of Kinetic Education. The Kinetic Sculpture course within the INDS department at UMBC was created to exemplify how academic inclusiveness can inform undergraduate coursework, with students of every background contributing to a collective objective. As part of this course, students are expected to contribute to the design, creation and implementation of a human-powered vehicle representative of the chosen topic of interest. The course launched in the Fall 2014 semester with a focus on sustainability. Throughout the semester, students created a design for a vehicle that symbolized the monstrous effects material pollution has had on aquatic ecosystems around the world: The Kraken. This experiment in project-based learning will exist as a model for the development of future Applied Learning Experiences, in addition to contributing to best practices for arts integration in STEM education, commonly referred to as STEAM. Via a poster to exhibit the challenges faced by the team in the research and development phase of the project, a live demonstration to exhibit the collaborative production, and an interactive activity to involve the audience in the process of upcycling, this presentation will encompass each facet of the KSR project.

This work was funded, in part, by a Breaking Ground grant.

A Clinical Interface for Genomic Analysis for Neonatal Diseases Using Human Phenotype Ontologies

Kevin Nguyen
Maricel Kann, Associate Professor, Bioinformatics and Computational Biology

Three to four percent of newborns in the USA have congenital abnormalities that affect physical phenotype, development, or learning abilities. Advancements in prenatal testing has made it possible for early detection of chromosomal and genetic related causes of congenital abnormalities, resulting in a large collection of patient genomic data. However, linking a newborn's symptoms to their genomic data remains a challenge. We developed a pipeline to aid physicians incorporating genomic data into diagnosis and prognosis of newborns. The goal of our project is to obtain a prioritized list of candidate diseases for physician follow up. Using symptoms/phenotypes, we obtained a list of diseases and associated genes based on known linkage in disease and human phenotype ontologies. For preliminary analysis, we obtained all available information for child diseases from literature using a text mining program developed by our lab, Extractor of Mutations (EMU). Using EMU on 1,520 abstracts, we obtained a list of 971 genes. Results show that EGFR, TNF, and ADIPOQ are the most frequently occurring genes involved in childhood diseases. We plan to use our methodology to aid in the diagnosis of all newborns in the Neonatal Intensive Care Unit at the University of Maryland Children’s Hospital in Baltimore.

Expression Profile of Putative Receptors Involved in Xenobiotic Detection in Mouse Olfactory Epithelium

Akua Nimarko
Weihong Lin, Associate Professor, Biological Sciences

The main olfactory epithelium (MOE) in mammals detects environmental odors important for survival. To protect the MOE from environmental toxins 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 a distinct population of apical microvillous cells that reside in the MOE. To further investigate the expression profile of potential receptors involved in xenobiotic detection, we exposed both wild-type mice and mice deficient in microvillous cells to irritants and used real-time quantitative polymerase chain reaction (RT-qPCR) on total RNA obtained from freshly dissected olfactory turbinate tissue from both types of mice. 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 in varying levels and the expression of these receptors differs between wild-type and mice deficient of microvillous cells. Our results suggest that cells within the MOE may respond to diverse chemical ligands and contain different biological pathways important to xenobiotic detection.

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

Novel *Bacillus* Bacteriophage Isolated from Russian Soil

Julie Norton, Kevin Liao, Mimi Way, Brittnie Prakash
Steven Caruso, Senior Lecturer, Biological Sciences; Ivan Erill, Associate Professor, Biological Sciences

Bacteriophages are abundant biological entities that inhabit every known biome on Earth, utilizing susceptible bacteria as a means for replication. Bacteria have numerous bioindustrial applications; *Bacillus thuringiensis*, for example, sporulates and secretes δ-endotoxins that have pesticidal applications in agriculture. Because of the impact they have on bacterial ecosystems and their evolution, phages can potentially be used in many bioengineering applications. Here, a *Bacillus cereus* group Myoviridae bacteriophage, dubbed TsarBomba, was isolated on *Bacillus thuringiensis subsp*. Kurstaki from a soil sample taken from central Russia. We imaged TsarBomba via transmission electron microscopy, ran a restriction digest to determine genome length, and provisionally

characterized it as a C1 subcluster bacteriophage using PCR. We also ran a series of host-range tests, and isolated the TsarBomba DNA and submitted it to the University of Pittsburgh for sequencing. At the time of this writing the TsarBomba genome is being annotated by the Phage Genome Analysis class at the University of Maryland, Baltimore County.

This work was funded in part by Howard Hughes Medical Institute Science Education Alliance - Phage Hunters Advancing Genomics and Evolutionary Science (HHMI SEA-PHAGES) Program.

Role of Ecdysone in the Migration of Border Cells in *Drosophila melanogaster* Egg Chambers

Kamsi Odinammadu
Michelle Starz-Gaiano, Research Professor, Biological Sciences

Cell migration is a very important mechanism to understand. Understanding how cells migrate can help build information that future generations can use in the fight against diseases like cancer. The goal of this project is to study the importance of the steroid hormone Ecdysone in the border cells of Drosophila melanogaster (fruit fly) egg chambers. As in humans, steroid hormones in flies control the timing of key developmental events, so it is important to investigate how these hormones signal. Steroid hormone signaling controls the timing of when border cells exit from one end of the developing egg and migrate to the other. Our preliminary experiments have identified several factors that are regulated by steroid hormone signaling, such as the proteins Abrupt as well as other cell adhesion regulators. The goal of the current project is to identify which of these genes are most important. We will conduct a series of genetic experiments to determine if loss of function mutations in these factors disrupts cell migration. Mutations that cause an abnormal phenotype will be candidates for additional study. These results will inform us about the important signaling effectors downstream of ecdysone steroid hormone in cell migration.

The project is funded through an NSF-CAREER award to MSG.

The Application of CRISPR Genome Engineering to the Study of Host Antiviral Factors

Tolu Omokehinde
Paul Bieniasz, Research Professor, Aaron Diamond AIDS Research Center (ADARC), The Rockefeller University

Human immunodeficiency virus (HIV) is a retrovirus that infects cells of the human immune system. Previously, a screen of interferon-stimulated genes was used to identify

candidate genes with the capacity to protect cells from HIV-1 infection. A candidate gene Tripartite motif containing 56 (TRIM56) has been shown to be an interferon inducible E3 ubiquitin ligase that acts to restrict replication in positive strand RNA viruses. CRISPR and the CRISPR-associated (CAS) protein 9 is a nuclease system that can be programmed to induce DNA double stranded breaks (DSBs), which cause mutations that result in gene knock-out. We were able to clone sequences targeting TRIM56 into a LentiCRISPR plasmid. The cloned plasmids were then used to generate viruses that would deliver the necessary machinery to target and cleave TRIM56 genes. To test the efficiency of the CRISPR/Cas9 system, sequences targeting GFP were cloned. GFP deletion was observed in a 293T-GFP stable cell line and knockout efficiency was determined by analysis. Knockout results of TRIM56 are still pending, but we expect that TRIM56 deleted cell lines will demonstrate the contribution of this gene to the interferon response to HIV-1.

This research was supported in part by a grant to The Rockefeller University and the Aaron Diamond AIDS Research Center from the Howard Hughes Medical Institute through the Precollege and Undergraduate Science Education Program.

Determining the Role of Melanopsin C-Tail in Deactivation and Trafficking

***Elelbin Ortiz**, Juan Valdez, Preethi Somasundaram*
Phyllis Robinson, Professor, Biological Sciences

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 allows for internalization of G-protein coupled receptors (GPCRs) after melanopsin inactivation. It is currently unknown whether melanopsin is internalized. Angiotensin II type 1A receptor (ATII1AR) and β2 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 techniques. Sequencing has confirmed that these chimeric constructs have successfully been made. Western blotting has confirmed that these constructs are expressed when transfected into human embryonic kidney cells. Calcium imaging has confirmed that the constructs are active in the presence of light. Our next step is to conduct internalization assays using immunohistochemistry and fluorescence microscopy. 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, an Undergraduate Research Award from the UMBC Office of Undergraduate Education, and a National Eye Institute grant to P.R.R. (R01EY019053).*

Ribosome Biogenesis Mediated Cell Cycle Arrest in *Saccharomyces cerevisiae*

Clarence Pascual
Lasse Lindahl, Professor, Biological Sciences

Ribosome biogenesis is one of the most crucial processes for cell growth and development. We know that disruption of this process causes ribosomal stress, which eventually leads to cell cycle arrest, but we do not know how this occurs. We began the current investigation by looking into the organization and location of cell-cycle dependent proteins under ribosomal stress condition in *Saccharomyces cerevisiae* (yeast). By utilizing confocal microscopy and fluorescent-tagged cell cycle dependent proteins, we observed an accumulation of budded cells in stress condition, which is suggestive of arrest at post-cytokinesis stage. Furthermore, we also noticed the absence of actin-ring formation in the bud-neck of these arrested cells. Currently, we are investigating proteins that play a role in cytokinesis and the cell separation stage to further understand the relationship between ribosome biogenesis and cell separation. With this project, we are hoping to increase our understanding of the signaling pathways involving the ribosome biosynthesis and regulation of cell cycle.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Gender Differences in the Relationship Between Anxiety and the Function of Endogenous Pain Inhibitory Systems

Himadri Patel*, Eryka Boyd, Raimi Quiton*
Raimi Quiton, Assistant Professor, Psychology; Eryka Boyd, Psychology

Gender differences in anxiety and pain perception have been widely reported in the literature, with women generally demonstrating greater anxiety, greater pain sensitivity, and lower activation of endogenous pain inhibitory systems than men. Some researchers proposed that anxiety enhances pain while others argued that anxiety reduces pain. This study tested the hypothesis that gender differences exist in the relationship between anxiety and laboratory pain measures. Thirty-four healthy adults (14 females) completed the State-Trait Anxiety Inventory and underwent laboratory tests of heat pain tolerance, heat pain threshold, and conditioned pain modulation (CPM) magnitude. CPM is a psychophysical measure of the activation of endogenous pain inhibitory systems. State anxiety was not significantly correlated with heat pain threshold or tolerance measures in either men or women ($p>0.05$). However, state anxiety was significantly correlated with CPM magnitude in females ($r = -0.629$, $p<0.05$), with higher anxiety related to greater activation of endogenous pain inhibitory systems; this relationship was not significant in males ($r = -0.072$, $p>0.05$). These findings suggest that anxiety contributes differently to the activation of endogenous pain modulation systems in women than men. Understanding gender-

specific mechanisms of pain provides information that can help reduce gender disparities in pain prevalence and treatment.

This work was funded, in part, by the UMBC Psychology Department.

Does Socioemotional Competence Predict Oral Language Competence?

***Sagar Patel**, Alisa-Zeliger Kandasamy*
Linda Baker, Professor, Psychology

Previous research has demonstrated a positive relation between socioemotional development and expressive vocabulary in children. Both factors are important to academic success. The present study examines the longitudinal relations between children's performance on the Expressive One-word Picture Vocabulary Test (EOWPVT) and their socioemotional competence as rated by their teachers. Assessments were administered each fall and spring from pre-kindergarten through first grade. Teachers used the Social Competence and Behavior Evaluation (SCBE) when children were in pre-kindergarten and kindergarten and the Social Skills Rating System (SSRS) when children were in first grade. Participants were 138 urban children at risk for poor academic achievement who were enrolled in a larger study. It is expected that students whose socioemotional competence is lower will also have weaker oral language competence at each time point, consistent with previous research. Of particular interest is whether the amount of growth children make in socioemotional competence over time predicts their expressive vocabulary scores at the end of first grade, or whether the reverse relation holds, such that greater gains in oral language predict better social competence at the end of first grade. Possible interventions can be explored into how to improve both socioemotional competence and oral language skills.

Five Weeks, Ten Minutes, A Study in Physical Theater

Erin Patterson
Eve Muson, Assistant Professor, Theatre

I attended the SITI Company Workshop during the summer of 2014 to explore the use of two physical theater methods, Viewpoints and the Suzuki Method of Actor Training, as tools to create story and emotion through movement. This program served as a laboratory for actors to take part in intensive work, physical training, and the generation of new works. While attending, I trained everyday and collaborated with artists all over the world to implement new training in to short theatrical compositions we created each week. The Suzuki Method focused heavily on the control,agility, flexibility, and speed of an actor, as well as their connection between the body, the breath, and the ground. Viewpoints is a technique of movement improvisation that was developed out of the post-modern dance world to explore individual elements that make up performance. The majority of my work at UMBC is focused on naturalistic acting with psychologically- based actions and

emotions, but my physicality now allows me to find character through movement, rather than generated feelings. I will implement this training at UMBC with a group of students who will train and collaborate to create their own new theatrical work next year.

This work was funded, in part, through an Undergraduate Research Award from the UMBC Office of Undergraduate Education and the William T. Brown Shakespeare on Wheels Award from the Department of Theatre.

Characterizing Population Level Transcriptional Regulation using Metagenomics

Talmo Pereira, David Nicholson
Ivan Erill, Associate Professor, Bioinformatics and Computational Biology

Understanding how organisms regulate gene expression is one of the central questions in biology. One of the primary mechanisms that organisms employ for this task is transcriptional regulation. This process relies on specialized DNA binding proteins called transcription factors (TFs) which can promote or inhibit the transcription of genes. TFs bind upstream of the gene they regulate to specific DNA sequences that can be predicted computationally in the genome by using inferential methods from the fields of Information Theory and Machine Learning. Despite the advent of ever faster sequencing technologies, these methods have not yet been widely applied to study sequencing data sampled directly from bacterial communities in their natural environment - metagenomes. Here we seek to develop a bioinformatic pipeline to quantify TF binding site enrichment in metagenomic datasets to better understand how transcriptional regulation is affected by the environment at the bacterial population level. We describe here the outline of the main data processing steps, including (i) primary data acquisition from repositories, (ii) gene operon prediction, (iii) quality control filtering, (iv) orthologous gene clustering, (v) taxonomy prediction and (vi) database construction. This pipeline is coupled with the analytical tools for estimating enrichment of transcriptional regulation for specific TFs.

*This research was supported, in part, by NSF grant MCB-1158056, a grant to UMBC from the Howard Hughes Medical Institute through the Precollege and Undergraduate Science Education Program and NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Vocal Development in Grasshopper Sparrow (*Ammodramus savannarum pratensis*) Nestlings from Hatching to Fledging

Samantha Perry
Bernard Lohr, Assistant Professor, Biological Sciences

The complex adult song of many songbirds, such as the Grasshopper Sparrow (*Ammodramus savannarum*), has been studied intensively, but little is known about the

early vocalizations that are obviously critical to the survival of altricial (helpless) hatchlings. Analysis of recorded vocalizations of Grasshopper Sparrow nestlings from hatching (day zero) until fledging (day eight to nine) have demonstrated how the early, innate vocalizations change as the nestling grows into a mobile, full-sized juvenile. The frequency, duration, and modulation of frequency were measured in these early vocalizations using the SIGNAL sound analysis software, and results were tracked across day of age of the nestlings. Results showed that over the nestling period (days zero to nine) calls became higher pitched (increased in frequency), longer in duration, and developed pronounced frequency modulation as chicks aged. These results are expected given the development of the respiratory tract and vocal apparatus during this time period. Pending the success of a captive breeding program this spring, additional comparisons will be made between male and female nestlings and between captive and wild born nestlings to determine whether early vocalizations are sex-specific or depend on rearing environment.

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

Deceptive Innovation

Matthew Poissant
Kathy Bryan, Senior Lecturer, American Studies

This research aims to understand how a frontier narrative has been perpetuated by deconstructing the rhetoric used by Google, Facebook and Amazon in their promotions and comparing it to rhetoric of 1990s internet scholarship. Close reading was used to analyze both internet company promotions and early internet scholarship. In the 1990s a narrative emerged of the internet as the next American frontier. Scholars echoed the sentiment of the internet being a vessel of individual expression while also bringing people together in revolutionary communities that transcended geography. These academics failed to see that as the internet became more centralized and commercialized the agency of individuals in their virtual community diminished until community became another commercial good. As the population of the internet grew, producers of virtual communities shrank and consolidated into an elite. The landscape of the internet today makes it nearly impossible for anyone who is not established in the Silicon Valley elite to influence that landscape. Silicon Valley has consolidated the services of the internet to such a degree that they have a monopoly on technological innovation. This monopoly is achieved by promoting this outdated frontier narrative about the internet to create a false sense of agency within consumers.

B or Better

Matthew Poissant
Linda Oliva, Assistant Professor, Education

The purpose of this study is to determine if a “B or better” grading policy on written assignments will improve student academic performance. The study targeted students in a World History course who typically score in the “average” or “C” range. The “B or better” writing policy requires that students meet enough of the requirements of an assignment to warrant a “B” in order to receive credit. Students are able to revise their assignment as often as necessary to earn a “B”. This classroom policy facilitates high expectations as well as promotes writing as a process rather than as an unchangeable product. Implementing this policy includes providing students with a rubric along with prompts so they are aware of the expectations and requirements. Furthermore students will be given precise and specific feedback on their responses as to what they need to improve in order to earn a “B”, as well as the opportunity to work with the teacher after school for more guidance. The progress in student writing will be tracked through using a standardized rubric for each writing assignment.

Framing Congressional Authority to Protect Minorities: A Content Analysis of Newspaper Coverage of the Voting Rights Act

Divya Prasad, Feyisanmi Ojo, Nathan Legg, Shawn Tang*, Molly Wilson*
Tyson King-Meadows, Associate Professor, Political Science

Previous studies have documented the impact of media framing on public acceptance of Supreme Court decisions and federal legislation. Yet, little is known about the media’s portrayal of the Voting Rights Act of 1965 (VRA), a signature law and an unparalleled fulcrum for debates about Congress’ authority to protect minority voting rights. Adapting a coding scheme used to examine campaign commercials, we analyzed coverage of minority voting rights in five major newspapers from 1990 to 2014: Washington Post, Los Angeles Times, New York Times, Atlanta Journal-Constitution, and St. Louis Post-Dispatch. Our timeframe encompassed controversial judicial rulings on the VRA, three redistricting cycles, and congressional repudiation of judicial action. We evaluated the narrative frames of nearly 600 news stories, editorials, and letters to the editor. We found regional, tonal, and thematic differences in treatments of congressional action. We conclude that certain narratives nurtured skepticism about the VRA. We assert that skepticism further weakened judicial support for the law, a point punctuated by the Shelby County, Alabama v. Holder (2013) ruling invalidating a provision of the VRA enacted in 1965. Our results further document connections between public sentiment toward federal action and news coverage about the intent and beneficiaries of said action.

This work was funded, in part, through an Undergraduate Research Assistantship Support (URAS) Award from the UMBC Office of the Vice President for Research, UMBC's Africana Studies Department and UMBC's Political Science Department.

Mapping Genetic Markers of Childhood Diseases Using Text Mining of Biomedical Literature

Devona Quasie-Woode
Maricel Kann, Associate Professor, Bioinformatics and Computational Biology; Thomas Peterson, Bioinformatics and Computational Biology

There are numerous childhood diseases that have devastating effects and yet can be prevented if detected early. For instance, one in six children in the U.S. has one or more developmental disabilities or other developmental delays. Current genome sequencing has the potential to provide genetic markers that can aid physicians in determining early diagnosis and prognosis of diseases in newborns. This project is in collaboration with another team of researchers at the University of Maryland Medical School Children's Hospital aiming to sequence the genomes of all newborns in the Neonatal Intensive Care Unit (NICU). We have developed computational techniques to extract genetic markers related to childhood disease from all available scientific literature and using manual curation to verify their disease relationship. The extractor of mutations (EMU) tool was used to query literature from the PubMed database using Medical Subject Headings (MeSH) that are associated with childhood illnesses. EMU then identified mutations and their related genes from the literature. This database of mutations related to childhood disease has been manually curated by our team, thereby creating an invaluable resource for physicians working in the NICU.

Visualization of Axons in the Human Optic Chiasm

Rafay Qureshi
Cha-Min Tang, Professor, Department of Neurology, University of Maryland School of Medicine; M. Samir Jafri, Assistant Professor, Department of Neurology, University of Maryland School of Medicine

The human optic chiasm is the region that carries axons from each eye to the brain. About half of these axons must cross to the other side of the brain. The path they follow in the chiasm has never been mapped. Although there are many cartoons of crossing pathways, they are all assumptions based on the belief that axons take the most direct path to their target. Using a novel optical technology we have developed called "anisotropic scattering imaging" we can, for the first time, directly visualize the path crossing fibers take as they cross at the chiasm. Their paths are far more complicated than anyone could have imagined. These include the abrupt transition from a peripheral nerve type of organization to a CNS white matter tract at the chiasm; we also note evidence that crossing fibers turn backwards towards the opposite eye before returning to proceed to the thalamic nucleus. Our data shows evidence that crossing fibers cross as thin sheets rather than as bundles. This unexpected complexity may provide insights into the fundamental mechanism of axon guidance in the developing brain. The method we are developing can serve as a platform technology for the emerging field of connectomics.

This work was funded, in part, through the VA Merit Review and Saddiqui fund to C.-M. Tang.

Improving Spatial Visualization Skills of Engineering Majors at UMBC

Nishay Raja
Anne Spence, Professor of the Practice, Mechanical Engineering; Jamie Gurganus, Mechanical Engineering

Spatial reasoning is a cognitive skill that helps engineering students understand and interpret space when mentally manipulating two-dimensional and three-dimensional figures. Nurturing this ability in engineering students has shown to increase retention in their engineering program according to research. To assess this variable, a case study was performed on UMBC ENES 101 students in the fall of 2014. The Purdue Spatial Visualization Test (PSVT), a validated assessment tool, was administered through BlackBoard to all students enrolled in ENES 101. Participants who scored below a 70 percent on the test were recommended to enroll in ENES 100, Spatial Reasoning. Students in this course were required to re-take the PSVT at the end of the semester. In addition, self-efficacy of all students was evaluated, using a validated survey, and then compared to their PSVT scores. Data from the post-PSVT assessments, as compared to the pre-test, showed an increase in scores. Currently, self-efficacy surveys for this case study are being analyzed. Future assessment and results will allow a more defined conclusion. It is recommended that students who score below a 70 percent on the PSVT be enrolled in ENES 100 making it a permanent standardized practice for College of Engineering and IT.

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

Development of Novel Wide Bandgap Substrate for High Power and High Temperature Electronics

Tahira Raja
Narsingh Singh, Research Professor, Chemistry and Biochemistry

Magnesium oxide (MgO), sapphire (Al_2O_2), silicon carbide (SiC), aluminum nitride (AlN) and Gallium nitride (GaN) have become important wide bandgap III–V semiconductors of choice to replace silicon and gallium arsenide (GaAs) since these have excellent properties for high power microwave devices. We will explore the possibilities of beta gallium oxide (B-Ga_2O_3) as a novel bandgap material. Aluminum nitride is an extremely promising substrate for high power microelectronic and radio frequency devices and has been grown by physical vapor transport method. It was observed that high purity aluminum nitride grew in long hexagonal needles with large aspect ratio. At extremely slow growth rates these needles flattened and SEM showed distinct hexagons. But growth of bulk AlN suitable for

large substrate has been a challenge. B-Ga_2O_3 has the second largest bandgap after that of diamond among semiconductors, which would make an optimal semiconductor for commercial uses. We will present preliminary results on a novel wide bandgap material B-Ga_2O_3 also which has much favorable properties for low temperature growth and fabrication.

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

Gender Wage Discrimination in the Philippine Labor Market

Alyssa Ramos
T. H. (Tim) Gindling, Professor, Economics

This research seeks to quantify the extent to which discrimination can explain the gender wage gap in the Philippine labor market. It is now fairly well established that women trail behind men in many domains in developing countries, and that this can have far-reaching impacts on human and economic development. On average, women earn significantly less than men in the Philippines. It is uncertain, however, whether this wage gap is due to different levels of productive skills, or if employers discriminate based on gender. Using the 2008 Philippine Labor Force Survey, this research adopted the Oaxaca-Blinder decomposition method to determine the portion of the gender wage gap that is due to discrimination. The variables used to assess the portion that is attributed to differences in productive skills include education and experience. The results of this study suggest that although women have a higher average level of education, they still earn significantly less than men because of high levels of discrimination. Discrimination against women in the Philippine labor market is more intense in the rural than in the urban sector. Appropriate policies are needed to address these discriminatory practices and the government must start in the rural sector.

Speciation Reversal: The Case of the Common Raven

Hayley Richardson*, Jin Ah Kim, Anna Kearns*
Kevin Omland, Professor, Biological Sciences; Matthias Gobbert, Professor, Mathematics and Statistics

Speciation reversal results when two or more distinct species interbreed to form one species. This phenomenon is a well-known part of human evolutionary history; most modern humans include genes from both modern humans and Neanderthals. We focus on the case of Common Ravens, which are a likely case of speciation reversal. The Common Raven (*Corvus corax*) has a wide range, spanning throughout North America, Europe, and Asia. Within this species, there exist two deep mitochondrial lineages, the California clade (found exclusively in western U.S.) and the Holarctic clade (found throughout the entire

range). These two genetically distinct clades now have overlapping ranges, and Holarctic and California alleles are intermixing, which is likely causing the merging of these two lineages. We sequenced ACO1, a nuclear intron, to evaluate specific clusters of alleles that are present in our raven sample. We then compared these data to the known mitochondrial clades and found that the nuclear genome indicates a similar story of divergence and remerging. Using the program GENELAND, we mapped the geographic ranges of each clade. These data are the first step in understanding the evolutionary history of the Common Raven and elucidating the process of speciation reversal.

This work was funded by NSF Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences (UBM) and the Research Council of Norway.

Using Excitation-Emission Matrix Analysis to Characterize the Impact of Leaking Wastewater on Urban Water Resources

***Nicholas Rogers**, Ke He, Claire Welty*[1]
[1]Center for Urban Environmental Research and Education
Lee Blaney, Assistant Professor, Chemical, Biochemical, and Environmental Engineering

Dissolved organic matter (DOM) is a broad category of compounds that contains thousands of complex molecules, including materials formed from the decay of plant and animal matter and organic molecules discharged from wastewater treatment plants. Recently, fluorescence spectroscopy has been used to qualitatively measure and characterize DOM from wastewater, water basins, and lake water, and other sources. This technique allows samples to be quickly, reproducibly and inexpensively analyzed. We propose that fluorescence spectroscopy can be used to determine whether urban water resources are compromised by leaking wastewater infrastructure. The hypothesis of this work is that natural DOM matrices of streams differs from those of raw wastewater. By recording the fluorescence excitation-emission matrices (EEMs) for these waters, the associated signature may indicate the presence of raw wastewater in streams. Surface waters samples were collected from nine sites along a rural-to-urban gradient in Baltimore, Maryland; wastewater samples were collected from three nearby wastewater treatment plants. EEMs were generated for the surface water and wastewater samples. Analysis of the EEMs indicated that raw wastewater is leaking into several streams in the study watershed. These results indicated that trends in land use (i.e., more rural vs. more urban) are correlated to the fluorescence signature.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Approaches to Learning and Academic Achievement for Hearing Impaired Children: A Longitudinal Study

Alexis Rubin
Shuyan Sun, Assistant Professor, Psychology

Approaches to learning refer to children's organization skills, task persistence, learning independence, flexibility, attentiveness, and eagerness to learn. Previous research consistently suggests that approaches to learning are positively associated with children's academic achievement. My earlier work showed that teacher-report approaches to learning significantly predict academic achievement for children with hearing impairment in first grade. This study evaluated the longitudinal relations between approaches to learning and academic achievement for hearing impaired children. A sample of 523 children with hearing impairment was drawn from the Early Childhood Longitudinal Kindergarten cohort. Three time points were included in the analyses: fall of kindergarten, spring of kindergarten, and spring of first grade. Approaches to learning were measured by a teacher-reported Social Rating Scale. Children's academic achievement in reading, math and general knowledge was measured by IRT scores on standardized assessments. Preliminary results indicate that teacher-reported approaches to learning have positive effects on children's academic achievement over time. Findings from this study are vital to developing appropriate interventions to help hearing impaired children improve their academic performance.

Enhancing Students' Ability to Leap

Alexa Saunders
Christopher Rakes, Assistant Professor, Education

The present study examined the degree to which an instructional focus on five cue sets (run, takeoff, flight, landing, and run) improved leaping ability for 21 first-grade students in an urban, Title I elementary school. Leaping is a fundamental dance movement that is necessary for developing more advanced movements in dance and building a movement repertoire, a series of theatrical movements that can be presented regularly in various sequences throughout a season). The students were asked to perform what they interpreted as a leap and were assessed on each of the five cue sets. Throughout the study, the correct leap movements were taught through visual demonstrations and verbal descriptions. The students performed leaps on their own, were given corrections and allowed time to practice. The target goal was that at least 65 percent of the students would improve their personal leap movements and be able to accurately perform continuous leaping movements. Reaching this goal may provide compelling evidence for explicitly focusing on the five cue sets when teaching students how to perform leaps.

Briggs-Rauscher Oscillating Color Change Reaction

Emily Schultheis, Waleed Waris
Stephen Mang, Lecturer, Chemistry and Biochemistry; Lisa Kelly, Professor, Chemistry and Biochemistry

The Briggs-Rauscher experiment, a dramatic color-changing oscillating reaction, requires the mixture of three colorless solutions. Immediately upon mixing, these solutions alternate between colorless, yellow and blue. This experiment is traditionally performed as a demonstration, but has not yet been studied in extensive detail. Our investigation explored how reactant concentrations and temperatures affect the frequency of these color-changing oscillations. A custom red-blue-green (RGB) sensor apparatus was developed and evaluated to measure the color change of solutions that require simultaneous stirring and temperature control. The data demonstrate that variance in hydrogen peroxide concentration produced the most precise way to control the speed of the oscillations. The frequencies of one oscillation at 2.9 and 5.9 M H_20_2 were found to be 0.013 ± 0.002 and 0.071 ± 0.002 Hz, respectively. The data also show that as temperature increased from 22° C to 40°C to 60°C, the rate of oscillations increased to 0.013 ± 0.002, 0.016 ± 0.002, and 0.021±0.002 Hz, respectively. While the RGB sensor apparatus requires further calibration to maximize optical contact with the sample, it is a promising way to measure color change in solutions that cannot easily be monitored in a spectrometer.

The Study of Chemical Modification of Crotamine and Its Interaction with DNA

Amir Salar Sepehri
Richard Karpel, Professor, Chemistry and Biochemistry

Crotamine is a highly basic polypeptide from the venom of South American rattlesnake. It is a toxic and deadly component. Crotamine could serve to selectively target malignant cells, either by itself or as a carrier of nucleic acids. The long-term goal of studying crotamine is to produce potential anti-cancer and anti-microbial drugs. With this in mind, we propose to determine the nucleic acid binding site(s) on the protein by observing the effects of interacting DNA on chemical modification reactions of crotamine amino acid residues. Our specific goal is to find where the DNA interacts with this protein. By using chemical modification, we intend to discover if modification of arginine and tryptophan residues, which are only found in a specific region of crotamine, and lysine will alter the DNA binding, cellular uptake, and toxicity properties of crotamine. We are currently locating the binding sites of DNA on the crotamine's surface, protected against modification, by using mass spectroscopic and spectrophotometric analysis.

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

Elucidating the Folding Pathways of Calcium-binding Proteins

Apurva Shah
Carlos Bustamante, Professor, University of California, Berkeley

During translation, ribosomes synthesize proteins according to the mRNA template. The polypeptide chain acquires its 3-D structure either co- or post-translationally in a process termed “folding.” Understanding folding mechanisms is important since protein structure is critical for biological function, and misfolded proteins are correlated with cell stress and disease. We map the folding pathways of two distantly related proteins: Calmodulin, a eukaryotic, calcium-dependent signaling protein, and Calerythrin, a prokaryotic, calcium-buffering protein. These proteins have a highly conserved sequence and structure dictated by their similar calcium-binding function. Both proteins have two domains, and each is composed of two “EF-hand” motifs. To probe the folding of these proteins, we utilize a focused laser beam to form an optical trap and exert mechanical force on the molecule, while measuring the molecule’s response to force via its change in extension. These single-molecule experiments reveal the folding dynamics at a level of detail not possible by traditional ensemble methods. We find that domain proximity, determined by the length of a bridging helix, impacts folding and unfolding cooperativity even though the proteins share folding motifs. Studying folding mechanisms allows for better understanding of how domains communicate with each other and how tertiary contacts affect protein stability.

This research was funded, in part, by a grant to UMBC from the Howard Hughes Medical Institute through the Pre-college and Undergraduate Science Education Program.

Synthesis of Halogenated thieno[3,2-*d*]pyrimidines as Anticancer Agents

Matthew Shin
Katherine Seley-Radtke, Professor, Chemistry and Biochemistry

Cancer rates have steadily increased over the last 10 years and there is an ever-increasing need for new and more effective therapeutics. Existing studies have shown that when small molecules are introduced into cancer cells, competition occurs between the natural bases and modified base analogues for DNA-synthesizing enzymes, thus disrupting the normal synthesis of DNA. Halogens are of particular interest as potential disrupters due to their high electronegativity. We believe that these analogues will produce a compound that exhibits stronger, more favorable bonds in active binding sites than previously reported analogues. Therefore, halogenated thieno[3,2-d]pyrimidines offer a new and exciting approach to drug design and may successfully address an important unmet medical need for cancer patients. The aim of this project is to synthesize and test modified analogues, 2,4-halogenated thieno[3,2-d]pyrimidines, as potential anticancer agents. We will test the hypothesis that these analogues will be more efficacious than existing analogues, which already show a higher efficacy of 6-10 times the current standard treatment. If patients can take more efficacious dosages of potentially cytotoxic drugs to achieve the same results,

then their quality of life can be improved through a safer and more tolerable treatment regimen.

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

Model in Session

Hunter Shippey
John Sturgeon, Professor, Visual Arts

Model in Session is a twelve-minute short film project that focuses on the endearing subtleties that coincide with mutual attraction between two peers in a nude modeling scenario. The primary thematic focus of this project has always been the way two people look at one another, their gaze upon each other's faces and bodies. Taking on the archetypal stories of male artists falling for their subjects, the idea behind crafting the story was to undress a man and have him subjected to the objectifying gaze of both a female character, and the camera. This reverses the concept of the male gaze, subsequently challenging its inherence to both heterosexual courtship and filmmaking.
This is achieved through a focus on acting. Scenes were rehearsed all the way through with a skeleton crew, director and actors, until all the desired nervous subtleties in both speech and gaze were fully realized, and characters fully inhabited. Finally, each scene was run, in full, multiple times, lights on, with the camera trained on a different subject each time, resulting in a naturalism otherwise unattainable. The result is an earnestly toned, feminist re-rendering of the connection between visual art and romance.

Flexible Nucleosides as Potential Ebola Inhibitors

Matthew Shirley
Katherine Seley-Radtke, Professor, Chemistry and Biochemistry

The Ebola pandemic has brought the virus to the forefront of international concern. Ebola’s high capability of evading the body’s immune system is the reason it is extremely virulent and deadly. Currently, there is no FDA-approved treatment or vaccination for the Ebola virus and with mortality rates fluctuating above 90 percent, a reliable Ebola therapeutic is undeniably necessary. Nucleoside analogues have taken the spotlight as potential antivirals against Ebola; they can function as inhibitors by competing with DNA or RNA, preventing the binding of the natural substrate. Previous studies have shown that the inhibition of the enzyme S-adenosylhomocysteine hydrolase (SAHase) has exhibited activity against Ebola. A compound known to inhibit Ebola through SAHase inhibition is the carbocyclic nucleoside Neplanocin A (NpcA). Our project’s specific aim is to synthesize a flexible version of NpcA, termed Flex-NpcA, where the adenine base of NpcA is separated into its imidazole and pyrimidine moieties, connected by a carbon-carbon bond. We hypothesize

that base flexibility modifications will allow for increased beneficial interactions that the stiff adenine base fails to form, all while maintaining the aromatic and hydrogen bonding characteristics of NpcA. This may lead to an enhanced SAHase binder, and therefore a more effective inhibitor.

This research was funded, in part, by a grant to UMBC from the Howard Hughes Medical Institute through the Pre-college and Undergraduate Science Education Program.

Psychological Correlates of Video Game Enjoyment in Children

Gideon Shrier, Mariana de Matos Medeiros
Lynnda Dahlquist, Professor, Psychology

Gideon Shrier, Mariana de Matos Medeiros, Jess Hoehn, Emily Foxen-Craft, Caitlyn Thompson, Wendy Pinder, Lynnda Dahlquist, Professor, Department of Psychology

A review of prior research yields a wealth of data on the psychological effects of video gaming, but exiguous data on the psychological traits that make one predisposed to enjoying video games in the first place. This study aims to determine whether there is any significant correlation between traits measured in the Behavioral Rating Inventory of Executive Function (BRIEF) and overall enjoyment of video gaming. The BRIEF was administered to 61 children between the ages of 6 and 16. The sample consisted of both boys and girls, some of whom played video games regularly and some not at all. Video game enjoyment was measured by the time the child spends per week playing video games. Prior research suggests that a sense of control over the game is highly correlated with enjoyment, leading us to hypothesize that children who score lower on measures of self-control will enjoy the control that video games provide more than other children.Statistical analyses are still being conducted. The final results will be displayed on the poster.

Renal Function and Apoptotic Cell Death is Interrelated in HIV-associated Nephropathy

***Vivek Shukla**, Poornachander Guda[1], Vamshi Nimmagadda[1], Sugata Ray[1], Bijay Sarkar[1], Christopher Bever[1], Joseph Bryant[2], Tapas K. Makar[1]*
[1]Neurology, University of Maryland School of Medicine, [2]Animal Facilities, Institute of Human Virology
Tapas Makar, Assistant Professor, Neurology, University of Maryland, School of Medicine

HIV-associated nephropathy (HIVAN) is the most common cause of renal failure with HIV/AIDS and is characterized by focal glomerulosclerosis, dysregulated renal tubular epithelial cell proliferation, and apoptosis. The aim of this study was to determine how the apoptosis mechanism is involved with renal dysfunction associated HIVAN. HIV-transgenic mice (HIV-Tg) mimic some of the HIVAN in patients. Renal injury and

apoptotic markers were determined by immunohistochemistry, RT-PCR, western blot, and TUNEL assay from the kidneys of HIV-Tg and wild type (WT) normal mice. HIV-Tg mice showed decreased renal function by inhibiting nephrin expression and ameliorated histopathological injury when compared to the WT mice. Furthermore, our results demonstrated that HIV-Tg kidney attenuated renal tubular apoptosis through: (a) the overexpression of cleaved caspase-3 in tubular interstitial cells, (b) the increase of bax/bcl-2 ratio, and (c) the increase of the TUNEL-positive cells. The results delineate a novel pathway of HIV-induced apoptosis in the animal model of HIVAN mediated by mitochondrial dynamics causing renal injury.

Understanding the Mechanosensing Mechanisms of Fibroblasts in 3D Cell Culture

Sadjo Sidikou
Jennie Leach, Associate Professor, Chemical, Biochemical, and Environmental Engineering

Two-dimensional cell cultures have provided valuable insight into cell-material as well as cell-cell interactions, but findings support that cells better replicate *in vivo* responses when encapsulated within three-dimensional (3D) culture substrates. While cells have receptor proteins that are able to recognize chemical signals from their extracellular matrix environment (ECM), it is also true that cells are capable of sensing the ECM mechanical properties. Therefore, we propose the use of a synthetic biomaterial, Poly(ethylene glycol) (PEG), which is inert and shown to be biocompatible, to study cellular mechanisms from a mechanosensing standpoint. Experimentation has shown that fibroblast encapsulation significantly decreases the swelling capacity of our PEG-based gels. We now seek to further investigate fibroblasts' impact on degradation time and hydrogel stiffness and understand the cellular mechanisms that influence cellular remodeling of the ECM. Though 3D culture substrates have become more common in cell culture, studies using these systems typically overlook how cells alter their extracellular environment and focus on directing cell fate (e.g. proliferation and differentiation). Therefore, this work aims to lay the groundwork for future studies of more complex cell types e.g. neurons and glia) and phenomena (e.g. secretion and/or addition of ECM molecules) in 3D culture.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Writing Interventions in the Science Classroom

Abigail Singer
Jonathan Singer, Associate Professor, Education

For eighth graders in a school in highly diverse Maryland County, effective analytical writing had been identified as a critical skill necessary for success on the state's science

MSA (Middle School Assessment). Historically, within this school approximately one percent of students had been rated as advanced on MSA Science, compared 6.7 percent statewide. In addition, 34.3 percent of students scored basic compared to 28.6 percent statewide. To collect data, writing samples were pulled from Benchmark examinations and quizzes, and were assessed according to a rubric focusing on data analysis over a period of three months. Students with basic scores on assessments were identified and targeted for individual interventions focusing on interpreting questions and supporting responses with data. The goal was set to have 70 percent of students attain either a proficient or advanced score as determined by the MSDE rubric, with the hopes that this will correlate to an improvement on the school's MSA scores. Success was measured with a post-assessment graded according to the same rubric. General strategies for student improvement included modeling and peer revision.

An Analytically Reduced Mathematical Model of the Effects of RNA Interference in the JAK/STAT Signaling Pathway

Pranjal Singh
Bradford Peercy, Associate Professor, Mathematics and Statistics; Michelle Starz-Gaiano, Biological Sciences

Cell migration is a critical and recurrent biological process, involved in repair and development of animals. Egg chamber development in *Drosophila melanogaster*, a model organism for human genetics, provides a suitable opportunity to research the molecular regulation of migratory cells. To analyze this phenomenon mathematically, we started with a previously derived system of differential equations that modeled the signaling pathway, created an analytical reduction of the system using simplifying assumptions, and introduced parameters to account for the effect of RNA interference on the levels of mRNAs that encode key transcription factors within the pathway. Through computational methods, we simulated time courses of select proteins, and created a bifurcation diagram of their steady states. We also analyzed the initial conditions in which cells would either exhibit migratory or non-migratory behavior, allowing us to uncover the basins of attraction. Due to the predictions in our mathematical model, research into this process has further examined the biological bases for temporal variation in RNAi-based reduction of protein expression. Expanding our knowledge of cell migration through mathematical approaches can eventually lead to discoveries in related phenomena, such as in immune function and cancer metastasis.

This work was funded, in part, by an Undergraduate Biology Mathematics (UBM) Research Award from the National Science Foundation under Grant No. DBI 1031420, PIs Drs. Leips and Neerchal.

The Relationship Between Boys' and Girls' Self-Awareness of Learning Strategies and their Cognitive Task Performance

Rupsha Singh, Dafina I. Chisolm*, Cassandra L. Simons, Shari R. Metzger*
Susan Sonnenschein, Associate Professor, Psychology

Children's approaches to learning (attentiveness, organization) and self-regulation (working memory, inhibitory control) are related to performance on cognitive/academic tasks. Girls routinely receive higher scores on approaches to learning and self-regulation, as well as higher academic grades, than boys. However, research has not examined children's self-awareness of their learning strategies or how they acquire them, or relations between such knowledge and performance on cognitive tasks. Of particular interest are possible gender differences. The present study examined how boys' and girls' awareness of their organization, persistence, paying attention, and planning skills are related to their performance on memory and inhibition tasks. Elementary school children (N=74) completed an interview about their knowledge of learning strategies, and were subsequently tested on a picture memory and cognitive inhibition task (Stroop test, 1935). Girls' ratings of their ability to ignore distractions, organize their work, and persist on tasks were significantly higher than boys'. Girls also performed significantly better than boys on the picture memory task. Children's ratings of their ability to complete tasks uniquely predicted inhibition; perceived organizational skills uniquely predicted memory. This study adds to the body of research on gender differences and relations between these aspects of metacognition and performance on cognitive tasks.

The Association Between Intimate Partner Violence and Conflict Disengagement in Newlywed Couples

Rupsha Singh
Robin Barry, Assistant Professor, Psychology

Recent advancements in treatment and theory of intimate partner violence (IPV) have identified emotion dysregulation and experiential avoidance as important contributors to IPV. This perspective suggests that conflict disengagement is associated with risk for IPV because both IPV and disengagement may function as avoidance of aversive emotion. Further, an emotion regulation perspective suggests that greater negative emotional intensity during couple conflict (i.e., conflict intensity) confers IPV risk for individuals who have emotion regulation difficulties (i.e.,difficulty modifying emotional experiences and expressions). Insecure adult attachment styles are frequently conceptualized as emotion regulation difficulties and both avoidant and anxious attachment have been found to be associated with IPV. This study examined the association between attachment, conflict avoidance, conflict intensity and IPV in a sample of 114 heterosexual newlywed couples using actor-partner interdependence modeling. We expected insecure attachment and conflict avoidance to predict IPV perpetration for individuals with higher conflict intensity. Results showed that 26.3 percent of husbands and 31.6 percent wives perpetrated IPV. Additionally, one's own higher conflict avoidance predicted IPV perpetration when one's partner was more anxiously attached. In sum, this research supports an emotion regulation

perspective of IPV. Findings have implications for IPV treatments that focus on emotion regulation skills training.

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

Nerds Rule, Jocks Drool

***Angelo Skarlatos**, Scott Seiss, Hannah Kelly, Zachary Garmoe, Jason Klimek, Parker Damm, Ramon Burris, Andrew Kelly*
Cathy Cook, Professor, Visual Arts

Nerds Rule, Jocks Drool is a short film nominated for best story at the 2014 Campus MovieFest competition in Hollywood. The film is a five minute piece shot entirely over the course of one week, and it explores an alternate reality where "nerds" are the popular kids and the "jocks" are mocked daily for playing sports. The film is meant to be a hyperbolic demonstration of the movement of modern culture towards valuing intelligence over physical strength. The use of comedy in the film makes the story much more engaging than it would have been otherwise. The funny nature of the film comes from a collaboration between the scriptwriting process and the improvisations of the actors. At the beginning of the film, a long extended take is utilized to introduce the characters in an interesting and efficient way. This is followed by a back and forth between the nerd characters and the jock characters that creates the central conflict of the piece. The conclusion of the film is a framing device that brings all these elements together into one final punch, ending on a laugh and reminding people of the central message.

Afrofuturism in Visual Art

Jazmin Smith
Preminda Jacob, Associate Professor, Visual Arts

Art can help audiences to navigate their own experiences and better understand other people. Genres such as science fiction and fantasy utilize the speculative to comprehend real life. An Afrofuturist work uses the tropes and mechanisms of science fiction and fantasy in order to examine the actual experiences of those in the African diaspora. This genre is not merely an insertion of black bodies in science fiction stories; it is telling black stories by using science fiction. These speculative works can help to mediate some of the traumas facing people of color as well as create moments of empathy for others. My project researched the idea of Afrofuturism as it relates to visual arts. I educated artists in the UMBC community about the subject through oral presentations and through a website I created (afrofuturismresources.tumblr.com) that provides a resource for those interested in Afrofuturism. The project culminates in a premiere of an original film by UMBC

filmmaker Emily Eaglin. Eaglin found inspiration from my research to write and create her project. The film will premiere April 25 at Terrault Contemporary.

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

Bandit: Video Game To Teach Players about the Pratt Street Riots of the Civil War

JR Smith, Savannah Myers, Paul Tschirgi, Ben Walsh*, Samantha Carestia, Brandon Cole, Celeste Haskett, Jeff Hurd*
Marc Olano, Associate Professor, Computer Science and Electrical Engineering; Anne Rubin, Associate Professor, History

Team and Art Lead: Savannah Myers **Design Lead:** Paul Tschirgi **Producer:** Ben Walsh **Programming Lead:** JR Smith **Collaborators:** Samantha Carestia, Brandon Cole, Celeste Haskett, Jeff Hurd

Bandit represents a cross section of art, engineering, and history finalized in the form of an education video game. The game centers around the Pratt Street Riots, one of the seminal events in the American Civil War - important not only to the nation's history but also because it highlights the struggle between the citizens of Baltimore and the Union soldiers. The player plays an animal, sneaking through Baltimore to collect documents and overhear conversations - exploring the viewpoints of and motivations behind the involved factions. The implementation represents a culmination of students' studies in both Art and Computer Science, combining detailed 3D models and animations with complex behavioral programming to create a rich and engaging environment for historical learning.

This work was supported in part by the Habrowski Fund for Teaching Innovation, Epic Games, and NVIDIA.

Geographic Variation in Community Structure in Drosophila Species and their Parasitoid Wasps in North America

Parisa Soleimanifar, Jaelyn Bos
Jeff Leips, Professor, Biological Sciences; Chia-Hua Lue, Biological Sciences Research

Geographic variation in biodiversity can generate testable hypotheses about the factors that determine species distributions, a central question of ecology. We are characterizing geographic biodiversity of *Drosophila* host-parasitoid wasp communities along the eastern coast of North America, especially focusing on *Drosophila melanogaster* and *Drosophila simulans* (*Diptera: Drosophilidae*) two closely related host species, and their major parasitoid predator, *Leptopilina boulardi* (*Hymenoptera: Figitidae*). Female parasitoid wasp deposit their eggs in host larvae. Larval wasps feed on host tissues to complete their

development, killing the host in the pupal stage. Our data indicate that *D. melanogaster* are more common in the north and *D. simulans* more common in the south. Interestingly, we found no *L. boulardi* in our northernmost site. This suggests many testable hypotheses. The first is that in the absence of one of the major parasitiods, *D. melanogaster* may be able to outcompete *D. simulans* and so reach higher density. Alternatively, different parasitoid species that are found in the north may preferentially target *D. simulans*, reducing competition with *D. melanogaster* leading to higher*D. melanogaster* density. These, and other experiments are planned in the near future to investigate the factors giving rise to these geographic patterns of biodiversity.

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

A Smart Vent to Reduce Energy Consumption via Wireless Home Automation

Hunter Somerville, Kevin Sears, Michael Warren, Sergei Grishin
E.F. Charles LaBerge, Professor of the Practice, Computer Science and Electrical Engineering

Heating and cooling a home accounts for 48 percent of an average utility bill. Part of this expense can be attributed to rooms being over heated or over cooled due to vents that require manual adjustment, and therefore remain open even when the desired room temperature has been reached. The goal of this project was to develop a device that replaces an existing register cover to automatically control the amount of airflow through a vent thereby increasing HVAC efficiency. An infrared temperature sensor was used to detect the average temperature of the room and an ambient temperature sensor was used to detect the temperature of the air in the vent. Based on inputs from these sensors and a desired temperature set point, a microcontroller restricted or relieved airflow. Target temperatures for a room were precisely set by means of an intuitive mobile web application, eliminating the need for manual adjustments at the vent itself. The use of lithium-ion polymer batteries and algorithms to reduce power consumption allowed the device to last up to six months on a single charge. This solution will help reduce energy consumption, reduce monthly costs, and optimize heating and cooling patterns.

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

An Ethical Analysis of the Mars One Project; the Concept of Planetary Colonization

Tyler Sousa
Richard Wilson, Lecturer, Philosophy

Founded in 2011, MarsOne, is a non-profit organization who's statedgoal is to colonize Mars, with a handful of humans. The intentions of the project are made problematic by the extended list of technological, political, sociological and ethical questions that arise about the project. My research is focused on identifying the technical, political, and ethical challenges that need to be addressed for the MarsOne project to be successful. While the technical problems with carrying out the project can potentially be resolved, there seems to be a general lack of evidence that the benefits of this undertaking will outweigh the substantial expenses. In addition, the concept of moving to another planet seems to try and divert attention away from the countless issues that need to be dealt with on Earth. A central concern of my research focuses on identifying the technical and ethical problems with the MarsOne project. This research will include an anticipatory ethical analysis of the technical and ethical issues facing the MarsOne project and will attempt to both qualify and quantify the issues with colonizing Mars, and answer the question, what consequences for humankind will result from the colonization of Mars?

A Flexible Approach to Treating the Ebola Virus

Natalie Steenrod
Katherine Seley-Radtke, Professor, Chemistry and Biochemistry

The Ebola virus is at the center of the world's stage due to the recent outbreaks in West Africa. Filoviruses such as Ebola are among the deadliest pathogens known, with fatality rates reaching near 90 percent. Despite dire need, there is no FDA-approved treatment or cure. Presently there are several nucleoside analogues being investigated, including the carbocyclic nucleoside 3-deazaneplanocin A (3-deazaNpcA). The proposed mechanism of action for 3-deazaNpcA is the inhibition of S-adenosylhomocysteine hydrolase (SAHase). Inhibitors of this enzyme indirectly inhibit DNA methyltransferase through a biofeedback mechanism. This halts S-adenosylmethionine-dependent methylations of the 5'-cap of mRNA, leading to defective viral transcription and translation, inhibiting viral replication. For this project, the modified adenine base in 3-deazaNpcA will be "split" into its imidazole and pyridine components, remaining connected by a single C-C bond to give the target compound Flex-3-deazaNpcA. This will allow the base to adjust to form non-canonical binding interactions, without losing the integrity of the functional groups required for recognition, hence adopting an optimum conformation within the enzyme binding site. This strategy has been successful in multiple preliminary studies. Thus, endowing the 3-deaza scaffold with flexibility should prove strategic in terms of increased potency against Ebola.

This research was funded, in part, by a grant to UMBC from the Howard Hughes Medical Institute through the Pre-college and Undergraduate Science Education Program.

Using Structural Parameters in Transcription Factor Binding Site Prediction

Nicholas Stewart
Ivan Erill, Associate Professor, 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. Transcription factors are proteins that bind to specific sites within the promoter region of regulated genes and modulate their transcription. 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 are dependent (for binding) on the structure of the DNA molecule and not just its nucleotide sequence. The goal of this project is to calculate structural parameters from a nucleotide sequence, and then use those parameters as features that will improve the effectiveness of an Artificial Neural Network (ANN). Artificial Neural Networks are a powerful Machine Learning paradigm that can be trained on input patterns to predict which are true binding sites. This project has already built on previous research to create portable libraries for the inference of structural parameters that can be deployed inside of existing prediction programs. Currently, experiments are determining how these additional features impact prediction performance.

Kineret: A Potential Therapeutic Drug For Chronic Prostatitis/Chronic Pelvic Pain Syndrome

Stephanie Stookey
Charles Bieberich, Professor, Biological Sciences

Abstract not available for publication.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

A Many-Valued Interpretation of Modal Logic and Applications for Actualists

Greg Strack
Jessica Pfeifer, Associate Professor, Philosophy

Claims that a statement is true “of the past” or “in the future”, or true “possibly” or “necessarily” are often understood to be claims about some particular time or possible world. The sentence, “In the past, Greg did not exist” can be interpreted as a claim that there is some instant, “located” in the past, at which point I had not yet been born. Likewise, the claim “It is possible that UMBC could have had a top-tier football team” can be interpreted as a claim that there is some consistent set of facts, characterizing a way the world very well could have been, in which this was the case. These explanations, however,

seem to commit us to the existence of not only physical objects and the relations in which they actually stand to one another, but also to the existence of possible objects and facts about how they may be arranged, hypothetically, or in the past or future. Building on work by Arthur Prior, I found that we could alleviate this concern and be better equipped to model nuance in practical modal language by reinterpreting modal and temporal logics as many-valued logics, in which the modal operators relate propositions directly.

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

Associations of Marijuana Use and Blood Pressure in a Diverse Sample of Urban-dwelling Adults

***Salam Syed**, Jessica M. McNeely[1], Megan R. Williams[2], Michele K. Evans[2], Alan B. Zonderman[2]*
[1]Grow Baltimore, [2]Intramural Research Program, National Institute on Aging
Shari Waldstein, Professor, Psychology

Associations between self-reported marijuana use and higher bloodpressure have been reported. However, key confounding variables have not been considered as well as potential moderating influences of race and sex. We examined whether self-reported marijuana use is associated with resting blood pressure and pulse pressure (an indirect index of arterial stiffening) in a diverse, community-based sample. This study included 2728 adults from the Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study (mean age: 48.06, 44% male, and 58% African American). Participants reported whether they have used marijuana within the last six months (343 users, mean age: 44.90, 58% male, 70% African American). Blood pressure was measured during seated rest. Multivariable linear regressions adjusted for education, poverty status; cigarette, alcohol, cocaine, and opiate use, blood pressure medication, and cardiovascular disease, revealed that marijuana use was positively associated with systolic blood pressure ($b=3.75$; $p<0.001$) and pulse pressure ($b=2.86$; $p<001$), but not diastolic blood pressure. Race and sex did not moderate the association between marijuana use and blood pressure. This pattern of results suggests that marijuana use contributes to higher resting blood pressure, perhaps in part, via arterial stiffening. Marijuana use should be considered in future public health investigations.

This investigation was sponsored by the National Institute on Aging's Intramural Research Program.

The Sounds of Shangri-La: Community Radio and Culture Shift in Rural Nepal

Alexander Szabo
Robert Rubinstein, Professor, Sociology and Anthropology

This research focuses on the rise of community radio in rural Nepal and the subsequent rise of shifting cultural identities. This study took place in Jomsom, Mustang, focusing on the first local radio station, Radio Mustang FM, which opened in Fall 2013. Research included 11 interviews with radio staff and local villagers, informal group discussions, and observations of radio's cultural impact on the community. Field research was conducted over a two week period. Radio Mustang was praised by locals for providing a new, free service and type of media that could be consumed passively and for bringing reliable news and music programming to the region; additionally, the majority of people interviewed listen to the radio nearly every day. Radio programs - including music, news, and live programming - solidify the Mustang cultural identity while acting to expand Nepali national identity within the area. Radio is shown as a tool for creating cultural unity and understanding through cutting across ethnic, age, and gender lines of various groups while simultaneously emphasizing indigenous autonomy through the focus on folk programming. This tool shows promise for global and rural development projects, and also for understanding media's power within other cultures from a new angle.

This research was sponsored by the School for International Training Nepal: Development and Social Change program.

Early Achievement in Primary Source Education

Alexander Szabo
Linda Oliva, Assistant Professor, Education

This research focused on interventions to improve middle school students' ability to use primary sources in Social Studies. Using primary sources can aid in the development of critical reading, literacy, and thinking skills necessary in high school, university and the job market. Additionally, seventh grade coincides with early development of critical thinking, and introducing critical thinking skills earlier may lead to higher rates of future success. The subjects were 30 seventh grade students, of which 80 percent were expected to achieve primary source literacy by the end of the semester. Primary source literacy is defined as the ability to engage with a text through analysis and identification of key traits of such sources, such as type of source, bias, and historical context. The interventions designed to support primary source literacy included an analysis of student knowledge through exposure to primary sources, followed by giving information on primary sources and establishing students' ability to answer short answer questions identifying key characteristics of these sources; students were given a pre-test analysis of primary source literacy and a final assessment was given that revealed student performance in using primary sources.

Characterization of High-Secretion *A. nidulans* Mutants through Chemical Phenotypic Profiling

Victoria Taylor, John Ruth
Mark Marten, Professor, Chemical, Biochemical, and Environmental Engineering

Filamentous fungi are used widely for the production of therapeutics,commodity chemicals and enzymes, having a combined value of over $10 billion annually. However, fungal production of recombinant proteins is inconsistent because fungal protein secretion is not well understood. We hypothesize protein secretion is linked with fungal morphogenesis, in particular, degree of mycelial branching. To test this hypothesis, we used random mutagenesis to generate thousands of *Aspergillus nidulans* mutants. These were screened for highly branched fungi with compact morphology, and 700 mutants were selected. Each of these was then tested for increased secretion of two different homologous proteins, and 85 mutants were selected. To generate insight regarding these beneficial mutations, each of the 85 mutants was subjected to "chemical phenotypic profiling" by growing in low concentrations of 10 different toxins, each of which inhibits a different cellular pathway. Significantly reduced growth on a particular toxin implies a mutation impacting the respective pathway. Based on phenotypic response (i.e., growth) mutants were then organized into groups. A diverse set of 25 mutant strains will be chosen from these groups and have their genomes sequenced, leading to a better genetic understanding of protein secretion in filamentous fungi.

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

Argumentative Writing Skills in the 12th Grade Social Studies Classroom

Daniel Theisen
Linda Oliva, Assistant Professor, Education

Effective argumentation is among the most important interdisciplinary literacy skills. The study investigated how to improve the argumentation skills of 12th grade Modern World History students. The population consisted of 31 students that constituted the lowest performing class on the initial research paper baseline assessment. On a seven-category rubric with point values ranging from 0-4, their mean score was 0.80. This research was conducted in an urban competitive admissions college preparatory high school. The intervention treatment consisted of explicitly focusing on a specific facet of an effective argument (each corresponding to one of the rubric categories) using collaborative learning strategies involving group discussion, sharing of experiences, and student created solutions or strategies to deal with problems. The intervention was repeated every seven days, highlighting aspects of effective argumentation, for two months. Students were assessed periodically with in class writings, second research paper drafts, and argumentative essay questions on tests. At the end of the intervention cycle, students submitted a final draft of the second research paper, scored using the same rubric from the baseline. The target was

for at least 23 of the 31 (74.2%) students from the baseline population to attain a minimum average score of 1.50.

Paper or Pixel? The Influence of Metacognition and Text Format on Student Reading Comprehension

Phillip Thompkins
Linda Baker, Professor, Psychology

Over the years, there has been a rise in format options for university textbooks, with many courses and publishers allowing physical textbooks, electronic portable document format (PDF) textbooks, and specialized electronic interfaces that mimic looking at and interacting with a physical text. While many students may favor the electronic texts due to cost or convenience, there is inconclusive evidence as to which format, if any, leads to better learning. This study will investigate the effect of text format on learning and understanding of passages from a college-level psychology textbook. It will also examine whether text format impacts students' accuracy in assessing their comprehension, an important metacognitive skill. Sixty students will read passages in both formats, answer multiple choice questions based on each reading, and students will indicate how many of the questions they believe they answered correctly. Individual differences in students' self-reported use of learning strategies will be assessed using the Metacognitive Awareness Inventory. Of particular interest is whether students with high levels of metacognitive awareness will be better able to adapt their approaches to the different text formats.

Discovering Portable Options through Automated Mapping

Nicholay Topin, Nicholas Haltmeyer*, Shawn Squire, John Winder, James MacGlashan*[1]
[1]Department of Computer Science, Brown University
Marie desJardins, Professor, Computer Science and Electrical Engineering

One goal in creating artificially intelligent agents is to learn the most efficient process by which to complete a task in a given domain. Once learned, this knowledge can potentially be re-used or used in a different domain through transfer. By automatically generating a mapping that expresses how this transfer should occur across domains with different objects and attributes, we provide a new method for leveraging prior task knowledge in a source domain to learn how to perform tasks in a target domain by identifying the commonalities between the source and target domains. Previous research has described how to use transferred knowledge to efficiently solve tasks, but this work either assumed that a mapping was provided or that all domains were represented identically. Our research demonstrates how automatically identifying a mapping results in improved performance over existing methods, such as Pickett and Barto's PolicyBlocks algorithm (2002) and MacGlashan's Transfer Options method (2013). As part of this work, we introduce novel techniques for scoring mappings and abstracting domains.

This work was supported by NSF's Division of Information and Intelligent Systems on awards 1065228 and 1340150 (REU supplement).

The Genetic Basis of Host Defense Traits in the Drosophila Host-Parasitoid System

***Ngochan Tran**, Theresa Hodges*
Jeff Leips, Professor, Biological Sciences; Chia-Hua Lue, Biological Sciences; Theresa Hodges, Non-UMBC

Many studies have been dedicated to understand how genetic variation contributes to phenotypic variation at the DNA sequence level and through observable traits. By understanding this relationship, scientists can better understand how natural selection influences the evolution of species, giving rise to diverse features. The purpose of this research is to use the host-parastoid relationship between *Drosophila melanogaster* and their parasitic wasp, *Leptopilina boulardi*, to identify specific genes contributing to the host defense traits and fitness in Drosophila. A previous genome-wide association study in our lab was conducted to identify candidate genes that influenced larval host defense. We used RNA interference techniques combined with the GAL4-UAS system in Drosophila to deregulate the expression of these target genes. The first gene tested was *pumillo*, a protein-coding gene that affects larval neuromuscular and neuroanatomy functions. By knocking down the expression of *pumillo* in the targeted tissue, I can measure its effects on Drosophila's larval behavior and non-immunological defense response against *L. boulardi* through locomotion patterns and mortality rates, respectively. Identifying genes critical to the fitness of Drosophila will be the first step toward understanding how these candidate genes play a key role in the co-evolution of the host and parasitoid wasp.

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

The Role of Peer Networks and Maternal Involvement in Predicting Chinese Immigrant Childrenï¿½s Socio-emotional Adjustment

***Queenie Tran**, You Jung Seo*
Charissa Cheah, Associate Professor, Psychology

Preschoolersï¿½ social networks and their parents' involvement in these networks (e.g., initiation and monitoring of play dates) significantly contributes to childrenï¿½s socio-emotional outcomes. However, the social networks of Chinese immigrant (CI) preschoolers in the U.S. is unknown, despite the unique challenges these children may face in the U.S. cultural context. The present study investigated: (1) the characteristics of CI preschoolersï¿½ social networks outside of school, (2) mothersï¿½ levels of initiation and monitoring of their childrenï¿½s play dates, and (3) the associations between (a) the characteristics of childrenï¿½s social networks and (b) their mothersï¿½ play date

involvement with (c) childrenï¿½s socioemotional adjustment. CI mothers (N=133) of preschoolers in Maryland reported on their childrenï¿½s social network composition and their involvement. Teachers rated childrenï¿½s socioemotional outcomes. Results showed that the typical peer network of a CI pre-schooler contained five to six peers, who are mostly Asian and live within the immediate neighborhood. Mothers usually controlled initiation of contact with peers, but encouraged their children to act as hosts. Importantly, children whose mothers gave them greater autonomy in initiating contact with playmates displayed fewer peer problems. The need for culturally-sensitive parenting interventions to promote CI childrenï¿½s peer networks and positive socio-emotional development was discussed.

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

Mobile Games as Advertising for Businesses

Krista Trostle, Zsade Flemming, John Pham, Matthew Reeping, Alison Holloway, Adam Kline, Edward Thang, Tyler Rasmussen
Marc Olano, Associate Professor, Computer Science and Electrical Engineering

This study focuses on building a mobile game around a specific business, Signature Theatre in Arlington, Virginia. It balances the fun aspect of mobile gaming, keeping the game fun enough to want to play again and again, and using that to increase visitor attendance to the theater. This will be done by connecting game actions with visits to the physical theater. Examples include gaining new levels, new looks to characters, and new props available for the character. The game will increase viewers to the theater by showing small in-game advertisements for upcoming shows and offering incentive such as in-game prizes once an actual theater ticket has been scanned. When the game is complete and marketed, the number of viewers connected to the game can be carefully measured and studied to see if this increases attendance.

This work was supported in part by the National Endowment for the Arts, Signature Theatre, Northrup Grumman, and NVIDIA; with guidance by Ben Walsh and Jonathan Moriarty, Pure Bang Games.

Interactive Performance Mapping

Paul Tschirgi, Courtney Tyler
Doug Hamby, Associate Professor, Dance

Interactive experiences such as video games and simulations bring many technologies together to capture aspects of real life in an immersive world. This project captured live performances of a violinist and original choreographed dancers. Their movements and

sounds were then translated into digital form where they can be experienced from the perspective of a viewer using game controller buttons. Translating the action from real life to the fabricated characters involved filming the performances from multiple angles. The video was then used to manually animate three-dimensional characters created according to drawing concepts in a computer program. Finally the models were placed in a professional display environment where game controllers allowed viewers to experience the violin performance and dance from different angles. This technique explored a new way to engage an audience in performance art in an interactive environment.

This work was funded, in part, by Epic Games.

Synthesis of Dendronized Nanoparticles for Intracellular Trafficking Studies

Phoebe Tsoi
Marie-Christine Daniel, Associate Professor, Chemistry and Biochemistry

Drug-delivery systems are being studied to improve the efficacy of therapeutic agents. There are many classes of drug-delivery systems with different sizes, charges, and composition. These differences affect agent interactions with cells and intracellular trafficking. It is essential to understand the cellular fate of the drug- delivery system in order to translate these systems into clinical applications. The proposed system consists of a gold nanoparticle core, water soluble spacers, and carboxylate-terminated dendrons. The gold nanoparticle serves as an anchor for the spacers, which optimize the surface area of the nanoparticle. The objective of this project was to synthesize a new nanoparticle-cored dendritic system to aid in intracellular studies. Thus far, the spacer has been prepared and coupled to a methyl ester-terminated poly(propyleneimine) dendron. Proton NMR was used to characterize each intermediates. The next step is to prepare gold nanoparticles and form dendronized nanoparticles via ligand exchange reaction. The final compound will be sent to collaborators for carrying out the intracellular trafficking studies.

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

Swans in an Ugly Duckling World

Courtney Tyler
Sandra Lacy, Instructor, Dance

This work, completed during the fall 2014 semester, is a dance that used research on the role of women in American society throughout history as a basis for choreography. Research topics included the history of various memorable American women, media's role in culture, the Triangle Shirtwaist Fire of 1911, and the choreographic methods of Martha Graham. One way this history was translated into movement was by taking memorable

photographs from women's history and recreating these on the dancer's bodies to create a living portrait. From there, movement phrases were created by taking the living portraits and making them travel through space while still exposing each original photograph. Through collaboration with the dancers, this piece tells their stories as well as the stories of the many remarkable women that came before us. To communicate their own beliefs to the audience, the dancers share brief snippets of their experiences with lack of freedom by speaking as they move. This dance seeks to focus attention on the lack of freedom women still experience in America today and aims to show the audience that even though women have come a long way, change still needs to happen for female Americans to truly thrive.

Ebb & Flow

Molissa Udevitz
Doug Hamby, Associate Professor, Dance

Ebb & Flow is an abstract contemporary dance work for four dancers inspired by my personal observations of the extreme ocean tides of Kachemak Bay in Homer, Alaska. These tides can fluctuate over 25 feet in one day, drastically altering the physical appearance of the bay and inspiring me to capture this repetitive transformation through dance. *Ebb & Flow* was created by choreographing abstract movement sequences that suggest different aspects of the tide, such as kelp swaying in ocean currents or churning waters on stormy days. The dance strives to encourage the audience to reflect upon the external forces that seemingly push and pull the dancers across the stage. *Ebb & Flow* premiered in November 2014 at UMBC's Fall Senior Dance Concert and was also selected to perform in an adjudicated concert at the American College Dance Festival Association Mid-Atlantic conference in March 2015.

Is Breast Center Risk Assessment Clinic Attendance Improved with a High Risk Recommendation in the Mammography Report?

Ankur Vaidya
Alison Chetlen, D.O., Assistant Professor, Department of Radiology, Division of Breast Imaging, Penn State Hershey Medical

This study evaluated the effectiveness of introducing a standardized recommendation into the mammography report in 2012 to recruit women at high risk for breast cancer into our risk-assessment clinic. The study population was comprised of patients presenting for mammography in 2011 and 2013 with â‰¥20% lifetime risk for developing breast cancer by NCI criteria. We evaluated the intra- and inter-observer variability of radiologistsï¿½ annotations, identifying the patientsï¿½ risk status, and recommendations made to high-risk providers. The number of patients subsequently seen by a high-risk provider within one year of their mammogram was analyzed; 173 patients in 2011 and 241 in 2013 were identified with â‰¥20% lifetime risk of developing breast cancer. 40.5% of patients

received a risk-assessment clinic recommendation in 2011 versus 75.5% in the year 2013. Despite an overall increase in recommendations by the radiologists for clinical risk assessment, only a modest increase was observed, from 11.4% to 14.3%, in patients that subsequently kept appointments for this evaluation. Although a modest increase in referrals occurred following the institution of the standardized reporting recommendation, >85% of the identified high-risk patients in 2013 were not evaluated by a high-risk provider for their elevated lifetime risk of developing breast cancer.

Development of a Real-time, Highly Time-Resolved Atmospheric pH Measurement System

Michael Valerino
Christopher Hennigan, Assistant Professor, Chemical, Biochemical, and Environmental Engineering

Atmospheric aerosol acidity has effects on human health, climate, and the environment. Direct filter methods to measure this critical component of pollution suffer from low time resolution (~12-24 hours) and are prone to post-collection sampling artifacts. In place of filters, indirect proxy measures are often used, but fail to accurately predict the pH of particulate matter. To address this deficiency, an online, automated method that directly and accurately measures aerosol acidity with high time resolution is currently under development. A Particle into Liquid Sampler (PILS) continuously captures particulate matter into a liquid stream. A liquid handling protocol injects the liquid sample (containing dissolved components of the collected particles) into a glass cell where a pH electrode measured the change in acidity from a known baseline (Δ pH). It is straightforward to compute atmospheric aerosol acidity levels from this measurement. Initial results show the system is able to detect small changes (~5-15 nmol/m^3) in atmospheric acidity. When the calibration system is fully refined, the system will be placed on the roof of the engineering building to continuously and remotely monitor the atmospheric acidity. Once developed, this tool offers great potential in understanding the impact of human activity on many global systems.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*

Nontraditional Students in the Writing Center

Juliana Venegas
Anissa Sorokin, Lecturer, English

Defined as fitting any of seven characteristics, such as having dependents or full-time employment, non-traditional students face challenges that differ from those considered traditional college students. These challenges have sparked conversations surrounding

resources for non-traditional students, such as writing centers, in institutions of higher education. Constantly evolving, writing centers are still learning how to address the needs of non-traditional students. To assist this process at UMBC, I examined our writing center. I first conducted research using academic publications to gain a sense for the needs and challenges of non-traditional students. Using this information, I then considered our writing center's outreach to non-traditional students and tutors' interactions with them. I created a professional development session for the Writing Center in which tutors learn about the needs of non-traditional students and how to address those needs in tutoring sessions; a survey was given to participating tutors before and after the session to measure the effectiveness of the program. Developing writing center resources for non-traditional students is one step towards helping them feel a greater sense of success, which in turn leads to greater retention rates and, consequently, a more diverse campus population.

Close to the Sun

Ganna Vikhlyayeva
Cathy Cook, Associate Professor, Visual Arts

Close to the Sun, a hand-drawn narrative animated short film, 2:24 minutes in length, is accompanied with the musical theme of Franz Schubert's "Piano Sonata No. 20 in A Major." This music was picked because its gracious harmony reminded me of the movements of a playful cat chasing falling leaves. It was perfectly suited for the idea of my animation in which a woman turns into a cat. The interplay of images and music quickly turned into a project. I wrote a scenario and shot video sketches of people and cats. I used video materials as references to reproduce realistic movements of the characters. Not surprisingly, I ran into a problem. First, I tried sketching a frame-by-frame animation on the paper, but it was taking an incredible amount of time. To accelerate the process, I drew frames in Photoshop and animated them in AfterEffects, but this strategy also did not work. The animation looked stiff. Finally, I discovered a better way, which was drawing the animation directly on a screen of an iPad Air 2 in Animation Creator HD. When my animation was finished, I enhanced it in AfterEffects. The final animation turned out as I first imagined it.

An Unlikely Refuge: The Shanghai Jewish Ghetto during the Rise of Nazism

Jennifer Wachtel
Meredith Oyen, Assistant Professor, History

Between 1933 and 1941, when most nations closed their doors to Jewish refugees from Europe, over twenty thousand German, Austrian, and Eastern European Jews survived the Holocaust by escaping to Japanese-occupied Shanghai. Popular interest and scholarship in the community of Jewish Holocaust refugees in Shanghai has surged in the last five years. My research investigated whether the newly emerging narrative belongs within the existing

body of Holocaust research and literature. By examining the experience of survivors in Shanghai as represented in oral histories, memoirs, and scholarly publications, I found that this community experienced unique challenges as stateless refugees. The stories of the Holocaust refugees who lived in Shanghai's Hongkou District (formerly the Restricted Sector for Stateless Refugees) contribute crucial missing elements of Holocaust scholarship by relaying the trauma of displacement in China. Additionally, in the years leading up to and in the early years of the Second World War, the refugee community in Shanghai played a previously unexplored role in the power dynamics between Germany, Japan, China, and the United States.

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

Developing Argumentative Writing Skills through Music Education in Students, Grades Six to Eight

Catherine Waddell
Jonathan Singer, Associate Professor, Education

Argument writing is an important professional skill that needs to be integrated in all subjects - including music. Students were pre-assessed by listening to two different performances of either Samuel Hazo's "As Winds Dance" or Keith Sharp's "The King's Fiddlers" and then directed to construct a written argument as to which performance would receive a higher rating at Assessment - an annual event where schools' ensembles perform and are rated. These pieces were selected because the students have rehearsed them in class. The students were instructed to support their argument using musical vocabulary and specific details from the performances. The students' arguments were assessed using a 10-point rubric. Based on the pre-assessment results 19 students who scored 50 percent or below were targeted for explicit instruction. Throughout the targeted learning period students participated in activities that provided them opportunities to describe their own performances, to describe the performances of their classmates, and to correctly use musical vocabulary. The targeted students are expected to have their rubric scores improve by 2 points on the post test.

The Transcription Factor Nrf2 is not Required for Down-regulating the Adhesion Molecule L-selectin

Neha Wali
Suzanne Ostrand-Rosenberg, Research Professor, Biological Sciences; Daniel W. Beury, Department of Biological Sciences

Reactive oxygen species (ROS) are toxic to most cells; however, up-regulation of the transcription factor Nrf2 activates genes that detoxify ROS. Using Nrf2 wild-type ($Nrf2^{+/+}$)

and Nrf2-deficient ($Nrf2^{-/-}$) mice, we are determining if Nrf2 contributes to the function of myeloid-derived suppressor cells (MDSC). MDSC are present in most cancer patients where they promote tumor growth by inhibiting anti-tumor immunity through the production of ROS and by down-regulating the adhesion molecule L-selectin which is required for naive T lymphocytes to enter lymph nodes. Since MDSC produce ROS, we hypothesized that Nrf2 activation may protect against ROS and that $Nrf2^{-/-}$ MDSC may not down-regulate L-selectin. To test this hypothesis, blood cells from $Nrf2^{-/-}$ and $Nrf2^{+/+}$ mice carrying mammary carcinoma tumors were analyzed for the quantity of MDSC and the level of L-selectin on T lymphocytes. T cells in blood consisting of 40-85% MDSC had reduced L-selectin, while T cells in blood consisting of 4-20% MDSC had more L-selectin. There was no difference between MDSC or L-selectin levels in $Nrf2^{+/+}$ and $Nrf2^{-/-}$ mice. These results confirmed that MDSC reduce L-selectin expression on naïve T cells and indicated that the transcription factor Nrf2 does not play a role in the reduction of L-selectin.

This work was funded by NIH RO1CA 84232.

Increasing College Readiness through Student Ability to Analyze Data

Matthew Weisman
Jonathan Singer, Professor, Education

The goal of this study was to improve student ability to analyze a set of data and construct appropriate summaries. These skills are key components of the Maryland State Biology curriculum and research indicates that many incoming college freshman are unprepared to coherently analyze and summarize data. Baseline data was collected from 26 ninth grade students enrolled in an Honors Biology one class, at an urban high school. From this population the lowest preforming 30 percent of students were targeted. The specific objective of this study was to increase the target population's performance within the above mentioned standards by 50 percent. Specific intervention lessons were incorporated into the class, as a means to improve student ability to analyze a set of data and construct appropriate summaries. Student data was collected periodically from quizzes, unit exams, targeted review guides, and lab reports during the spring 2015 academic semester. The assignments were scored using a rubric, which applied these standards in a point format and allowed direct assessment of student ability to analyze data and construct summaries. Data was collected until the final post-test, in order to determine student progression within these standards.

Infrascapes: A Study of the Invisible

Mark White
Calla Thompson, Associate Professor, Visual Arts

Infrascapes: A Study of the Invisible is a photographic study of the invisible world around us. This project involved travel across the United States to apply infrared photography in a variety of environments. Specifically, this study had a dual purpose: 1) to gather practical information concerning infrared photography techniques, and 2) to analyze its place in technical and fine arts photographic dialogs. Four of the United States' most well-known National Parks were the subjects of this study: Glacier, Yellowstone, Grand Teton, and Badlands. In addition to being iconic American spaces, these parks presented a variety of biomes and climates to photograph. As one of the first extensive studies of this technology in such locales, the resulting images are novel to the industry. Present in them is evidence of effects unseen in other photographic applications. These include the riddance of atmospheric distortion (heat haze), high rates of light absorption in water, and the visual representation of chlorophyll reproduction rates in both monocot and dicot foliage. As intended, the final images provoke questions about the place of infrared photography as an artistic medium. Can it help us see known landscapes anew? What other ways of seeing do we not yet understand?

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

The Relation Between Birth Status and Cognitive Development in Early Childhood

Jenna Williams
Shuyan Sun, Assistant Professor, Psychology

Low-birth-weight and preterm birth are serious risk factors in child development. Previous research suggests that there is a relation between birth weight and IQ. However, the relations between birth status and child outcomes while controlling for external risk factors need to be further addressed. Using data from the Early Childhood Longitudinal Study Kindergarten Cohort (N = 17,225), this study examines the relation between birth status and cognitive development after controlling for external risk factors. Children's birth status was classified into four categories: (1) preterm birth normal weight (n = 2,293), (2) preterm birth low weight (n = 605), (3) full term low weight (n = 315), and (4) full term normal weight (n = 14,012). Data on children's cognitive development (e.g., problem solving, reasoning skills) were collected through teacher-report Academic Rating Scale in the spring of kindergarten. External risk factors including family socioeconomic status, child race/ethnicity and gender, mother's marital status, and maternal education were collected from parent interview questionnaire. Regression analysis indicates that after controlling for external risk factors, preterm birth and low birth weight are negatively associated with children's cognitive development in kindergarten. This study has important implications for research and policy for maternal health and prenatal care.

An Introduction to the World of Dance

Symone Williams
Christopher Rakes, Professor, Education

The present study examined the effects of providing students with an introduction to the world of dance through exploration of the elements and history of dance, the use of dance as a form of communication, and the retention and performance of choreography. Through dance, students not only learn about the benefits of exercising, but they also develop and strengthen skills in balance, flexibility, stability, coordination, and stamina.I hypothesized that if students are able to demonstrate mastery in these areas, they will be able to apply the acquired knowledge to future processes requiring creative thinking skills, bodily awareness, physical fitness, and memorization. The data in this study were collected from fourth graders in a public school physical education class, where most of the students have had little to no experience with dance. Students took a written pre-test and post-test on the material covered throughout the study in order to track the students ability to identify and recall key ideas and concepts.

Constructing Responses Using the AACPS Criterion of Communication

Tyler Wilson
Linda Oliva, Professor, Education

The purpose of the study was to investigate students' ability to construct papers/persuasive writings for criterion D (Communication). This involved constructing their own argument based upon sources given or ones that they must research on their own. As students are involved in social studies classrooms and a multitude of other classes, they will be required to build upon their own literacy within the contact area which involves their own skills as researchers as well as their ability to gain information outside of what is taught to them in a classroom. The data will come from a suburban high school in American Government (two honors level classrooms with 61 students) and compare their ability to construct responses in a way that their writing represents a clear argument that can easily be broken down. Students used the primary documents as well as researched and prior knowledge in order to construct their responses. Checkpoints and activities to supplement their work consisted of brief constructed responses that were a part of larger tasks such as quizzes and exams.

Measuring and Drafting in Stage Design

Harley Winkler
Cheryl North, Instructor, Education

This study investigates whether hands-on, multisensory methods of teaching assist 12 ninth grade students in correctly measuring and drafting a scale ground plan of the black box theater. This experiment utilizes a simple pretest, post-test model where the teacher will assess measuring ability in student drafting pretest in comparison to actual dimensions of

the theater. Implementing hands-on activities such as drawing and labeling an enlarged depiction of an inch, slicing pizza to understand fractions, and drawing objects to scale with an architect's ruler, the teacher will be able to assess any improvement in measuring and drafting ability. The students will generate a ground plan before and after intervention to assess growth, and draftings will be compared to actual dimensions of the theater, and an accurate draft previously generated by the teacher. The activities will take place in the scene shop and black box theater of an urban arts high school.

Differing Rates of Leaf Litter Decomposition of Common Tree Species in Rivers Draining to the Chesapeake Bay

Darryl Wise, *April Sparkman*
Christopher Swan, Associate Professor, Geography and Environmental Systems

Stream ecosystems rely heavily on energy from terrestrially-derived organic matter in the form of leaf litter, and changes in litter quality can have implications for decomposition in streams. Leaf litter breakdown in streams has been studied extensively and evidence suggests that variation in foliar chemistry, i.e., nitrogen, phosphorous, tannin, and lignin concentration, can greatly influence how leaves are processed. Nutrient concentration is positively correlated with decomposition rate, whereas tannin and lignin are negatively correlated with decomposition rate. Using the Forest Inventory and Analysis (FIA, US. Forest Service) dataset to determine a regional species pool, leaf litter from 11 deciduous tree species were placed in three headwater streams in Patapsco State Park to study how decomposition relates to chemical composition of leaves. The treatments were left in the stream for approximately 40 days and then removed and processed to determine rates of decomposition. We found that leaf characteristics significantly influenced breakdown rates, with carbon-to-nitrogen ratio having the largest effect. We also found that breakdown rates across the 11 tree species differed significantly. Studies such as this will allow us to make better decisions about urban planning and stream restorations as we can choose more productive species in terms of decomposition.

Entanglement Dynamics of Singlet-Triplet Qubits in the Presence of Inductive Coupling

Michael Wolfe, *Shawna Chisholm*
Jason Kestner, Assistant Professor, Physics

A quantum computer has the ability to solve certain problems exponentially faster than a classical computer at the expense of rigorously challenging manipulation of quantum bits (qubits). Recent advances in solid state physics have improved the fabrication of spin qubits by confining electrons in a 2D Fermi gas of Gallium Arsenide - Aluminum Gallium Arsenide heterostructures (i.e., quantum dots). These qubits entangle electrostatically but suffer decoherence due to external coupling to nuclear spins, thus limiting the time for

logical controlled NOT operations to take place. We investigate alternative coupling methods for two qubits such that their interaction is amplified. For example, two qubits can be entangled at distances on the order of microns via a floating metallic gate that mediates their electrostatic interaction (i.e., capacitive coupling). We theoretically examine how the entanglement dynamics of the system are affected by stray inductance in the floating gate when the qubit's charge configurations are driven at high frequencies. By controlling certain parameters of the coupling inductive element, we can manipulate the time the system has to reach maximum entanglement.

Improving Mathematical Problem Solving Through Student Journaling with Guided Questioning

Michael Wonders
Christopher Rakes, Assistant Professor, Education

The present study investigated whether student journaling with guided questions led to stronger mathematical problem solving strategies involving algebraic expressions and equations for 25 seventh grade students. These questions were designed to explicitly direct students' attention to key information and help them organize this information to a solution path. Implementation began with simple problems that focused on the process of looking for key information and a solution path prior to solving. The problems then became more complex requiring students to organize information and recognize multiple solution paths. Analysis of variance was used to compare responses on three levels, analyze a given problem, strategize a solution path, and solve problems involving algebraic expressions and equations. The results of questioning demonstrated that providing students explicit instructions to analyze a problem can help improve their mathematical problem solving skills.

Media Discourse Surrounding MH17 in the Russian-Ukrainian Conflict of 2013-14

Benjamin Woodworth
Elaine Rusinko, Associate Professor, Modern Languages, Linguistics, and Intercultural Communication

The manner in which the Russian media have treated the crisis in Donbass (the eastern region of Ukraine where armed conflict broke out last year) following the 2013 ouster of Ukrainian President Viktor Yanukovych has been classified by some western analysts as "information warfare." Notably, in state-affiliated media outlets such as the former "RIA Novosti," information and terminology are manipulated to consistently favor the pro-Russian separatist groups at the expense of the Kiev government. A critical discourse analysis (CDA) approach applied to a selection of articles surrounding the MH17 disaster, an event that attracted worldwide attention to the conflict, reveals the patterns of discourse used by Kremlin-affiliated outlets to influence public opinion about the conflict. Media

discourse around MH17 typifies the patterns of discourse manipulation used throughout the conflict despite foreign scrutiny. Compared to Ekho Moskvy, a more Western-oriented news site with a history of challenging the Kremlin line, Russian state outlet RIA Novosti is shown to consistently use language which at once obscures the identities of and glorifies the separatist fighters in southeastern Ukraine, toward the goal of denying Russian involvement while placing responsibility on Ukraine.

The Alien, Alien: Depictions of Race in Star Trek's Final Frontier

Rahel Worku
Jessica Berman, Professor, English

The goal of this presentation will be to examine how Star Trek the Original Series used alien characters as veiled caricatures of specific racial groups, and show that these caricatures reflected commonly held opinions of these same racial groups in the 1960s. There are numerous parallels that can be drawn between the violent, and warlike depictions of alien races like the Klingons and post World War II depictions of the Japanese in media and similar connections between the pseudo-Native American aliens and the "Noble Savage" archetype. I have completed research concerning the significance of these characters and the dehumanizing effects of romanticizing minorities. I am completing further research into media depictions of Asian and bi-racial characters in the 1960s to draw further connections between them and the alien characters in Star Trek. Ultimately this paper will show how contemporary media reflects the commonly held fears and beliefs of the times in which they are produced, and that these depictions can be harmful to the minority groups being represented.

Putative Function of Calsyntenin-1 in Cell Adhesion

Grant Wunderlin
Michelle Starz-Gaiano, Assistant Professor, Biological Sciences

During development, cell migration is a vital component for tissue formation, which allows embryogenesis to proceed normally. To prevent any disruption of this migration these cells rely on adhesion molecules to prevent them from drifting off course. One commonly used system to study development is Drosophila due to their fast generation time and the number of conserved pathways between them and humans. calsyntenin-1 is a putative adhesion molecule that contains two calcium ion binding domains, similar to the known adhesion molecule Cadherin. Calcium binding is vital for cadherin’s ability to function as a trans-membrane cell-cell adhesion molecule within adherens junctions in both epithelial and endothelial tissues. We are currently studying cell adhesion during Drosophila oogenesis, examining a type of motile cells called border cells. Previously, introduction of a mutation in calsyntenin-1 was shown to result in the partial or complete arrest of border cell migration. By knocking down calsyntenin-1 with various RNAi lines we hope to observe

other similar changes in the movement of border cells during oogenesis. This along with further genetic analysis may reveal a specific role for calsyntenin-1 in cell adhesion.

This work was funded, in part, by NSF funding awarded to Michelle Starz-Gaiano.

Mechanism of Post-Translational Modification of GAPDH by Dithiolethione Compounds using Tandem Mass Spectrometry

***Pauline Xu**, John Chavis[1], Michael R. White, Christopher Switzer[2], Thomas W. Miller[3], David A. Wink[4], David D. Roberts[5]*
[1]Cornell University, [2]King's College, [3]Paradigm Shift Therapeutics, [4]Radiation Biology Branch, National Cancer Institute, National Institutes of Health, [5]Laboratory of Pathology, Center for Cancer Research, National Institutes of Health
Elsa Garcin, Assistant Professor, Chemistry and Biochemistry

Dithiolethione compounds possess chemopreventive, cytoprotective, and antimitogenic effects. We have shown that these compounds interact with glyceraldehyde-3-phosphate dehydrogenase (GAPDH), an abundant glycolytic protein. One compound of interest is ACS-1, whose chemopreventative effects 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. Wild-type and cysteine mutant GAPDH proteins were overexpressed in bacterial cells 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 suggests that ACS-1 forms covalent adducts with cysteine residues in both wild-type and cysteine mutant proteins, including a cysteine residue at the GAPDH dimer interface. To unambiguously confirm these GAPDH posttranslational modifications, we are now preparing ACS-1 modified GAPDH samples for further mass-spectrometry analysis under oxygen-free conditions. 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 Award from the UMBC Office of Undergraduate Education.

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

Saiah Yates
Jeff Leips, Professor, Biological Sciences; Mariann Gabrawy, Biological Sciences

Frailty is a condition in which particular physical abilities deteriorate with age. There are a number of factors that indicate frailty, but the factor we focus on is strength, which was assessed in a Drosophila model. Specifically, we focused on a medication, which acts on the angiotensin system in mammals, with the aim of testing the effects in delaying weakness in the model system *Drosophila melanogaster*, the fruit fly. We looked at the independent effects of age and the combined effects of age and medication in order to determine if strength declines with age in the fruit fly and if the medications delay this decline in strength. Strength decline was assessed at ages one, three, five, and seven weeks using a Drosophila escape assay. The results of the strength tests indicate that age and medication have significant effects on fly strength over a lifetime. As age increased, fly strength decreased, and medicated flies consistently performed better than control flies on strength tests. Future work will focus on understanding the mechanism by which this drug acts to enhance strength.

This research was funded, in part, by a grant to UMBC from the Howard Hughes Medical Institute through the Pre-college and Undergraduate Science Education Program.

Confirmation of the Presence of *Streptococcus oralis* in the Oral Cavity

Jasmin Zarb
Allen Bush, Professor, Chemistry and Biochemistry

The oral cavity is home to a large and diverse population of microbes, such as pathogenic and commensal bacteria. Human oral bacteria communicate in order to colonize and form biofilm on the enamel surfaces of teeth. The commensal bacteria live in homeostasis with teeth and oral cavity ecosystem; however, pathogenic bacteria invade and adhere to these communities and biofilms in order to initiate colonization and to form organized multispecies communities called dental plaque. *Streptococcus oralis* ATCC 55229 (also known as*Streptococcus sanguis* H1) is a part of human oral microbiota and is associated with dental plaque formation. Our collaborator, a dentist, extracted a clinical strain that is an antigenic and coaggregate match for the genes of*S. oralis*. Our goal is to study and determine the structure of this new clinical strain's polysaccharide via Nuclear Magnetic Resonance (NMR) structural studies and determine if this strain has similar structural properties of *S. oralis*. We prepared the sample by deuterium ion exchange.
Using ^{1}H NMR, We confirmed that the clinical strain's polysaccharide has similar structural properties of *S. oralis* strain H1.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC.*