The 20th Annual
Undergraduate Research and Creative Achievement Day
Wednesday, April 27, 2016

Abstracts

Regulating Chemical Access to Mouse Vomeronasal Organ by Solitary Chemosensory Cells

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Weihong Lin, Associate 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. The purpose of our project is to investigate the regulatory role of SCCs in limiting potential harmful chemicals from accessing the VNO. We performed a short-term quantitative VNO chemical access assay in wild-type (WT) mice and Skn-1a knockout mice in which SCCs are genetically ablated. Mice exposed to bitter compounds, pheromones, and irritants were respectively mixed with a fluorescent dye, imaged, and the collected data used to assess the amount of chemical solution entering the VNO. This procedure was later applied in a chronic setting. Preliminary results indicate that nine percent more bitter compounds and twelve percent more irritants entered the VNO in Skn-1a knockouts in comparison to WT. Future directions will incorporate behavioral testing and immunohistochemical techniques in order to correlate chemical and morphological data to behavioral phenotypes.

This investigation was supported in part by a MARC Undergraduate Student Training in Academic Research (U-STAR) National Research Service Award (NRSA) Institutional Research Training Grant (2 T34 GM008663) from the National Institutes of Health, National Institute for General Medical Sciences and NIH/NIDCD research grant to DC012831.

Memory's Middle Ground: Union and Confederate Memory of Antietam

Michael Adamovich
Anne Sarah Rubin, Professor, History

Maryland's scars from the Civil War reflect the entire nations. Brother fought brother. Sons were pitted against fathers. Much like in war, the commemorations pulled the state apart at the seams. Maryland was a border state with sympathies for the Union and for the Confederacy, yet it is a

state that is mostly overlooked by Civil War historians. I argue that the way Maryland remembers the Civil War is as divided as its allegiances were. Using the Battle of Antietam along with the Centennial as focal points, I investigate the differences and similarities in the commemoration between Union and Confederate soldiers and sympathizers. Not only do I examine secondary sources that look at the Centennial, how it attempted to bring the nation together, and all of the issues that arose during the event, but I also examine first-hand accounts and pamphlets from the actual time period. I also examine how Antietam, as both a battle and a battlefield, has been commemorated and preserved. These sources provide a comprehensive look at how these commemorations shaped Maryland's history.

Recognition of Bacterial Ligands by the NAIP Immune Receptor

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The innate immune system discriminates pathogens from self-cells based on conserved pathogen features. However, microbial pathogens replicate and evolve more rapidly than their mammalian hosts, increasing their opportunity to evolve in order to circumvent immune detection. We investigated how the immune system prevents microbial escape from recognition via an innate immune receptor, the NAIP2/NLRC4 inflammasome. Inflammasomes are multi-protein complexes assembled in response to the presence of bacterial pathogens inside the host cell cytosol. Formation of the NAIP2/NLRC4 inflammasome is triggered by NAIP2 binding to the inner rod protein of bacterial type III secretion systems (e.g., PrgJ from *Salmonella typhimurium*). We hypothesized that NAIP2 binds to multiple binding motifs on PrgJ, thereby decreasing the probability of PrgJ evolving to evade recognition. We have identified two regions, on the N-terminus and C-terminus, of PrgJ that are necessary for ligand binding. Point mutations in the N-terminal region show two leucine residues are critical for recognition by NAIP2, suggesting that hydrophobic residues are crucial for NAIP2 binding affinity. Point mutations of these leucine residues decrease stimulation of endogenous NAIP2 in murine macrophages. Our work showed that bacteria may be less able to evade recognition by NAIP2/NLRC4 inflammasomes due to high stringency of binding.

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

Investigation into Strengthening Freshman Argumentative Writing and Comprehension

Jacob Adcock
Linda Oliva, Assistant Professor, Education

The subjects of this investigation were fifty-seven high-school freshmen. This investigation addresses students' abilities to develop well-supported arguments regarding controversial historical events. The topic is important because of the continued use of argumentative or persuasive writing across content areas and to help students develop into thoughtful, well-informed citizens. The goal was to evaluate the students' abilities to use the Toulmin model of argumentative writing. Students completed a diagnostic assignment in which they were asked to create and defend a claim about the impact of European imperialism on Native peoples in imperialized states. In the weeks following, the students examined the claims in primary and secondary sources, including speeches, letters, and political cartoons, as well as the evidence and reasoning for the evidence (warrants) used. The students then engaged in a writing workshop based on evidence and warrant writing, used samples to identify each of these parts of writing, and used peer review to increase their skills. At the end, the students wrote an argumentative essay about the actions of the world governments during the Cold War and used primary and secondary source documents to support their claims. We documented the change in writing skill.

Comparing Emotional Regulation Strategies to Predict Satisfaction with Life and Perceived Stress

Mobolanle Adebesin*, Taylor Berens-Crouch, Daniel Knoblach, Meagan Graydon*
Carlo DiClemente, Professor, Psychology

Individuals exhibit emotional regulation when dealing with various circumstances. However, the method an individual uses to regulate emotions may impact life satisfaction and stress levels. Two common strategies include cognitive reappraisal (changing how one thinks about an event) and expression suppression (concealing one's reaction). Past studies have shown cognitive reappraisal predicts higher life satisfaction and lower stress as compared to expression suppression. The current study investigated these relationships using data obtained from a doctoral dissertation study involving a national sample of young adults ($n = 562$). We hypothesized that the emotion regulation strategy used would predict reported life satisfaction and perceived stress. Results of multiple regression analyses revealed that cognitive reappraisal positively predicted life satisfaction ($\beta = .33$, $p<.001$) and negatively predicted perceived stress ($\beta = -.22$, $p<.001$). Expression suppression had an inverse relation with both outcomes [life satisfaction ($\beta = -.18$, $p<.001$), perceived stress ($\beta = .18$, $p<.001$)]. These results suggest that young adults' emotion regulation strategies can impact emotional well-being, as assessed by life satisfaction and perceived stress.

Using DNA Sequences to Determine the Geographic Origins of Agriculturally Important Invasive Leafmining Flies

Eric Adjakwah
Sonja Scheffer, Melecular Biologist, Systematic Entomology Laboratory, United States Department of Agriculture; Matthew Lewis, Systematic Entomology Laboratory, United States Department of Agriculture

The increased global movement of people and goods has resulted in introduction of agricultural pests into new areas. Understanding the patterns and processes of colonization by introduced species is crucial in planning interventions and management strategies. However, determining the origin and colonization patterns of invasive species can be difficult. Molecular markers such as DNA sequence data can help determine the history of movement by an invasive species. *Liriomyza huidobrensi*s is a leafmining fly that feeds within leaf tissue of crops, including potatoes and beans. Although native to South America, it has spread throughout the world and is of great concern. Understanding the origin and pathways of dispersion can determine the means of spread, possibly leading to the development of interception and control programs. We analyzed 2125 base pairs of mitochondrial *cytochrome oxidase* genes (COI and COII) in a phylogeographic approach to uncover distribution of genetic variation of *L. huidobrensis*. Our phylogeographic analysis of mitochondrial COI and COII found substantial geographic structure within *L. huidobrensis* in its native range, but almost none within and between invasive populations around the world. The data suggest that the invasive populations trace to the Peru/Ecuador region. We are collecting additional data to test this hypothesis.

Perceptions of Police: African Immigrants vs. African American Citizens

Akinlolu Afolabi
Nancy Kusmaul, Assistant Professor, Social Work

The study “Beyond 'Model Minority,' 'Superwoman,' and 'Endangered Species': Theorizing Intersectional Coalitions among Black Immigrants, African American Women, and African American Men” demonstrates that Black immigrants and African Americans share an experience of gendered and ethicized racism that situates them differently environmentally, in the labor force, and beyond. The conclusion of this journal by Keisha Lindsay inspired this research. This experiment compares perceptions African immigrants and African Americans have of police. Snowball sampling was used to recruit five African American citizens and five African immigrants. A phenomenological analysis was used to detect themes between ethnicities, incorporating open-ended questions and direct questions about participants’ personal experiences with police officers. The questions used in the survey provided a clear image of the participants' opinions about and comfort levels with dealing with police officers. The data collected is qualitative and the participant’s comfort levels were analyzed in form of a Likert scale. The information was collected in form of a survey. This survey contains 10 questions about police officers and their personal encounters with police officers. The participants were recruited from

University of Maryland, Baltimore County and the Community College of Baltimore County from the Baltimore area. Participants were 20-70 years old.

Seamus Heaney's Strange Fruit, Billie Holiday, and the Bog People

Jackie Airhart
Michael Fallon, Senior Lecturer, English

“Southern trees bear a strange fruit, blood on the leaves and blood on the root.” Billie Holiday’s unnerving song about lynching in the American South echoes through time and in the work of Seamus Heaney, Ireland’s Nobel Prize winner for poetry. By examining draft revisions of Heaney’s poem, “Strange Fruit,” at the National Library of Ireland archives, I was able to trace the echoes of the famous jazz song in Heaney’s meditation on religious violence as part of a greater exploration of the complex literary genealogy that he drew from in his work. This was particularly aided by an analysis of Heaney’s struggle for an appropriate title to what would become “Strange Fruit” in successive drafts of the poem. This research gains deeper insight into the historical context of an important literary work by revealing how the Holiday song became connected to the 1960s civil rights movement in the United States—a movement that in turn helped inspire Irish Catholics fight for civil rights during The Troubles of Northern Ireland, Heaney’s home. Heaney’s writing process is also further explored, as I examined a poem that required an unusual amount of revision compared to his other works.

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

The Effect of State Religion and Empowerment Rights on Political Freedom in Middle Eastern and North African Countries

Summer Akhtar
Carolyn Forestiere, Associate Professor, Political Science

Do state religion and empowerment rights affect the amount of political freedom a Middle Eastern or North African (MENA) country has? The relationship between rights and freedom is imperative in understanding whether a government is protecting the rights of its people, regardless of the way it chooses to rule. The study examines MENA countries post- 2011. Data was collected from Freedom House’s 2015 Freedom in the World Report, the 2011 CIRI Human Rights Data Project, and the 2015 New World Encyclopedia. Using a most similar systems design, the quantitative analysis statistically evaluated the relationship between the variables. In addition, two hypothesis-confirming case studies of Saudi Arabia and Tunisia are included. The study concluded that state religion has no effect on the level of political freedom in MENA countries. Secondly, it found that a MENA country with less government respect for empowerment rights is more likely to have a lower amount of political freedom, as opposed to a

MENA country that has more government respect for empowerment rights. Thus, the findings demonstrate that personal rights and political freedom are related to one another, which may explain why several countries in the region have experienced violent conflict.

The Role of Phospho-histone 3 in the Developmental Arrest of Zebrafish

Kemi Akinnola*, Catrina Johnson, Hilary Bright*
Rachel Brewster, Associate Professor, Biological Sciences

Most organisms depend on oxygen to produce cellular energy (ATP) via aerobic respiration, without which they cannot survive. Diseases caused by ischemia (transient interruption in blood flow/oxygen delivery) such as stroke are devastating as they result in ATP depletion and cell death in the brain and other sensitive organs. Interestingly, some organisms, including zebrafish, survive prolonged periods of anoxia (zero oxygen) without any adverse effects. Understanding the mechanisms underlying anoxia tolerance in such organisms may reveal potential therapies for treating ischemic injury. Studies on developing zebrafish embryos have shown that they withstand anoxia for upwards of 20 hours in a reversible arrested state, which is thought to conserve ATP levels. Younger embryos survive anoxia for longer periods than older embryos, which has lead us to hypothesize that they arrest faster. The aim of this project is to test whether there is an inverse relation between the time it takes to arrest and length of survival in anoxia. The timing of arrest will be determined using both morphological criteria and a quantitative assay for cell proliferation. Our studies thus far confirm a more rapid arrest in younger stage embryos, suggesting that the signaling mechanism inducing arrest may be developmental-stage specific.

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Argumentative Writing in the Middle School Social Studies Classroom

Ahmed Al-salihi
Linda Oliva, Assistant Professor, Education

Students face difficulty expressing ideas and opinions in a sophisticated manner that is supported by factual, research-based data. Communicating opinions in a coherent manner is a fundamental skill in education and is a factor that aids students in becoming responsible adults. This study investigated the influence of teaching strategies on increasing students' ability to effectively respond to argumentative-based essay questions. Study participants included 25 middle-school students who previously struggled when responding to argumentative-based questions. Various methods were used to improve the students' ability to write an argumentative essay, including direct instruction, warm-ups, exit tickets, quizzes, practice guides, and charts. Post-test data was compared to baseline data. The target for improvement was to increase every student's ability by

at least 20 percent. Improvement was defined according to a rubric that was based on how well the students increased their ability to create a convincing argumentative essay.

Experimental and Computational Analysis of Lift Generation by Wing Morphing Bird

Theophilus Aluko
Meilin Yu, Assistant Professor, Mechanical Engineering; Jamie Gurganus, Instructor, Mechanical Engineering

This research aims to study and mimic the lift of a barn swallow via computational and experimental analysis, by meeting finite dynamic constraints such as flapping amplitudes and frequency. This bird was selected because of its maneuverability, efficiency and conical morphing wing-flapping motion. An animation of a simplified lifting process was obtained by creating a three-dimensional scan of a representative bird from the Smithsonian National Museum of Natural History. In addition to the animation, we constructed a physical aerial robot prototype that mimicked the take-off process of the bird in its natural environment. Using the physical model, the generated lift force caused by the morphing flapping structure was measured and then compared with the force derived by a conventional flapping structure. Our analysis and measurements support the hypothesis that the lift generation is highly affected by a characterization of changes in the bird's wing due to geometry. In particular we hypothesize that leading-edge vortices (LEVs) play an important role in lift generation and should be further parametrized for the making of safer, more efficient wing-morphing commercial aircraft.

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

Analyzing the Effects of Vascular Calcification on the Mechanical Properties of Elastin

Roy Anderson*, Sunita Mengers*
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 and remain intact for the lifetime of the organism to maintain the tissue structure and elasticity. The purpose of this experiment is 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 bovine thoracic aortas are cut into dog bone specimens after harvesting. Records of width, gauge length, and thickness of the isolated elastin specimens are recorded before testing. The elastin is then placed into the Biomaterials Testing Machine, which contains a phosphate buffered saline solution to best represent *in vivo* results. A uni-axial tensile test, which provides loading on the elastin and determines the mechanical properties, is

initiated at zero load and increases the force until a maximum load of 2200g. Engineering stress and strain values are then calculated using the raw data. Experiments with and without vascular calcification will be 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.*

Effects of a Chromatin Remodeler on Migratory Cell Fate Determination

***Lilian Anosike**, Afsoon Saadin, Lindsay Mercer*
Michelle Starz-Gaiano, Associate Professor, Biological Sciences

Cell migration is a critical process involved in wound healing, tissue formation, and immune response. We study the highly conserved Janus Kinase/Signal Transducer Activator of Transcription (JAK/STAT) pathway that regulates cell migration in *Drosophila melanogaste*r ovaries. There is evidence that Brahma, a chromatin remodeler that controls DNA accessibility, may interact with two downstream targets of STAT, *apontic (apt)* and *slow border cells (slbo)*, that determine migratory cell fate. To investigate this potential genetic interaction, we utilized RNA interference (RNAi) to reduce expression of *brahma* and each of STAT's target genes and we compared the resulting phenotypes. To study Brahma's effects on migration timing, we reduced *brahma* expression in *Ecdysone receptor (EcR)* mutants because proper timing is dependent on EcR signaling. We found that a reduction of *brm* in conjunction with *apt* and *brm* in conjunction with *slbo* introduced migratory and specification defects respectively. Experimental data is compared to simulations using differential equations representing the JAK/STAT signaling. Into the model, we introduced a Brahma parameter and new constants to observe the effects on the static versus motile bistability of the system. This research should help biologists better understand the impact of chromatin remodelers on genetic pathways that regulate cell migration.

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Increasing Students Writing Skills through Research-Based Practices

Cindy Arevalo
Cheryl North, Assistant Professor, Education

Effective writing is an essential skill for all members of a school community. It is necessary for students to know why grammar and word order is important and that proper application is relevant to everyday writing. This research study focused on 32 sixth-grade students who had struggled with writing at their suburban mid-Atlantic middle school. Students were given a pretest and were rated using a standardized rubric to collect baseline data of their writing skills. Throughout the school year, students were given the opportunity to write every day. The teacher assessed student writing to determine what areas of instruction were needed and then adapted her pedagogical approach through mini-lessons that focused on both grammatical and structural issues. Students were asked to identify weakness prior to writing and then focused on strengthening the areas of weakness in their own writing. With structured mini-lessons and contextual practice in their own writing, students' skill levels increased. Sample lessons and examples of student work are presented to demonstrate how growth was achieved over the course of the school year.

Recovery of Nutrients from Chicken Litter to Create a Slow-release Fertilizer

Hannah Aris*, Utsav Shashvatt, Josh Benoit*
Lee Blaney, Assistant Professor, Chemical, Biochemical, and Environmental Engineering

Large loads of nutrients are introduced to the Chesapeake Bay from agricultural runoff, fueling the growth of algal blooms and jeopardizing water quality and the ecological health of the Chesapeake Bay and its tributaries. Recently enacted regulations in Maryland have made it increasingly important to remove nutrients, namely nitrogen and phosphorus, from chicken litter. We have devised a nutrient recovery process, in which chicken litter is mixed with water to form a high-solids slurry. The pH of this slurry is decreased to approximately 4.3 by bubbling carbon dioxide and dosing hydrochloric acid; at this pH, nitrogen and phosphorus are released from litter solids, generating a nutrient-rich solution. After solid-liquid separation, the pH of the nutrient-rich solution is increased to 8.8 through addition of sodium hydroxide. At this pH, struvite ($MgNH_4PO_4 \cdot 6H_2O$), which is a slow-release fertilizer, precipitates. Trace amounts of other nutrient-laden minerals, such as potassium struvite, hydroxyapatite, newberyite, and monetite, are also generated. We postulate that nutrient loads to the Chesapeake Bay can be drastically reduced by implementing this nutrient recovery process, and that the recovered struvite can serve as an alternate source of phosphorus.

This work was funded, in part, by a grant from the National Science Foundation (CBET 1511667).

Differential Relations of Neighborhood Disorder to Pain Interference in Urban-dwelling African Americans and Whites

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African Americans are at greater risk than Whites for experiencing pain conditions as well as acute pain and sensitivity. Environmental stressors (physical/social neighborhood conditions) were examined for association with racial pain disparities. The present analyses included 147 urban-dwelling adults in Baltimore participating in the Healthy Aging in Neighborhoods of Diversity across the Lifespan study (HANDLS); 56% women; 61.2% White, 38.8% African American, mean age 46.9, 30% living in poverty. Participants rated bodily pain using the Short-Form Health Survey (SF-12) and neighborhood conditions (e.g., crime, access to resources) within communities using the Neighborhood Assessment Scale. Multiple regression analyses were conducted adjusting for sex, age, depression, poverty status, and education. Results indicated that neighborhood condition was associated significantly with less pain interference among African Americans ($b = .52$, $t = 3.20$, $p < .05$), but not Whites. While opposing hypotheses, findings show a novel relation of pain and neighborhood conditions. Sample demographics, racial identity, community coping, and resiliency may contribute.

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Illustrating the Unseen: Analogy and Metaphor in an Ancient Gynecological Text

***Sarah Auer**, Hao (Zoe) Wang*
Molly Jones-Lewis, Lecturer, Ancient Studies

Analogy and metaphor are powerful aids in communicating complex ideas simply. Soranus' Gynecology, a Greek text of the first-century CE, was written as a handbook for choosing and training midwives, and it employs analogy and metaphor as a means to increase the accessibility of its subject. For example, Soranus describes the shape of the placenta with the word κιβώριον (ki-bo-ri-on), which is often translated as "bean"; however, there are a range of possible translations, including: seed-pod, bean, or lotus pod. Consequently, a variety of images are presented to the reader. The aggregate image created through the various meanings delivers a complete image of the placenta. With the assistance of artistic rendering, I examine the analogies presented within Soranus to determine the sources from which Soranus selects his imagery, and provide insight into the complex nature of his choices. This text must be read within its historical context in order to fully understand Soranus' audience and communication strategy. Many of the metaphors used by Soranus still persist in modern medical terminology; by analyzing Soranus' usage of language for specific and metaphoric meaning we can gain a better understanding of how and why medical language is created.

This work is supported, in part, by "Seeing Science: Science, Photography, and Visual Culture," a public programming project organized by the Center for Art, Design and Visual Culture and the Interdisciplinary Studies Program.

Fluorescence Image Analysis via Threshold Enhanced Alternative Morphology Guided Image Segmentation

Farhan Augustine
Songon An, Assistant Professor, Chemistry and Biochemistry

The recent push towards high-throughput high-content screening has created a growing need for fast, accurate, and automated algorithms for cellular content analysis. However, most image-segmentation algorithms pose unique challenges for studying cellular components, including fluorescently labeled proteins. Furthermore, no algorithm is able to correctly segment cells or the cellular compartments as well as visual examination. We are developing such an algorithm to give any user the ability to perform reliable single cell analysis to sample the number, sizes, and areas of fluorescently tagged proteins. Our semi-autonomous approach is flexible to account for variance in fluorescent intensity, stochastic cell-to-cell differences, and region-to-region variations introduced during image acquisition processes. Due to the design of the algorithm, user input is necessary to facilitate verification and correction of each cell after the initial segmentations. Preliminary trials have shown that the algorithm successfully handles multiple assays and even different image sets. Further studies must be performed to establish a merit of performance for the algorithm. Images gathered via low magnification objective lenses will be used to establish our algorithm's usefulness for high-throughput high-content work.

A Flexible Approach to Treating the Ebola Virus

Sola Awojoodu
Viviana Cordova, Assistant Professor, Visual Arts

Natalie Steenrod is a student under the HHMI Scholarship Program at the University of Maryland, Baltimore County (UMBC), researching a more flexible approach to treating the Ebola virus. I am a student at UMBC in the Visual Arts Department studying Graphic Design. Natalie and I are working together, as students from two different fields of study, to determine the best solution to presenting her research material. Natalie has worked hard to produce the results of her research on Ebola, a virus that is becoming more widespread in West Africa, and it is my job, as a design student, to ensure that her final poster is presented excellently in the URCAD Exhibition this coming April. Together, we are establishing a simple, clean, presentable, solid and creative approach to the design of the exhibition poster that plainly communicates her research to the viewer while keeping the audience engaged in the topic. I will determine what is necessary and effective design-wise for this specific subject and execute my results in the final product.

This work is supported, in part, by "Seeing Science: Science, Photography, and Visual Culture," a public programming project organized by the Center for Art, Design and Visual Culture and the interdisciplinary Studies Program..

Headspace

Emma Ayala
Corrie Parks, Assistant Professor, Visual Arts

Headspace, a neurotic self-portrait, is animated with a variety of traditional media and processes. After struggling to execute a narrative short, I shifted my focus and sought to communicate the cause of my failure and frustration: my lethargy and waning lucidity. For me, working in an experimental, non-narrative way was more intuitive than working from a scripted storyboard. With only motifs and a vague visual concept, I began crafting sequences immediately, intending to compose them later. I incorporated progressive drawing with charcoal, cut paper, and found media and blended processes in the short sequences. Later, when I composed the sequences I addressed the challenges of unifying disparate images and creating engaging structure. With Adobe Premiere, I used color-keying and blend modes to layer animated textures over sequences to make them more visually cohesive. And while the overall narrative is cyclic, I used sound and pacing to build to an engaging and explosive climax. Besides the exploration of combining media and processes, the project's relevance additionally comes from its subject matter and conception. Numerous peers of mine are hindered by mental blocks and illnesses, and this piece demonstrates a procedure that one could use to overcome internal obstacles. (1:15 min)

October

Ryan Bailey
Doug Hamby, Associate Professor, Dance

My creative project challenges conceptions of modern dance and the rules associated with dance making. Breaking code of traditional methods, my piece consisted of pauses of silence in addition to a classic rhythm and blues song of the 1970s. The challenge was to create a dance that maintained an artistic integrity, despite the familiarized pop-culture lyrics of the song. In order to accomplish this task, attention to detail was crucial. One of my goals was to accent musical embellishments or accents within the song through dance. In doing so, I carefully crafted the choreography to match the lyrics or patterns formed in the song, without being redundant or predictable. Apart from visually pleasing choreography, the dance needed genuine human interaction to emphasize the playful relationships among the dancers. One struggle throughout my process was to choreograph non-dance steps. To avoid a seemingly choreographed party scene, my dancers and I found inspiration in real life experiences. My creative project was intended to remain artistic, yet capture and entertain the audience through music and human interaction, evoking reminiscent memories individual to each audience member.

Quantitative Analysis of Purine Nucleotide Pools Involved an AMPK Regulatory Loop

Gabriella Balaa
Songon An, Assistant Professor, Chemistry and Biochemistry

AMP-activated protein kinase (AMPK) has been well documented as the master energy regulator of the cell. AMPK's activity is allosterically regulated by a metabolic intermediate of human *de novo* purine biosynthesis. However, whether AMPK associates with *de novo* purine biosynthesis has remained elusive. We have investigated how the metabolic activity of *de novo* purine biosynthesis is governed by AMPK. First, we optimized a high performance liquid chromatography method to quantify purine nucleotide pools as cellular AMPK is pharmacologically activated. Second, we determined retention times of various purine nucleotide standards in the presence and absence of cell lysates. Afterward, we quantified the cellular levels of IMP, AMP, GMP and ATP from the AMPK activator-treated HeLa cells. We observed that the metabolic activity of *de novo* purine biosynthesis was decreased in response to pharmacological AMPK activation. By coupling this data with fluorescence live-cell imaging data, we propose that AMPK downregulates *de novo* purine biosynthesis through the spatial sequestration of one of six purine biosynthetic enzymes from the rest of the pathway enzymes. Collectively, quantitative analysis of purine nucleotide pools contributes to our understanding of how *de novo* purine biosynthesis is regulated in the AMPK-governed network of cellular energetics.

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

The Social Impact of Air Pollution in China

Kayla Barrett
Constantine Vaporis, Professor, Asian Studies

In 2015, a TEDtalk-style documentary produced in China entitled “Under the Dome” went viral on the internet, alerting the entire world to the problem of air pollution and the lack of environmental safeguards in place in China. In a modern society, the protection of the environment is vital to the health of the people, not to mention the legitimacy of the government. This research addresses the question of how the government has managed environmental policy, the nature and scope of the health crisis facing Chinese society, and the strategies the Chinese people have taken to cope. To assess the impact of pollution on society, I analyzed government policies, popular media and scholarly reports, focused on air pollution in major cities, especially Beijing. The paper concludes that the Chinese state is continuing to put economic expansion above environmental health and leaving the people to defend themselves from the ever-growing problem.

Sex Differences in the Influence of Physical Activity on Central Nervous System Pain Inhibitory System Function

***Allison Basiley**, Eryka Boyd*
Raimi Quiton, Assistant Professor, Psychology

Mechanisms of chronic pain are not well understood, though poor function of CNS pain modulatory systems appears to play a role. Physical activity has been identified as a factor that may reduce risk for chronic pain development. In this study, it was hypothesized that more physical activity would lead to better activation of CNS pain modulatory systems. Physical activity intensity was collected from 76 participants (mean age = 22.8 years, 42 females) by self-report. Participants also underwent a conditioned pain modulation (CPM) laboratory test to obtain a measure of CNS pain modulation. The CPM paradigm measured the change in intensity ratings of painful heat applied on the arm when a painful pressure stimulus was simultaneously applied to the leg. Physical activity and CPM were significantly positively correlated ($r= 0.262$, $p=.022$), indicating that greater physical activity was associated with decreased function of CNS pain modulatory systems. However, this correlation was mainly found in women ($r=.335$, $p=.030$); no significant correlation between exercise and CPM was found for men ($p>.05$). Physical activity and CPM magnitude did not differ significantly between men and women ($p>.05$). In conclusion, exercise may be associated with decreased function of CPM pain modulatory systems in women but not men.

This work was funded, in part, by UMBC startup funds to Dr. Quiton.

Wasted Neighborhoods: Narratives and Political Ecologies of Persistent Trash in West Baltimore

***Yinka Bode-George**, Dawn Biehler, John-Henry Pitas, Joel Baker, Sacoby Wilson[1], Shannon Ladeau[2]*
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Dawn Biehler, Associate Professor, Geography and Environmental Systems

This study emphasizes the ways waste production and distribution intersect with ecological marginalization of communities of color in America, with a focus on West Baltimore. The study examines the production and distribution of waste from both an historical perspective and the perspective of residents who live with waste that accumulates and persists in the landscape. This project involved a review of historical laws and regulations pertaining to racial redlining and employed social science research methods, including interviews of West Baltimore residents to gather oral histories, and site visits to West Baltimore neighborhoods to investigate vacant lots and buildings. These methods allowed an examination of modern-day psychosocial impacts of excess waste resulting from historical community divestment, and subsequent degradation, of West Baltimore communities. Abandoned buildings, trash piles, litter, and organic waste become habitat and food for animals such as rats and mosquitoes. Longtime community members argue that city government neglect has shaped residents' own

haphazard household disposal practices. Some state that trash has become simply "normal." Amid aggressive public-private efforts to revitalize other parts of the city, West Baltimore residents see waste accumulations near their homes as a message that they themselves are excess matter to be discarded.

Characterization of the HIV-1 Monomeric Conformation of the 5'-Leader

Nicholas Bolden
Michael F. Summers, Professor, Professor, Chemistry and Biochemistry, and Investigator, Howard Hughes Medical Institute

An estimated 35 million people live with human immunodeficiency virus (HIV-1), with approximately 1.7 million associated deaths per year. While there are numerous drugs and therapeutic options available to treat HIV-1, the virus's high mutation rate combined with patient noncompliance with strict drug regimens can lead to drug resistance. This creates the need for new therapeutics to be developed that target highly conserved areas of the replication cycle. A potential drug target is the HIV-1 5 Prime Leader (5'-L). The 5'-L is the most conserved region of the RNA genome. It exists in two conformations: a monomeric form, important for translation of the genome, and a dimeric form, important for genome packaging. Based on the different roles carried out by the different conformations, we predict that the monomeric and dimeric structures significantly differ. To solve the structure of the monomeric 5'-L, we are using nuclear magnetic resonance (NMR). Due to the large size of this RNA construct we are analyzing the small hairpin oligos and comparing the NMR spectra.

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.

Identifying as an American: Acculturation in First Generation Latino/a and Hispanic Immigrants

Maria Cara Borja
Anne Brodsky, Professor, Psychology

People of Hispanic origin constitute the largest minority group in the nation, with 35 percent of Hispanics being immigrants. First-generation immigrants face the challenge of adopting and integrating American values, beliefs, and traditions. The purpose of this study is to investigate both the facilitators and barriers to first-generation Latino/a and Hispanic immigrants' sense of connection, identification, and membership with the American community. This study explores the interactions and relations between first-generation Latino/a and Hispanic immigrants and U.S. born individuals, occurrences of both inclusion or exclusion from the American community, and how these interactions influence first-generation Latino/a and Hispanic immigrants' sense of identification with U.S. American culture. The analysis is based on 15 semi-structured

interviews with first-generation Latino/a and Hispanic immigrants living in the Baltimore/Washington D.C. area. The ultimate aim of the study is to understand how first-generation Latino/a and Hispanic immigrants can be integrated into and identify with the American community.

CRISPR/Cas9-mediated Genome Editing for Fluorescence Single-cell Microscopy

Syrena Bracey
Songon An, Assistant Professor, Chemistry and Biochemistry

Dysregulated glucose metabolism is an emerging hallmark of cancers. We have investigated the spatiotemporal role of human liver-type phosphofructokinase (PFKL) in glucose metabolism using fluorescence single-cell microscopy. Based on our preliminary data, we hypothesize that PFKL is a scaffold to other enzymes involved in human glucose metabolism. We wish to develop a genome-edited cell line expressing endogenously-tagged PFKL by knocking in a gene encoding an enhanced green fluorescent protein (EGFP), using the Clustered Regularly Interspaced Short Palindromic Repeats/Caspase 9 (CRISPR/Cas9) technology. Currently, we are preparing a nuclease plasmid containing a Cas9 nuclease and a guide RNA sequence pinpointing the genomic locus for EGFP insertion, and a donor plasmid containing PFK homology arms and EGFP. We anticipate that these plasmids will be transfected into human breast cancer Hs578T cells to incorporate the EGFP tag into the C-terminal region of the genomic PFKL gene via a homology-directed DNA repair system. Development of this cell line will allow us to investigate the scaffold hypothesis of PFKL and the importance of the scaffold in spatiotemporal regulation of glucose metabolism.

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

Myriam Bleau: A Voice in Electronic Music

Briana Bradley
Anna Rubin, Associate Professor, Music

Myriam Bleau is a young composer working in music and digital art. Perhaps the most notable of her works is Soft Revolvers. The piece is written for four acrylic spinning tops. Each top contains an instrument-based sound. As the tops spin, they communicate with a computer wirelessly, and musical algorithms control the sounds that they produce. What makes this composition unique is Bleau's notion of "musical gesture." Technology gives composers access to a wide range of effects. However, these works are often limited in their performance. The click of a button, for example, is a very small gesture that can set off a very disruptive alarm. Bleau aims to make these elements equivocal. Soft Revolvers has a one-to-one ratio, meaning the gyration of a top produces a singular pre-recorded sound, and the force with which the artist

spins a top directly affects its quality. Predecessor Laurie Anderson achieved a similar effect by stringing a violin bow with magnetic audio tape. In bowing the violin, she could play segments of the tape backwards and forwards. These unique achievements will be explored through the life and works of Myriam Bleau and her colleagues, with Soft Revolvers as a focus.

A Reb in Rockville: The History of the Confederate Memorial in Rockville, Maryland

Daniel Brezina
Anne Sarah Rubin, Professor, History

In 2015 the Rockville (MD) City Council began public discussion on the Confederate Monument located in its downtown, prompting many questions from the public. Many in the area were not even aware of its presence. My research focuses on the history of the monument, including the context of its construction, as well as modern discussions over its appropriateness. The monument, thought to be the northernmost Confederate memorial, had been erected by the United Daughters of the Confederacy (UDC) in 1913 and features a statue of a soldier, with an inscription on the base. Using records from various chapters, including the Maryland Division of the UDC, as well as the national organization, my research shows how this memorial was part of a larger effort by the UDC to promote the Lost Cause myth of the Confederate war effort. My presentation also uses newspaper articles from the time of the monument's construction as well as articles from the subsequent years over to examine the history of the monument. The presentation concludes by examining the modern discussion, especially in the Rockville City Council, over its place and belonging in the larger context of the national discussion over Confederate memorialization.

Role of Secretory Pathway Proteins in Cell Migration

Margarita Brovkina*, Afsoon Saadin*
Michelle Starz-Gaiano, Associate Professor, Biological Sciences

Migratory cells have a central role in embryonic development, the immune response, and cancer metastasis. However, the molecular mechanisms behind the events signaling and mobilizing a cell for migration are not fully understood. For this project we use *Drosophila melanogaster*, which serves as a tractable model system for investigating the genetic and cellular mechanisms behind migration. In the *Drosophila* ovary, anterior polar cells of the developing egg chamber secrete the ligand Unpaired, which activates the Janus Kinase/Signal Transducer and Activator of Transcription (JAK/STAT) pathway and induces nearby border cells to migrate. Proteins of the secretory pathway have been previously shown to be important in migration. Here we investigate the role of secretory pathway proteins Sar1, Sec23, Sec16, Membrin, and Garz in the specification and maintenance of motile cell fate through depletion of these proteins via RNA interference. In motile cell-specific knockdowns of secretory pathway proteins, we expect to see severe migratory defects due to loss of secretion of Unpaired. Analysis of mutations in the

secretory pathway can provide new insights into the specification and maintenance of migratory cell fate, and has broad implications for understanding migratory pathways in immune response, metastasis of cancer, and development.

This work was funded, in part, through a National Science Foundation Career Award to Michelle Starz-Gaiano, Ph.D.

Understanding the Impact of a Unique Myristylation Signal on HIV-1 Matrix Protein Myristylation Efficiency

Paige Canova
Michael F. Summers, Professor, Professor, Chemistry and Biochemistry, and Investigator, Howard Hughes Medical Institute; Janae Baptiste, Chemistry and Biochemistry

The human immunodeficiency virus (HIV) and feline immunodeficiency virus (FIV) are retroviruses that elicit a similar immune response in their hosts. The Gag polyprotein (Gag) is a major structural protein of HIV-1 required for membrane targeting which leads to production of new virions. Matrix (MA), the N-terminal domain of Gag, mediates assembly to the cell membrane, and better understanding of this process may lead to development of a novel therapy for HIV. A key structural feature of MA is the myristate, which is proposed to aid in assembly. The myristate is linked to MA by the enzyme N-myristyltransferase (NMT), a process which requires NMT recognition of the substrate MA myristylation signal. Mammals possess a consensus myristylation signal, and, while HIV-1 MA bears the common mammalian signal, FIV MA displays a unique signal. To gain insight into the impact of a unique myristylation signal, mutagenesis was employed to make mutations to HIV-1 MA, and, upon protein expression, myristylation efficiency of these mutants was determined by mass spectrometry. Further analysis of the impact of a unique myristylation signal with regard to HIV-1 MA structure and function may imporove our understanding of the cause of evolutionary adaptation of the FIV MA myristylation signal.

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.

The Effects of Chemical and Physical Irritants on Olfactory Sensory Neuron Death in Mice

Kathleen Carino, Augusto Benavides Panizo*, Kayla Lemons*
Weihong Lin, Associate Professor, Biological Sciences; Tatsuya Ogura, Research Assistant Professor, Biological Sciences

The main olfactory epithelium (MOE) detects odor molecules from the surrounding environment. The primary cell type in the MOE is the olfactory sensory neurons (OSN), which are responsible for detecting odorants as well as sending information to the main olfactory bulb

to be processed. Additionally, the MOE contains TRPM5-expressing microvillous cells (TRPM5-MCs), whose function is largely unknown. These cells can be visualized using TRPM5-GFP mice, which express GFP in TRPM5-MCs. Our research investigated the effects of irritants on OSN death and the role of TRPM5-MCs by using Skn-1a knockout mice, which lack TRPM5-MCs. For our experiments, we divided TRPM5-GFP and Skn-1a knockout mice into groups exposed to either water or a combination of physical and chemical irritants daily for two weeks. The mice were then perfusion fixed and the MOE was later harvested and cryosectioned. We used immunolabeling methods with an antibody against caspase 3 to visualize cell death in the MOE. We are currently conducting quantitative analysis to determine the density of the apoptotic cells. Our results are expected to provide experimental evidence for the irritant exposure-induced cell death and a potential role of TRPM5-MCs in maintaining the survival of olfactory neurons.

This work was funded, in part, by NIH/NIDCD DC012831 to Dr. Lin.

Probing the Structure of the HIV-1 5′-L Monomeric Conformation and Start Site Heterogeneity by NMR Spectroscopy

Hannah Carter*, Michael Lopresti, Seung Ho Choi, Aishwarya Iyer, Nicholas Bolden*
Michael F. Summers, Professor, Professor, Chemistry and Biochemistry, and Investigator, Howard Hughes Medical Institute; Joshua Brown, Chemistry and Biochemistry

The late phase of Human Immunodeficiency Virus Type-1 replication cycle is characterized by the equilibrium between the monomer and dimer conformations of the highly conserved 5′ Leader (5′-L) in the RNA genome. The 5′-L has two documented start sites on the trans-activation region (TAR) hairpin. In newly budded virions, RNA exists primarily with a methylated guanosine cap and one additional guanosine, which favors the dimer conformation. 5′-L with a cap and two guanosines have been found in polysomes and associated with stabilizing the monomeric conformation. Our model suggests that the additional guanosine causes a shift in the adjacent polyA hairpin, opening one side for binding to the additional guanosine, and the other for binding to the Dimer Initiation Site (DIS), which is bound to the Unique 5 region (U5) in the monomeric conformation. We've synthesized a construct of TAR, PolyA, U5, and DIS to analyze the effects of this additional guanosine and its role in the of the PolyA and U5:DIS hairpins. By comparing the Nuclear Magnetic Resonance Spectrum of this construct with the full-length 5'-L, we can identify folding patterns of the 3-D structure of the 5′-L, and elucidate the mechanism behind this molecular switch.

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 CdSe and Au Nanoparticles Assemblies to Study the Optical Properties of New Hybrid Nanomaterials

Devyn Catterton
Marie-Christine Daniel, Associate Professor, Chemistry and Biochemistry

The coupling of cadmium selenide quantum dots and gold nanorods is predicted to produce a system that has qualitatively different properties from the isolated particles. These properties can be controlled by exciting the system with a short laser pulse. We hope that the resulting nanoparticle assemblies can serve as a key enabling technology for future optical information processing at high speeds and low power, including quantum-mechanical information processing at the single-photon level (i.e., quantum computers). There are also potential applications to more efficient conversion of sunlight into electricity and in the development of highly efficient displays and ultra-small lasers. The goal of this project is to couple cadmium selenide quantum dots to gold nanorods in order to study the optical properties of this new type of hybrid nanomaterial. We have synthesized both the core shell CdSe/ZnS quantum dots and gold nanorods, which have been characterized using UV-Vis spectrophotometry, fluorometry, and transmission electron microscopy (TEM). We have also covalently linked the quantum dots with the gold nanorods. These constructs have recently been characterized with TEM and are now ready for optical studies.

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

Focus of Magnetic Fields though the use of Magnetic Shielding for Transcranial Non-Invasive Brain Stimulation

Mitchell Cherry
Fow-Sen Choa, Professor, Computer Science and Electrical Engineering

Transcranial magnetic stimulation (TMS) is one of the few noninvasive neural stimulation techniques available for treatment of neurological disorders including migraine, treatment-resistive major depressive disorder and neuropathic pain. The TMS tools currently available cannot produce a focused magnetic field that can target specific areas, particularly the deep brain regions, because they cannot retain focality two centimeters from the coil. In TMS tools intended for deep brain stimulation, like the H-Coil, the field is dispersed and cannot target specific locations in the brain. In this work we implement a novel magnetic shielding technique to achieved focused stimulations. Multiple layer arrays of copper ring are placed near the surface of the TMS coil. When the coil is fired, each copper disk generates an induced current, as well as an opposing magnetic field. This reduces the field in undesired regions and enhances the field at the desired location such that the vector summation of the combined fields produces a focused field. The effect of each disk can be modeled using Lenz's Law and Maxwell's equations to obtain optimized arrangement. We have experimentally demonstrated focusing effects by using

magnetic and electric field probes to measure the field distributions with and without magnetic shields.

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

Probing the Structure of the HIV-1 5`-L Monomeric Conformation and Start Site Heterogeneity by NMR Spectroscopy

***Seung Ho Choi**, Hannah Carter, Michael Lopresti, Aishwarya Iyer, Jana Hijji, Nicholas Bolden*
Michael F. Summers, Professor, Professor, Chemistry and Biochemistry, and Investigator, Howard Hughes Medical Institute; Joshua Brown, Chemistry and Biochemistry

Human Immunodeficiency Virus (HIV), the AIDS pathogen, proliferates within infected human helper T cells, compromising an otherwise healthy and responsive immune system. Viral replication is mediated by the 5`Leader (5`-L) element in viral genomic RNA. This 5`-L RNA exists in an equilibrium of two structural conformers – monomer and dimer, by which it directs and mediates viral assembly and replication. Here, we demonstrate an approach to probe for and characterize secondary structure in the 5`-L monomeric conformer by high-field nuclear magnetic resonance (NMR) spectroscopy, a technique used for high-resolution biomolecular structural studies. Signal assignment and validation of characteristic peaks in NMR experiments designed to explore the through-space interactions of base-paired residues provide evidence to support the formation of distinct secondary structures in our proposed model. Our study of the HIV-1 5`-L monomeric conformer structure and the processes that this highly conserved RNA sequence mediates in retroviral replication not only provide further insight into our current understanding of the functional and dynamic nature of three-dimensional RNA structure, but also highlight potential therapeutic value in the monomer as a drug target in clinical medicine.

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

Xenobiotic Exposure-induced Morphological Changes in the Mouse Olfactory Epithelium

Kritika Chugh
Weihong Lin, Associate Professor, Biological Sciences

The main olfactory epithelium (MOE) in the nasal cavity plays an essential role in odor detection and transmission, which aids in the survival of organisms. Inhaled xenobiotics, including irritants and harmful microorganisms, negatively impact the MOE sensitivity and integrity. The epithelium contains populations of cells such as olfactory sensory neurons, basal cells, microvillous cells, and supporting cells. In order to understand the morphology of the supporting cells in Skn-1a mice (which lack microvillous cells), we analyzed these cells under two

conditions: water-exposed (control) and irritant-exposed mice. Mice were exposed to irritants for two weeks and sacrificed. The MOE was sectioned and immunostained with OMP, DAPI, and Gap43.We compared the size of nuclei of supporting cells using ImageJ in the two conditions with the spatial position of the MOE (anterior versus posterior). Preliminary results show a significant difference between the overall average nuclear size of the control versus the irritant-treated mice, with the control condition having a larger nuclear size. Furthermore, the morphologies of three regions in the olfactory epithelium (classified as more anterior, middle, and more posterior) were different for the control compared to experimental conditions, with the control having a larger nuclear size in all three locations.

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Identification of Molecular Properties to Cluster Genetic Markers of Cardiovascular Disease

***Ann Cirincione**, Kaylyn Clark*
Maricel Kann, Associate Professor, Biological Sciences

Cardiovascular disease (CVD) is the leading cause of death worldwide in both men and women. It is especially prevalent in the United States, where it is responsible for one out of every four deaths. Genetic markers linked to susceptibility to CVD have been identified, however a large number are still unknown. We have mapped 15% of disease variants from the Human Gene Mutation Database (HGMD), 62% from the Clinical Variance database (ClinVar), and 28% from the Universal Protein Resource (UniProt) to the Online Mendelian Inheritance in Man (OMIM), which has direct links to the Human Phenotype Ontology (HPO). From these variants, we will extract the subset linked to CVD, as well as increase coverage of variants mapped to OMIM. We aim to use machine learning techniques and algorithms to cluster new genetic variants to molecular properties of known CVD markers in order to better diagnose and treat individual patients. For this purpose we have compiled a list of molecular properties including protein domain interactions, common gene ontologies, and metabolic pathways. In the future, these methods will be used to match individual genome data to corresponding CVD clusters, developing new diagnostic tools to personalize and optimize diagnosis of CVD.

This work was funded, in part, by NIH, R01LM009722 to M.G.K. (co-investigator).

Predicting Disease-Related Mutations Based on Protein Domain Framework

Thomas Coard, *Thomas Peterson*
Maricel Kann, Associate Professor, Biological Sciences

Genomic information about individual patients can be used to significantly improve diagnosis, prognosis, and treatment of diseases, however, given the lack of known genomic associations with disease, this task remains a challenge. Due to the complexity and interconnectedness of genes and biochemical pathways it is hard to predict unknown genotype-phenotype relationships when only one gene mutation is considered at a time. To overcome these problems, we analyze mutations in the building blocks of the proteins these genes code for. We have mapped the location of disease-causing mutations to homologous protein domain regions in order to compare to variants of unknown significance using a statistical method called Domain Significance Score. We have tested three machine learning techniques to classify putative disease variants and have concluded that one of them, random forest, is optimal for our purpose. Next, we will compare our domain-based methodology against other traditional methods that use sequence conservation, structural properties, and other molecular properties to classify the variants. Our results will provide new insights into the molecular underpinnings of disease and will identify new biomarkers and drug targets, enabling therapeutic research.

An Unexpected Relationship between Pain Catastrophizing and Pain Modulation in Young Adults

Matthew Cook, Jessica Black, Cameron Riddell, Sara Mast
Raimi Quiton, Assistant Professor, Psychology

Pain catastrophizing, the negative emotional response to expected or perceived pain, is a factor that has been shown to exacerbate pain; however, little is known about the effect of catastrophizing on the function of CNS pain inhibitory systems. We hypothesized that higher levels of pain catastrophizing would result in reduced conditioned pain modulation (CPM), a laboratory measure of the function of CNS pain inhibitory systems. The Pain Catastrophizing Scale (PCS) was used to measure catastrophizing in 40 healthy adults (female = 26; mean age = 21). CPM magnitude was measured as the change in heat pain ratings induced by a simultaneous painful pressure stimulus. No significant correlation between catastrophizing and CPM magnitude was found for the group as a whole ($p>.05$). Participants were subsequently grouped into CPM responders (heat pain rating reductions of >10%, N=20) and non-responders. Unexpectedly, in responders but not non-responders, higher catastrophizing was significantly correlated with greater activation of pain inhibitory systems ($r(18) = -.612$, $p =.004$). A possible explanation is that the CPM paradigm activated stress-related pain inhibitory systems in responders but not non-responders. Our findings highlight the need to further explore psychosocial factors that contribute to the relationship between catastrophizing and CPM.

The Unsleeping Guardian: Press Freedom, Regime Type, and Political Stability in Latin America

Nora Corasaniti
Carolyn Forestiere, Associate Professor, Political Science

This research set out to explore the relationship between regime type, political stability, and press freedom in Latin American nations. The study of press freedom is and has always been an important concept to understand. Press freedom is linked to almost every facet of governance. It was theorized that nations that are democratic are also often more transparent and open, allowing the press to report on government interactions and happenings of the nation.
Furthermore, nations that are politically stable are often less violent and foster an environment in which a free press corps can thrive without fear of repercussions for reporting the news about the government as truthfully and accurately as possible. Employing data from Freedom House's 2015 "Freedom in the Press" study and data from the World Bank's Worldwide Governance Indicators 2014 annual study, various statistical tests were performed to determine the size and significance of the relationship between variables in the way predicted by the research hypotheses. Quantitative results revealed that regime type and political stability both had a significant impact on press freedom. Two brief case studies of Columbia and Uruguay were also presented as a means to better understand the causal relationships between the variables.

Study of Binding Activity of Crotamine-Au Nanoparticles with DNA

Joelle Cusic, Andrew Butler*, Giovanni Marino*
Richard Karpel, Professor, Chemistry and Biochemistry

The protein crotamine has numerous potentially useful functions, including preferential binding for rapidly proliferating cells, DNA delivery and nuclear localization upon penetrating the cell. Thus, crotamine is an attractive candidate to be used as an instrument in drug delivery or multifunctional systems. Previous studies have focused on the goal of linking crotamine to gold nanoparticles (GNP) to create this multifunctional system in conjunction with other functional linked compounds. In previous experiments, a competitive assay, using the cationic dye, Azure A, was developed to determine binding of crotamine for DNA and heparin, a highly sulfated carbohydrate chain that is similar to heparan sulfate proteoglycans present in cell membranes. This method was adjusted to study crotamine adducts with polyethylene glycol (PEG) and gold nanoparticles in this project. The binding activity of crotamine when linked to PEG-GNP has yet to be observed. The aim of this project was to utilize the dye competition assay to study the binding of crotamine-PEG-GNP to heparin and DNA. In the course of this project, PEG-crotamine alone was observed to retain the same binding affinity as free crotamine. However, the work with crotamine-PEG-GNPs is still on going, as the properties these molecules possess are still unknown.

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

Suicide Terrorism in Sri Lanka

Hanna Dasoo
Devin Hagerty, Professor, Political Science

Recent years have seen a rise in suicide bombings, prompting researchers to ask why this tactic has become so widespread as well as why individual terrorists have embraced it. This research analyzed the type of suicide terrorism utilized by the Black Tigers, the militant wing of the Liberation Tigers of Tamil Eelam (LTTE), in their efforts to "liberate" Sri Lanka's Tamil minority community. It examined the strategic logic behind this tactic and evaluated how the LTTE leadership persuaded members to carry out suicide missions, based on the portrayal of successful suicide bombers and the LTTE's culture of martyrdom. I argue that suicide terrorism was the preferred tactic of the Black Tigers because of its symbolic, sacrificial nature and its power to inculcate its members with a strong sense of group cohesion. I also examine how the LTTE's suicide terrorism has inspired contemporary terrorist groups and individuals to emulate this tactic.

Everybody's Great Emancipator? African American Attitudes toward Lincoln

Matthew Davis
Anne Sarah Rubin, Professor, History

Today most people think of Abraham Lincoln as being responsible for fighting the good fight in the American Civil War and freeing the slaves. We think of the Emancipation Proclamation and all of the dramatic paintings where Lincoln is portrayed as the great hero surrounded by sunshine with former slaves praising him in the background. He appears as the ideal fatherly president who truly believes in the equality of all men. But is this portrayal an accurate representation of who Lincoln really was? Did African Americans truly praise Lincoln as we tend to think? Did Lincoln truly believe African Americans were equal and ready to be a part of society, or did he have political motives behind his actions? I will be conducting research using both primary and secondary sources to answer these questions. Secondary sources will consist mainly of books and journal articles (from a general and southern perspective) that gauge general attitudes and feelings from African-Americans. Primary sources will be diaries and other sources that gather specifics from African-Americans from all aspects of life during and after the war and through the twentieth century.

Principal Component Analysis and Self-Organizing Maps for Classifying Cardiac Tissue Ablation

Ezana Dawit
Murray Loew, Professor, George Washington University Department of Biomedical Engineering

The aim of this study is to allow physicians to determine in real time whether cardiac tissue has been sufficiently ablated. Cardiac tissue ablation is the treatment of arrhythmias through burning the tissue with radiofrequency (RF) energy. We compared the abilities of principal component analysis (PCA) and self-organizing maps (SOMs) to identify the minimum number of descriptors, characteristics describing the data, necessary to permit accurate identification of classes. PCA is a technique for identifying patterns in datasets using orthogonal transformations to redefine the axis system to one corresponding with its principal directions of variance. SOMs are able to cluster data into "neurons" while also expressing which neurons are closer and thus more similar to each other. Our methods have been performed on the Fisher iris data set and successfully reduced the number of descriptors from four to three. We are currently waiting on ablation data in order to further explore this method.

Air Curtain Development: An Energy Harvesting Solution for Hinged Doors

Vineed Dayal
Soobum Lee, Assistant Professor, Mechanical Engineering

This research aims to develop an air curtain system that is completely mechanical, without any type of electrical power source, operated by the input energy of opening a hinged door. Frequently opened doorways are regarded as a major element that cause significant energy loss and contaminated air conditions in buildings. Private companies, particularly those with warehouses, have introduced commercial electrical air curtains to block the open entrances from invading cold air. This project developed an original design of air curtain which operates its fans only when the door opens and closes, by directly converting door hinge motion to fan rotation without any electronic motor or power cable. The air stream created by this device helps prevent the transfer of outside air and contaminants. The conducted research found that an effective wind velocity can be generated from usual doorway operation. A prototype has been built according to the Building Services Research and Information Association's standards, and the actual fan specification has been found for practical use of the developed system.

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

Improving Literature Analysis Skills in a Grade 11 English Classroom

Caitlin Dea
Cheryl North, Assistant Professor, Education

Eleventh-grade English students have a history of struggling with interpreting literature on standardized assessments. This study examines students' ability to compare multiple texts to determine theme, analyze the author's choices in creating the story, and define words in context. All of these concepts were taken from nationally aligned Common Core standards for literacy. The chosen research population was one class of 37 English 11 standard students in a suburban high school. The chosen key concepts were assessed through quarterly benchmarks. International Baccalaureate Middle Years Program rubrics were used to determine how these standards were met in the students' analytical writing assignments. In addition to this, small activity-based formative assessments were used to analyze the students' weaknesses in grasping each concept individually. By presenting engaging extracurricular material with a higher readability, students were able to analyze and interpret literature based on these standards. This falls in alliance with the chosen school's improvement plan which is to increase the rigor of students' reading materials. The selected population of students responded well to the change in instructional strategy and exceeded the target results by scoring higher on these standards on their second quarter benchmark.

A Decade in the Buckeye State: Population Change in the Counties of Ohio between 2000 and 2010

Logan Dean
Carolyn Forestiere, Associate Professor, Political Science

Over the first decade of the twenty-first century the state of Ohio has seen conflicting change in population across the 88 counties. Economic factors and policy decisions may have affected the different rates of population change across the state. Over the period of 2000-2010 unemployment increased on average state wide while home values and property tax rates fluctuated. Preliminary data analysis suggests that increases in unemployment are associated with population decline at the county level. Home values and property tax rates while likely endogenously related, positively correlated with increases in population. Data suggest that economic factors are largely determinant of population change, while tax rates may limit urban growth conversely promoting the expansion of suburbs. Ohio's significance in national electoral politics stands to be influenced by population and demographic changes. Meanwhile, the state could also be a model for the overall decline seen in the Great Lakes region.

Improving Argumentative Writing in Co-taught Tenth-Grade English

Lynne Deckel
Cheryl North, Assistant Professor, Education

Writing is a key skill that is found in multiple academic and workplace disciplines. More specifically, the ability to write a convincing argument is invaluable as students will be applying to colleges, filling out job applications, composing resumes, and ultimately securing employment positions in the near future. The argumentative writing components investigated in this study were composing a logical introduction with a clear thesis statement, incorporating the intended audience, using rhetorical strategies, incorporating support from outside sources, appealing to opposing arguments, effectively summarizing the main points, and including a call to action. Tenth-grade English students from a mid-Atlantic high school were taught lessons targeting the above argumentative writing skills. Student work was evaluated using the Middle Years Program and International Baccalaureate rubrics, both of which incorporate College and Career Readiness Standards. Through a series of small-scale writing exercises that culminated in a large argumentative paper, students demonstrated improved argumentative writing abilities by meeting more criteria on the rubrics.

DJ Rekha: Ambassador of Bhangra

Cara Dekelbaum
Anna Rubin, Associate Professor, Music

I will present DJ Rekha's "Basement Bhangra Anthem" and discuss the various influences this piece reflects. DJ Rekha is a New York-based DJ, producer, educator, and curator. *The New York Times* called her the "Ambassador of Bhangra." Bhangra is a style of folk music and dance from the Indian state Punjab. DJ Rekha is known for being one of the first DJs to merge the classic sounds of Bhangra and Bollywood with contemporary hip-hop and dance-hall beats. One of her notable songs is "Basement Bhangra Anthem." Musician and composer Wendy Carlos can be seen as an influence. Carlos popularized the Moog synthesizer with the release of her 1968 album Switched-On Bach, which featured Bach compositions played on a Moog synthesizer as well as film scores in a more popular musical language. Carlos combined classical music with electronic music. DJ Rekha is also a musical pioneer. She was raised in an Indian family and faced criticism for being passionate about hip-hop. She took her passion for music and made a career out of it by fusing different musical styles to create a new musical genre. I am investigating the cultural melting pot of her music.

Fruit Punch: A Shooting Game to Stretch the Imagination

Cosette Delisle, Hailey Lain, Kyle Boyer, Paolo Frias
Eric Jordan, Adjunct Professor, Visual Arts

The video game Fruit Punch is inspired by a need for fun and pure absurdity. The game features a two-dimensional top-down shooter, the creation of which blossomed into an exciting challenge for artists and programmers. Artists who were well versed in Photoshop were forced to learn how to create assets that could be used and animated in Unity. They used their skills to create interesting and original characters, and designed goofy worlds to give players a mindless sense of enjoyment. Programmers working in Unity were tasked with creating different game types, power-ups, and interesting levels that all types of players could easily enjoy. In the game, the player is a scientist who creates a tree that produces enough fruit to abolish world hunger. The fruit becomes sentient and bent on destroying humanity. The player, as the scientist, must fight back using a gun that shoots fruit flies in order to stop the advance of a crew of ridiculous, murderous, fruit characters. We will present Fruit Punch and the various challenges faced by the creative team.

The Transcriptional Modulator HMGA2 Promotes Glioblastoma Invasion and Tumorigenicity

Yash Desai
Eric Raabe, Assistant Professor, Johns Hopkins School of Medicine; Harpreet Kaur, Johns Hopkins School of Medicine

Glioblastoma (GBM) is a highly invasive and devastating brain tumor with no curative treatments. GBM contains a small subpopulation of tumor stem-like cells believed to be highly invasive and resistant to therapies. Novel molecular targets regulating tumor stemness and developing therapies are urgently needed to improve patient outcomes. Our group has previously shown that the developmentally important LIN28A pathway regulates the stem cell factor HMGA2 in GBM. HMGA2 is highly expressed in normal and cancer stem cells. Elevated levels of HMGA2 in tumors are associated with increased stemness and invasion. We found that HMGA2 is highly expressed in a majority of GBM tumors and patient-derived GBM cell lines compared to the normal brain. Short-hairpin RNA (shRNA) mediated reduction of HMGA2 expression decreased GBM cell invasion and clonogenicity *in vitro*. Importantly, knockdown of HMGA2 using shRNA decreased GBM tumor formation in intracranial xenografts in immunocompromised mice. Our data suggests that HMGA2 is a viable therapeutic target in GBM. Future studies will focus on identifying the molecular mechanisms downstream of HMGA2.

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The Link between Criminal Justice History and Psychosocial Variables on The Likelihood of Identifying as an Ex-Offender

Nidhi Dheman, James Byrne, Christopher Hopkins
Bronwyn Hunter, Assistant Professor, Psychology

More than 700,000 individuals return from prison to the community each year. These individuals face many challenges reintegrating into the community, sometimes due to being labeled an ex-offender. Ex-offenders have limited citizenship rights and may be restricted from housing, employment, voting rights and other opportunities. Despite this knowledge, it is not clear whether individuals exiting the criminal justice system identify as ex-offenders, or if there are certain characteristics that increase the likelihood that an individual will identify as an ex-offender. This study examines the relationship among criminal justice history (e.g., type of conviction, incarceration history, time since last conviction) and psychosocial variables (e.g., self-esteem and social support) on the likelihood of identifying as an ex-offender among a sample of 390 adults who lived in sober-living homes and had been convicted of a crime. Participants responded to a survey online, through the mail, or with assistance from a local sober-living home recruiter. Approximately 70 percent of the sample self-identified as ex-offenders. Logistic regression analyses were employed to identify correlates among criminal justice history, psychosocial variables and self-identification as an ex-offender. The results have important implications for targeting interventions based on self-identification among individuals exiting the criminal justice system.

Real Negus: Exploring Perceptions of Blackness

DeVenna Dixon
Maleda Belilgne, Assistant Professor, Africana Studies

The word “Negus” means different things to different people, similar to the meaning of the term “Blackness.” There is no concrete definition of “Blackness,” but people still attempt to limit its meaning. My film asks the question, “What does it mean to be Black in America?” I conducted my research by speaking to familiar people, as well as subjects I have no affiliation with (from the UMBC and Baltimore Inner Harbor area), before and after the 2015 Baltimore uprising. Subjects were chosen randomly from a variety of ethnic backgrounds and races. I observed that I was most able to obtain responses from minority subjects, and all of the answers were individual and unique. The interviews were recorded, edited and compiled into one black-and-white video, with a soundtrack included. The purpose of this research is to shed light on the reality of the Black American experience. Moreover, the ultimate goal was to gather individual feelings, to prove that stereotypes should not be used, and that everyone has a different understanding of what it means to be Black.

'Til the Last Bloom Dies: A Rose-Tinted Vision of Southern Women, Post-Civil War

Lindsay Dixon
Anne Sarah Rubin, Professor, History

America has remembered the powerful contributions made by white women of the South in colorful ways. This is mainly due to the romantic novelization contributing to the media portrayal of their struggles. Historians have worked to convey the accuracy of the strife and day to day living, showing the depth and breadth of the work needed to provide for their families and themselves in a sometimes futile effort to make up for lost husbands, fathers, sons and brothers by engaging the mothers, sisters, wives and daughters to step out of the house and into the fields and businesses. Books such as *Gone with the Wind*, *Cold Mountain*, *The March*, and *Oldest Living Confederate Widow Tells All* have helped put forth a stereotype of these Southern women in such a strong way that it has influenced America's vision of what and who they actually were. By comparing and contrasting reality with these limited characters, I intend to discover how much these fictional women represent the pain and struggle of the real women who went through that era.

The Resurgence of the Ancient Astrolabe

Jacob Dohl
Esther Doyle Read, Adjunct Professor, Ancient Studies

The astrolabe is an ancient navigational device whose base consisted of a small metal disk, typically bronze, engraved with astrological and chronological markings. The base was attached to rotatable bars on the front and back, allowing users to accurately sight astrological objects. The time of day and the user’s global position were arrived at using sighting measurements in conjunction with the engraved markings. The astrolabe was at the heart of ancient navigation, allowing travelers to reach their destinations with impressive accuracy. It also paved the way for future navigational tools including the mural sextant and GPS technology. Though modern advances in navigational tools have eclipsed the device it remains a useful and accurate tool. In this study subjects were provided with a model astrolabe along with verbal instructions, intended to represent how the skill was taught during the eleventh through fifteenth centuries. The subjects utilized the tool to determine the time of day, a basic application of the device. The accuracy of reported time versus the real time, as well as the duration of time required to complete the task was then recorded and analyzed. This experiment is meant to demonstrate the ease of use and accuracy of the astrolabe.

Heart Monitoring System for Personalized Arrhythmia Detection

Elise Donkor
Tinoosh Mohsenin, Assistant Professor, Computer Science and Electrical Engineering

Electrocardiogram (ECG) heart signals have universal characteristics and can be easily acquired. Therefore, they serve as highly effective diagnostic tools for a variety of biomedical applications such as sleep monitoring and anxiety detection. Cardiac arrhythmia (irregular heartbeat) consists of faster or slower than normal electrical heart activity. These irregularities can be indicators of conditions such as diabetes, cardiomyopathy, or even an incipient heart attack. The purpose of this work is to build accurate algorithms to detect abnormalities in ECG signals from patients suffering from arrhythmia. ECG signals were obtained from the MIT-BIH arrhythmia database, filtered to remove noise, and extracted for features. The signals were then detected using neural networks, a biology-inspired machine-learning algorithm. The results ultimately yielded a arrhythmia detection accuracy of over 90%. The outcome of this study paves the way for more advanced monitoring systems and biomedical devices that can detect when biological changes are happening and alert a caregiver. With the promise of wearable sensors giving way to early diagnosis and detection, arrhythmia detection algorithms may be important diagnostic aids.

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

Empowering Occupational and Physical Therapists with Three-dimensional Printing Technology

Braxton Dubin, Niara Comrie, Samatha McDonald, Nicholas Carter
Amy Hurst, Assistant Professor, Information Systems; Erin Beuhler, Information Systems

Standardized assistive technology provides minimal customizations for users and leads to ill-fit devices and user abandonment. Our goal is to use three-dimensional (3D) printing technology to empower therapists to create customizable and inexpensive assistive technology for patients. Therapists can use medical expertise to tailor adaptations to existing assistive technologies, but current efforts to customize assistive technology are limited to materials like tape, clay, Velcro, and foam padding. We plan to familiarize medical professionals with 3D printing to make highly specific modifications to assistive devices and provide them with software to make 3D models. We will train therapists to 3D print through a series classes. Through data collection methods such as surveys and interviews, we will formulate the user specifications for the software. Employing user requirements, we will develop a software using html, css, and github. Our project's success will be determined by the adoption rate of this technology among therapists in hopes of decreasing user abandonment of assistive technologies. This project provides a potential solution to the problem of ill-fitting assistive devices through training physical therapists and students on the use of 3D printing technology and experience operating user-focused software for designing 3D printed assistive devices.

This project was funded by the Collaborative Research Experiences for Undergraduates Program.

The Textbook Factor: Assessing Civil War Memory in Post-War Education, 1865-1915

Tyler Duckett
Anne Sarah Rubin, Professor, History

The aim of this text is to examine how the American Civil War was taught in textbooks and schools from the period immediately after the war until approximately 1915 – primarily when individuals directly impacted by and involved in the war would still be alive. This exploration aims to assess the extent of Civil War memory and potential bias accessible to the next generation of American citizens through education, and how that is present within the various texts examined. A series of American history textbooks originating from the period will be analyzed to gain insight regarding the various attitudes and memory surrounding the war during this time, as well as alternative sources of educational content, aimed to gauge both Northern and Southern perspectives. Similarly, the aim of this text involves investigating any potential shift in the presentation of this information over this time period.

Student Interest and Performance on Mathematics Word Problems

Paige Dutrow
Christopher Rakes, Assistant Professor, Education

The Common Core Mathematical Practice 1 states, "make sense of problems and persevere in solving them," and is critical for deep mathematical learning. Math students of all grades and levels should strive toward the standards of mathematical practice to become mathematically literate. The present study investigated whether the inclusion of student interests and the personal creation of word problems increased students' ability to make sense of word problems and solve them accurately. Data were gathered from 22 ninth and tenth grade students in a suburban high school, consisting of written word-problem solutions and participation in class discussions. Classwork and assessment questions were scored on a scale of zero to four based on students' ability to use an appropriate process, arrive at a correct answer, choose appropriate precision levels, and interpret solutions in the context of the problem. Participation in discussions around word problems was tracked for each student. Analyses will focus on the degree of improvement in student performance in mathematics problem solving and may offer support for the importance of including student interests in the context of mathematics problems.

Marylandia: The Web Series

Emily Eaglin
Vin Grabill, Associate Professor, Visual Arts

Over the summer of 2015 I wrote, acted in, directed, and produced the web series Marylandia. I released five twenty-to-thirty-minute episodes of the show and the final total duration ended up being the equivalent to shooting an entire feature film (110 minutes). The show is about Maryland identity and the social aspects that make Marylanders unique. My ultimate goal was to bring the format of sketch comedy to Maryland and bring light to state and local issues. The issues featured covered everything from poor quality produce on campus to the Baltimore uprising and transphobia. In addition to our sketches we shared the spotlight with our community through featuring musical guests, artists, and activists by creating 30-second community announcements. I discovered how interconnected art and activism are in Maryland, and Baltimore in particular; the arts and activist communities are very supportive of projects such as mine. I accomplished my goal of creating this series with community help as well as through my own determination and commitment. I hope to inspire others to apply their crafts to spotlight solutions to specific challenges they see in the world.

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

Analysis of Psychosis-Risk Screener and Interview Response Mismatch

Katlyn Easter*, Camille Wilson, Caroline Demro, Elizabeth Thompson*
Jason Schiffman, Professor, Psychology

Brief self-report questionnaires of psychosis-risk symptoms (e.g., PRIME) correlate highly with clinician-administered gold-standard interviews (e.g., Structured Interview for Psychosis-Risk Syndromes, SIPS), indicating screener utility for assessing attenuated psychosis symptoms. Nonetheless, in some instances, psychosis-risk questionnaires produce false-positives and mismatched responses relative to clinician interviews. Examination of mismatches (e.g., when an individual's response on questionnaires differs from clinical interview) may help elucidate when and why discrepant responses occur. The current study attempted to identify patterns of response mismatches between the PRIME screen and corresponding items from the SIPS for 108 help-seeking adolescents who were administered both instruments. Mismatch response rates for PRIME items ranged from 5.9-29.4%. Participants who met criteria for psychosis-risk had a tendency to report interview/questionnaire mismatch regarding "mind-reading" experiences compared to non-at-risk participants. Male participants were more likely to have inconsistent reports about the experience of "hearing a person mumbling or talking when there is no one near." Finally, mismatch rates of reported experiences of "hearing their own thoughts being spoken out loud" were greater for younger aged participants. These patterns of mismatch may clarify possible reasons for discrepancies between screener and interview measures, ultimately helping to improve screener effectiveness towards early identification of psychosis-risk.

This research was funded, in part, by the Maryland Early Intervention Program.

Cloning, Mutating and Labeling of FK506-binding Protein (FKBP)

***Chidera Ekeocha**, Erin Kennedy, Miji Jeon, Sarah Pollock, Vanessa Nwaiwu, Minjoung Kyoung*
Minjoung Kyoung, Assistant Professor, Chemistry and Biochemistry

To develop a novel sensor analyzing multi-component macromolecular dynamics, we have prepared a model system to evaluate the sensor. The model system mimics multi-protein interactions at various binding affinities. The model system comprises FK506-binding protein (FKBP), FKBP12-rapamycin binding (FRB) domain and various drugs/small molecules. To probe the interactions between complex components in a nano-sized reaction chamber we employ fluorescence resonance energy transfer (FRET). To identify potential labeling sites of FKBP we constructed the tertiary structure of FKBP-rapamycin-FRB domain in JSmol Viewer. We then identified two specific serine in FKBP, which had good solvent exposure and minimal distance, to achieve great FRET efficiency. We cloned FKBP tagged with multiple histidine from a commercially available plasmid. To avoid multiple labeling of FKBP, we then performed site-directed mutagenesis on an endogenous cysteine to a serine in the newly cloned FKBP-his gene. Next, we will exchange the identified serine with cysteine. The gene will be expressed and the mutant FKBP-his will be purified from bacteria culture. We will label the purified mutant FKBP-his with cyanine dye, cy3. Using this model system, we will next evaluate the novel sensor tracking interactions between FKBP, FRB domain and various small drugs.

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

Gender Differences in Perceived Social Support and Heat Pain Tolerance

***Chiamaka Ekwunazu**, Eryka L. Boyd*
Raimi Quiton, Assistant Professor, Psychology

Perceived social support (PSS) has been implicated in positive responses to stressors, including bodily pain. Pain as a stressor has been determined to affect males and females differently, with females often experiencing increased pain sensitivity and lower magnitude of conditioned pain modulation (CPM), a form of pain inhibition. In this study we tested the hypothesis that a higher level of perceived social support contributes to a more healthy response to pain, including an increased amount of CPM, a higher pain tolerance, and a higher pain threshold. Participants in the study (n=76) were recruited and completed the Multidimensional Perceived Social Support Assessment in order to assess their levels of perceived social support from family members, friends, and significant others. Heat pain tolerance was significantly correlated with more PSS from a significant other in women ($p = .026$), but not in men ($p > .05$). Surprisingly, PSS was not significantly correlated with other pain measures, suggesting threshold and CPM are pain

measures that are not as modifiable as tolerance. This result may indicate that one's perception of the amount of social support in their relationships is modulated by gender-specific socialization experiences. Additionally, pain tolerance in women appears to be modulated by social support.

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To Assess Phylogenetic Relationships and Test Speciation Mechanisms in Darter Fish (genus: Etheostoma) in the U.S.

Samantha Eng
Tamra Mendelson, Associate Professor, Biological Sciences

This study used molecular methods to determine the relationships of species in a group of fishes (Genus Etheostoma, subgenus Doration) that appears to be an excellent example of speciation by sexual selection. Species in this group differ mostly in male breeding color, which is a sexual ornament. There is a suggested phylogenetic hypothesis of this subgenus based on morphology and breeding colors. However, molecular techniques have not been used. A phylogeny based on molecular (DNA) data is critical in modern biology. Mitochondrial cytochrome b sequencing and ddRADseq were primarily used since they have been shown to support relationships among darters. This study also used behavioral observational techniques during the mating season to test hypotheses about speciation mechanisms that involve mating preferences of males and females of different species. It is important to estimate a phylogenetic hypothesis of the subgenus to track the evolutionary history of the group and determine the speciation mechanisms. This phylogeny will allow us and others to select species based on their evolutionary relationships for future research. In addition, because of how widespread the species of this subgenus is throughout the United States, this work can provide insight into the geography of this area.

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

Power Feasibility Study of *in vivo* Electromagnetic Generator for Power-Sustainable Smart Knee Implant

Trevor Evans
Soobum Lee, Assistant Professor, Mechanical Engineering

Various kinds of *in vivo* sensors are used to monitor vital statistics for high-quality healthcare. These sensors are able to provide feedback on the state of an implanted joint in the body, giving key information such as force and wear and tear on the artificial device. The information helps patients correct any problematic habits and thus prolong an implants' useful life. However, it has been challenging to power these sensors for constant use without maintenance (i.e., battery

replacement or re-charging). In this research, we constructed an electromagnetic generator mounted on a knee implant and performed a feasibility test on power generation. The compact generator is embedded inside the knee implant and generates electrical energy derived from the normal knee joint motion during walking and running. Successful completion of this experiment will provide sustainable power supply to monitoring system and help patients to extend the use of implants, and even improve the patients' quality of life by removing replantation and continuous recharging of battery-operated *in-vivo* devices.

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The Effect of Students' Stress on Teacher Evaluations and Potential Burnout

Marziyeh Farshchian
Diane Alonso, Senior Lecturer, Psychology; Robin Goldstein, Psychology

Recent research has examined the relationship between frequent testing and student anxiety. Studies from the public school system have reported on the increased level of stress brought about by the overload of mandatory testing. This stress has been shown to continue into college, especially in classes in which instructors give many tests and exams. The current study examined whether students felt that teachers focused too much of the overall grade on test performance; and it also explored whether teachers perceived their student course evaluations as a major source of stress, since those evaluations were often based on student satisfaction. Approximately 50 undergraduate students and 50 faculty members were selected at random from the Universities of Shady Grove (USG) campus and the University of Maryland, Baltimore County (UMBC) main campus. Every participant filled out the Maslach Burnout Inventory (MBI), which measures burnout, depersonalization, and personal achievements. Teachers also filled out a teacher-focused questionnaire and students completed a student version of the same questionnaire. Results were expected to show a relationship between teachers' perceptions of how student evaluations affected their job status and their MBI scores; and also how student perceptions of tests and exams correlated with their MBI scores.

Propaganda Animation During World War II

Brake Finson
William Shewbridge, Professor of the Practice, Media and Communication Studies

During World War II the United States government enlisted the aid of several film studios in supporting the war effort. Studios without official contracts also tended to produce war themed material. For the several large animation studios, this involved the production of propaganda cartoons. My project investigates how these studios adapted to the challenge of presenting a united front in wartime. The Second World War was the first time Hollywood had any large-

scale involvement with war propaganda. For this reason, there was much experimentation in how to most effectively get their messages across. My research found that government contracts had a strong influence over the portrayal of the war in these cartoons. Unlike most other studios, Disney had an official contract with the government. Because of this, they produced many cartoons which instructed the viewer how to be a good citizen and help the war effort. Most other studios produced works purely for entertainment purposes. I conducted most of the secondary source research for this project at the MICA library. Another major source was the databases from Johns Hopkins University. I used both microfilm and online archives for newspaper articles and advertisements from 1941 to 1945.

Modular Bot for Emergency Reconnaissance

Mark Fisher, Jacob Darling, Sekar Kulandaivel, Gavin Lebo, Christian Alvin Aditya
Charles LaBerge, Professor of the Practice, Computer Science and Electrical Engineering;
Cynthia Matuszek, Assistant Professor, Computer Science and Electrical Engineering

First responders have very little information when they arrive to many emergency situations. A reconnaissance robot would allow these brave men and women to fully understand the situation without unknowingly risking their lives. There are many unmanned robotic vehicle solutions on the market; however, most lack the adaptability to handle a variety of emergency situations. To satisfy these needs, our work focused on the modularity and adaptability of a reconnaissance robot by incorporating a series of impact-resistant, interchangeable sensor modules. The prototype was designed to traverse through any ADA-compliant building with any number of feedback sensors that communicate through a Wi-Fi network to the first responder. The first responder was able to observe all of the sensor data in real-time through an intuitive command-and-control graphical user interface. Simply attaching an additional battery module to the chain increased the robot's time in the field. The combination provides adaptability, longevity, and ease of use and allows any first responder to quickly survey many different types of emergency situations without risk. Future work will focus on increasing maneuverability and reliability in more extreme environments.

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

Elucidating the Cellular Response Mechanisms of *S. cerevisiae* to Repression of the Essential Ribosomal Protein RPS15

Skylar Fisher
Lasse Lindahl, Professor, Biological Sciences

Ribosomes are the complex molecular machines which are responsible for the translation of mRNA into protein. In spite of many advances in the last fifteen years, much remains unclear about how ribosomes are built and maintained in the cell. Working in *Saccharomyces cerevisiae*, we hope to elucidate the effect of nucleolar stress on ribosome biogenesis. We induced nucleolar stress by repressing essential ribosomal proteins such as RPS15. The ribosomal species present in the cell culture after RPS15 repression were visualized by sucrose gradient analysis. Interestingly, the sucrose gradient profile for the RPS15 repression showed the presence of an additional peak compared to the wild type. Western analysis of the contents of this peak indicated the presence of large subunit ribosomal proteins, possibly establishing the identity of this particle as a ribosomal large subunit precursor. These data indicate the possibility of previously unknown cross-regulation between the large and small subunit maturation pathways of the ribosome.

Analysis of Psychosis Risk Interview Questions for Individuals with Autism Spectrum Disorders

Rivka Fleischman*, Camille Wilson*
Jason Schiffman, Professor, Psychology

Assessing for risk of psychosis among individuals with autism spectrum disorders (ASD) presents challenges as core symptoms of ASD can be difficult to disentangle from psychotic symptoms. The Structured Interview for Psychosis-Risk Syndrome (SIPS) is a semi-structured interview to assess attenuated symptoms of psychosis. Although the SIPS is used among individuals with ASD, its utility has not yet been demonstrated. This study examined expert clinicians' assessment of how SIPS interview items may be interpreted by adolescents with ASD. Clinicians (n=14) with ASD expertise were asked to rate questions from the SIPS based on their ease of interpretation for youth with ASD. If they were rated as difficult to interpret, the experts were then asked to describe why. Of the 95 SIPS questions, 35% were flagged as problematic for the ASD population by a majority of clinicians. The reasons the clinicians gave fell into categories of 1) poor wording, 2) complexity, and 3) overlapping symptoms between the two disorders (e.g. social skills difficulties, obsessions or rigidity of thought, sensory challenges, language problems, misunderstanding emotions). Given the growing recognition of overlap between ASD and psychosis, this study offers insight into how clinicians can more accurately assess psychosis-risk symptoms in individuals with ASD.

Transcranial Alternating Current Stimulation (tACS) Modelling and Measurement of Brain Phantom

Kolton Fodel
Fow-Sen Choa, Professor, Computer Science and Electrical Engineering

Transcranial Alternating Current Stimulation (tACS) is a non-invasive method of exciting the neurons of the brain. It uses pairs of electrodes placed on the scalp to create an electric field in parts of the brain. By focusing this field, weak electric currents can be created in specific areas of the brain. tACS offers a potential non-invasive method of treating many brain-related ailments including Parkinson's disease, schizophrenia, Alzheimer's disease, and depression. To develop better tACS results, we conducted COMSOL simulations on different concentric ring designs. Closely spaced, narrow rings produced the most focal electric fields. To further improve focality, a DC magnetic field was applied to guide the currents induced in the brain. Essentially, the magnetic fields were used to decrease conductivity of the brain in directions perpendicular to the magnetic field. This allowed us to create a thin rod-like current distribution. With this design, arrays of electrode pairs can be applied on two sides of a head and weak AC current sequentially applied to each pair within the neuronal charge holding time. By allowing only the overlapping point's current to be strong enough to induce action potential, we can achieve focused stimulation at any desired location in the brain.

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

Genetic Screen of Rgma Mutants

Caitlin Ford
Rachel Brewster, Associate Professor, Biological Sciences

Repulsive Guidance Molecule family member a (Rgma) is a GPI-anchored membrane protein that inhibits regeneration and assists differentiation. In order to explore Rgma function in the developing central nervous system (CNS) of zebrafish, we mutagenized exons 2 and 3 of the *Rgma* locus in zebrafish embryos using the universal CRISPR/Cas9 system. Manipulated founders (F0 generation) were screened by PCR, restriction digest, and high resolution melting analysis (HRMA) and had a mutation rate of ~80 %. However, F0 tissues were mosaic for wild type (WT) and/or various mutant *Rgma* alleles. Stable mutant alleles were isolated by generating heterozygous F1 progeny produced by an F0 X WT cross and screening larvae or adult tissues using the above methods. The F1 progeny were then outcrossed to WT fish to produce F2 offspring. F2 progeny were interbred to produce F3 progeny with homozygous and heterozygous *Rgma* alleles. We will use our CRISPR-induced mutants to investigate the role of Rgma during neural convergent extension (NCE), an early, conserved stage of neural tube development that is marked by high Rgma expression. We predict that our targeted mutagenesis approach will overcome the specificity challenges of Morpholino-based loss-of-function work.

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Evaluating Educational Games for Validity and Student-Player Engagement

Adam Freitag
Steven McAlpine, Assistant Director, Interdisciplinary Studies; Joan Kang Shin, Professor of Practice, Department of Education; James Thomas, Adjunct Faculty, Department of Philosophy

In order to ensure that educational games meet their stated learning objectives and are engaging to the student-player, quantitative assessment measures must be implemented. At present, research shows that a small number of assessment methods are being used, but there is disagreement as to which methods work best. In order to add to the existing literature, I have formulated EGAME (**E**ducational **G**ame **A**ssessment **M**easure of **E**ffectiveness), a new measure which analyzes the effectiveness of a given educational game on two separate dimensions (1) whether or not it is valid (i.e., meets the learning objectives stated by game's designer, based on Bloom's Taxonomy), and (2) whether it provides an engaging enough environment to keep the student-player playing (based on Deci and Ryan's Self-Determination Theory). This measure was tested over two semesters on Organic Panic!, an educational game developed by INDS 330 Honors students. EGAME serves both educators and students by providing a simple, easy-to-understand score that rates the effectiveness of the educational game in question.

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

Skeletal Muscle Atrophy Model

Samantha Furman
Bradford Peercy, Assistant Professor, Mathematics and Statistics

In skeletal muscle, atrophy occurs when a transcription factor, Foxo, becomes activated through dephosphorylation and enters the nucleus. External signals such as insulin help to keep Foxo phosphorylated. Previous research has given parameters for the rates of phosphorylation and dephosphorylation with a steady-state insulin value. We were recently able to enhance this model by modeling the effects of external stimuli, such as insulin like growth factor 1 (IGF-1) on the phosphorylation and dephosphorylation process inside and outside of the nucleus. We were able to link a previous model of insulin/IGF-1 activation of the phosphorylation enzyme Akt with our model of Akt phosphorylation of Foxo-1 to quantify the insulin/IGF-1 impact on the Foxo-1 nuclear cytoplasmic ratio. Furthermore, we were also able to replicate a model for other external stimuli such as Leptomycin, which allows us to study specifically the dynamics of the efflux of Foxo-1. We conducted this research using differential equations, non-dimensional analysis, parameter optimization and simulation using dynamical systems software, primarily MATLAB.

This system is a prototype of other transcription factor nuclear translocation systems that will benefit from our mathematical analysis.

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Understanding Induction of Suspended Animation in Zebrafish

Austin Gabel
Rachel Brewster, Associate Professor, Biological Sciences; Young-Sam Lee, Biological Sciences, Johns Hopkins University

Deprivation of oxygen, or ischemia, is observed in stroke, heart attack and cancer, and leads to severe depletion of intracellular energy. Depletion of adenosine triphosphate (ATP), the major cellular energy source, is believed to be irreversibly damaging to living tissues. Some organisms have adaptive mechanisms that prevent them from completely expending ATP under low- or zero-oxygen conditions. These processes are not well understood, but a prevailing idea is that arrest of activity or "suspended animation" prevents complete depletion of ATP. Zebrafish embryos arrest under anoxia within thirty minutes, suggesting arrest is triggered possibly involving a key change in metabolites. A favored model for oxygen sensing supports that the decrease ATP and corresponding increase in adenosine monophosphate (AMP) serve as the proximal signal to trigger arrest. Working in collaboration with Dr. Young-Sam Lee at Johns Hopkins University, we are utilizing metabolic profiling, an unbiased approach, to identify rapidly changing metabolites after exposure to anoxia in Zebrafish. Interestingly, the levels of lactate, a byproduct of anaerobic respiration, change dramatically and may precede the previously reported changes in AMP:ATP ratio. Current experiments are attempting to elucidate a possible role of lactate in signaling developmental arrest, as well as identifying other key metabolites.

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

'There is no good and evil, there is only power': Harry Potter and Political Theory

Taisha Gainor, Asfiya Mariam
Lisa Vetter, Assistant Professor, Political Science

This study analyzed one of the most influential book series of our generation, J.K. Rowling's *Harry Potter.* With an audience of 400 million readers worldwide, and translated into 68 languages, *Harry Potter* has become an indispensable part of the lives of generations of people. Scholars have begun to examine the social, cultural, and ethical values contained in the books. What does *Harry Potter* teach us about political life? How has it shaped our views on society

and its political structures? This project hypothesizes that the values and ideals of the four Hogwarts houses reflect the theories of important political theorists. Specifically, the houses Gryffindor, Ravenclaw, Hufflepuff, and Slytherin correspond to ideas of Jean-Jacques Rousseau, Plato's Socrates, Karl Marx, and Adam Smith, respectively. They embody justice and bravery, wisdom and knowledge, kindness and loyalty, and ambition and merit. Rowling provides her audience with an opportunity to explore these competing theories and gain a greater appreciation for their ongoing relevance in today's world. We conclude by exploring the influence of these political theories on the political values of millions of individuals and the political structures they have formed in the present day.

The Forgotten 47th: Memories of the 47th Alabama Infantry Regiment

Alan Gibson
Anne Sarah Rubin, Professor, History

The men of the 47th Alabama Infantry Regiment fought valiantly in some of the most heated and memorable battles of the Civil War, such as Gettysburg and Antietam, and on grounds that every Civil War Historian knows, such as Dunkard Church and Little Round Top. They faced some of the most famous Union regiments like the Iron Brigade and the 20th Maine, but unlike their counterparts have, for the most part, largely been forgotten by Civil War Historians. This presentation will track the 47th through their own memory of the war and experiences afterward, the writing of Civil War historians, national newspapers, and local events in the years and decades after the surrender at Appomattox Court House.

A Comparison of Song Patterning between Eastern Grasshopper Sparrows and Florida Grasshopper Sparrows

Lauren Gorelik, Rebecca Gregory
Bernard Lohr, Assistant Professor, Biological Sciences

We analyzed the daily and monthly patterns of singing of the endangered Florida Grasshopper Sparrow as a comparison with the singing patterns of the Eastern Grasshopper Sparrow. We operated six autonomous audio recording units in male territories from 04:00 – 22:00 EDT during May, June, and July 2014. Grasshopper Sparrows produce two song types during the breeding season: the “buzz” (primary) song and the “warble” (sustained) song. Using the Syrinx sound analysis software, we counted the number of buzz, warble, and combined buzz-warble songs throughout the three-month breeding season. Paired males showed regular song transitions between the buzz and the warble song types throughout the breeding season. In both subspecies we identified one major singing peak from 05:00 – 08:00 EDT and a shorter singing peak from 20:00 – 21:00 EDT. Additionally, we found a substantial decrease in the proportion of warble song in the third month of the breeding season. Although this decline is similar for both subspecies, the reasons for the diminution are unknown. The decline may have similar causes for

both subspecies (photoperiod, for example), but these causes may also differ, as conditions differ between the Eastern and Florida habitats in July.

This work was funded, in part, by the United States Fish and Wildlife Service.

Transcultural Studies in Televisual Language

Vicki Goutzoulis*, Landry Digeon, Ibrahim Er*
Edward Larkey, Professor, Modern Languages, Linguistics, and Intercultural Communication

This research sought to better understand and define what constitutes the "language" of television and involved a cross-cultural comparative quantitative and qualitative analysis of episodes from a Greek adaptation of the British medical series, Doc Martin. This research is particularly relevant due to the increasing volume of deterritorialized and localized narratives circulating within the global television format trade. Utilizing software tools like Adobe Premiere Pro, Atlas.ti, and Final Cut, I conducted a cross-cultural analysis of components like narrative structure, sound, music, camera, lighting, and dialogue and demonstrated how these contribute to adapting for cultural proximity in the new setting. This comparative methodology led to an analysis of cultural components such as gender, masculinity, and community. Each adaptation adjusts for cultural proximity by adjusting to cultural norms of gender, setting and community, with further adjustments in camera work and lighting. Comparatively, the Greek adaptation utilizes comical, campy humor to resolve conflict, while the Greek perception of community is evident in a more congenial depiction of the townspeople, and a less formal representation of business and professionalism.

By Ear: Hearing Poems into Being

Emily Grace
Lia Purpura, Writer in Residence

By Ear: Hearing Poems into Being describes an experimental approach to the composition of poetry, drawing upon my own experience of "writing by ear." As a writer, prior to working on this project, my compositional method was based upon hearing spoken phrases, jotting them down, and returning to them later. By the time I returned to my notes, however, I had lost the intensity and honesty of the phrase, or was too worried about forcing deliberate meaning into it. I set for myself the task of writing as much as possible as soon as I heard one of these suggestive phrases, exploring where it led until the idea was spent. This process forced me to write by ear and instinct, paying attention to patterns, rhythms, and stresses in natural and organic ways. I would later refine and edit these pieces into their finished states. My presentation and performance will focus on a discussion of this method as I explore my own work, as well as incorporating interviews from professional writers about their practices of "writing by ear." It

will also discuss how there is still an element of writing poetry that remains mysterious, despite an intentional and organized method.

Role of BRCA1 in the Susceptibility of Obesity

Shana Gregory
Laundette Jones, Assistant Professor, University of Maryland, Baltimore

Breast Cancer gene 1 (BRCA1) is best known for its role in preventing breast cancer. Mutations in BRCA1 predispose women to develop this disease. Recent studies suggest that mutations in the BRCA1 gene may also place people at increased risk for metabolic diseases such as obesity. We have found that that of the weight of adult male mice with loss of full-length BRCA1 is significantly greater than wild-type male mice. Building on this finding, we conducted the present study to determine whether there were differences the expression of BRCA1 in the white and brown adipose deposits in BRCA1 mutant mice. Using RT-PCR, the full-length and short (lacking exon 11) BRCA1 isoforms were analyzed in three fat depots: brown, subcutaneous, and gonadal adipose tissues. Our preliminary findings show that brown and white adipose tissues express both long and short forms of BRCA1 in six-month-old mutant mice. Interestingly, only the long form of BRCA1 was expressed in these tissues in mice at 12 months of age. We anticipate that these studies could provide insight into the significance of BRCA1 beyond its role in cancer risk.

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

Black Women in the West: Agency and Authority

Raquel Grinage-Ojooniyun
Michelle Scott, Associate Professor, History

Twentieth and 21st century literature and films often show the West during the 19th century as a region of America having an abundance of saloons, cowboys, sheriffs, and prostitutes. In popular culture, these people led lascivious, isolated and violent lives. Typically, Western residents are represented as white cowboys, Native American rebels and Chinese laborers. Excluded from the "Wild West" narrative are black women. While mid-1850s black populations were some of the smallest in the west, they increased in the post-Civil War era, and black frontier women's lives were some of the most vibrant. Western black women were free from many of the restraints black women faced in antebellum Southern states, and the allegedly more racially lax Northern states. Due to the independent nature of the West, some black women were given the opportunity to create their own schools, towns and invest in themselves. This research argues that black women attained great wealth in California during the mid to late 19th century, primarily because of the lack of development and social boundaries. This poster explores the lives of Biddy Mason

and Mary Pleasant who became black female pioneers in San Bernandino, Los Angeles and San Francisco between the 1850s and 1890s.

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

Creating a Biosensor to Measure Astrocytic ATP Release

Brenda Gutierrez
Ryan White, Assistant Professor, Chemistry and Biochemistry

The abnormal release of ATP by astrocytes 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 utilized for the quantification of ATP released by astrocytes, providing further insight into the function of this release in the brain. E-AB sensors use aptamers, which are oligonucleotides that bind a specific target such as ATP. These aptamers undergo a conformational change upon target binding, resulting in an increase in current that is quantitatively related to ATP concentration. We have optimized a micro-cylinder ATP E-AB sensor that will be used to make bulk measurements of ATP released from astrocytes cultured in a 3D collagen hydrogel serving as an *in vivo* mimic. In order to make these measurements, we performed calibration titrations to determine the percent signal changes corresponding with different ATP concentrations at room temperature and 37°C (cell incubation temperature). We found that the optimal frequencies used in square wave voltammetry for current measurements increased with increasing temperature. These new optimal frequencies will be used for measurements using cells cultured in a collagen hydrogel.

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

Investigating the Role of PRR5, PRR7, and PRR9 in Regulating Plant Immunity

Amelia Hallworth
Hua Lu, Associate Professor, Biological Sciences

Successful defense against pathogens is critical for plant survival. Recent studies have shown that the circadian clock, the internal time-measuring machinery, is involved in salicylic acid-(SA-) mediated disease resistance in addition to its roles in plant development. One such protein, LUX, binds to the promoters of the clock genes *PRR5, 7,* and *9*; however, it has not been reported whether *PRR5, 7,* and *9* are involved in defense. We have preliminary results to show that these genes are involved in defense. To confirm if these genes affect SA-mediated defense, we introduced individual single mutants of the genes *PRR5, 7,* and *9* into *acd6-1*, a small mutant

plant with constitutive defense whose size change predicts the defense levels. I have isolated the double mutants (*acd6-1prr5, acd6-1prr7, acd6-1prr9*), two triple mutants (*acd6-1prr5prr9* and *acd6-1prr7prr9*), and the quadruple mutant (*acd6-1prr5prr7prr9*). This spring, I will assess the plant phenotypes by measuring their sizes, cell death levels, and the expression of defence genes. Analysis of *acd6-1* phenotype suppression, if any exists, will show whether the *PRR5, 7,* and *9* genes act in a synergistic manner in the SA pathway. Significant phenotypic recovery would be evidence for roles of these genes in defense control.

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

Creating a Fiber-Laser Based System for THz Spectroscopy

John Hannegan
Michael Hayden, Professor, Physics

The purpose of this work was to create a fiber-based THz system operating at a wavelength of 1550 nm. THz spectroscopy and imaging has applications in fields such as materials science, medicine, and security. Current systems require large amounts of space to operate, as well as taking a long time to collect data. An optical-fiber-based THz system provides a more compact, mobile, and inexpensive means of performing THz spectroscopy than current commercial systems, while also increasing the rate of data collection. To build such a system, different emitters and detectors of THz radiation were paired together and tested to find the best pairings in terms of signal-to-noise ratio and bandwidth at 1550 nm. A technique known as Asynchronous Optical Sampling (ASOPS) was explored to achieve higher signal-to-noise ratios needed when using the relatively low power fiber lasers, while also eliminating the need for the large moving stages traditionally used in THz spectroscopy and allowing for extremely fast averaging of the THz signal. Results of this system development and suggestions for future work will be presented.

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

Comprehending Translational Missense Errors in *Saccharomyces cerevisiae*

Shahzeb Hassan*, Kartikeya Joshi*
Philip Farabaugh, Professor, Biological Sciences

The process of synthesizing proteins in cells, called translation, is carried out by adaptor molecules (tRNAs), which read three-lettered mRNA codons. Errors occur rarely during translation; misreading errors, substituting one amino acid for another, are the most common. Our lab focuses on these missense errors, which can result in an inactive protein. We have

developed systems to assay translational errors. The systems use mutant forms of genes that encode easily assayed enzymes and carry a mutation that alters an essential amino acid. Occasionally, the mutant codon will be misread, producing the normal wild-type protein, which has full activity. Sometimes it is not clear that increased activity is caused by an error in translation. To test that, we used a hyper accurate strain. If activity resulted from translational error, it would have been reduced in this strain, which is what we observed. Using these methods, we investigated errors at the third position of the codon, which had been predicted to be most error-prone. Our research aims to improve our understanding of translational misreading in *Saccharomyces cerevisiae* and contribute to the development of a broader perspective of errors in eukaryotic processes.

Characterizing Matrix's Role in Packaging tRNALys3 IN HIV-1 Virons via Site-Directed Mutagenesis of Highly Basic Patch

Tarik Hawkins
Michael F. Summers, Professor, Professor, Chemistry and Biochemistry, and Investigator, Howard Hughes Medical Institute

Upon infection of a CD4+ lymphocyte, the RNA genome of HIV is reverse transcribed into DNA. The initiation of this process requires a host cell tRNALys3 to act as a primer and bind to the primer binding site of the genomic RNA. After non-specific integration and subsequent transcription, the unspliced variant of the resultant RNA can be translated into gag and gag-pol proteins. The N-terminal of these polyproteins is characterized as the Matrix domain, which is quintessential for late stage HIV virion formation. Past studies have shown that the Matrix domain binds to RNAs, the majority of which are tRNAs, via a highly basic region. The previously mentioned tRNALys3, though found at a relatively low concentration in the cell, binds with a high frequency, suggesting that Matrix may play an integral role in packaging tRNA for further use. Our goal is to structurally characterize matrix and tRNA interactions through the use of Electrophoretic Mobility Shift Assays (EMSA). Here, we have constructed mutants at residues which have been previously reported to be integral for specific binding to PI(4,5)P2 containing membranes. The mutant construct K29A did not show a significant decrease in tRNA binding. The K29/31A construct needs to be studied further.

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Improving Student Sight Reading

Emily Hinz
Brian Kaufman, Assistant Professor, Music

In Western music education, sight reading is a skill that all music students must develop. Whether auditioning for All-State or reading through a new piece in class, all students need to sight read. Thus, it is critical that every student in the classroom be equipped to face this challenge. This project measured the growth of 60 sixth-grade students' sight-reading skills over one year. To measure growth in sight reading, a baseline test of eight measures was administered to all the students at a level one difficulty generated by Sight Reading Factory. If the students made fewer than two errors, they were given a level two sight reading excerpt. This practice was followed for level three sight reading excerpts as well. The students' performance was evaluated using domains from one to four, with domain one for limited sight reading skills, domain two for developing, domain three for proficient, and domain four for exemplary. After the baseline test, the students' sight reading skills were developed through instruction regarding sight reading strategies and rhythm instruction, while integrating both group and individual sight reading practice. The project's goal is to improve the thirty lowest-scoring students' performance by one domain level.

Parental Stress Impacts Children's Effortful Control through Maternal Psychological Well-Being and Physical Coercion

Christina Hong*, Merve Balkaya, Charissa Cheah*
Charissa Cheah, Professor, Psychology

Children's effortful control (EC) predicts their behavioral, emotional, and academic outcomes. Parents can undermine children's EC by employing highly controlling parenting practices such as physical coercion (PC). Asian-American parents are characterized as more controlling than European-American parents. However, the processes through which contextual and personal characteristics lead to controlling parenting practices and ultimately Asian-American children's EC is unknown. Asian-American mothers may experience high levels of parenting stress (PS) as immigrants navigating their new environment, which may impair their psychological well-being (PWB). Furthermore, mothers with decreased PWB might be more likely to use PC, which undermines their children's EC. The present study examined if Asian-American mothers' (N=111) PS predicted their PWB, which in turn predicted maternal use of PC, and ultimately their preschool children's EC, using questionnaire data. Serial mediation analysis indicated that higher PS predicted lower levels of maternal PWB ($a1=-0.90$, $SE=0.17$, $p<.001$), which in turn was associated with an increased use of PC. Higher PC was ultimately associated with lower levels of children's EC ($a3=-0.02$, $SE=0.01$, $p<.01$). All indirect effects were significant. Implications for the implementation of culturally-appropriate programs will be discussed.

Environmentally Benign Semiconductor Quantum Dot/Polymer Hybrid Solar Cells

Chana Honick
Zeev Rosenzweig, Professor, Chemistry and Biochemistry

Recently, much research has been done investigating the use of semiconductor quantum dots in photovoltaic devices. Semiconductor quantum dots have a range of optoelectronic properties that make them excellent candidates for use in photovoltaics. They are excellent optical absorbers over a wide range of tunable wavelengths, including the visible range, and they are highly efficient at facilitating charge separation, an imperative function in photovoltaics. However, most quantum dots used in optoelectronics are comprised of crystals containing heavy metals, such as lead sulfide (PbS) and cadmium selenide (CdSe). When particles degrade, heavy metal ions are released and are toxic to humans and the environment. Alternative materials, such as indium phosphide (InP), are non-toxic, and are currently under investigation as possible replacements for toxic materials. This study focuses on comparing solar cell functionality when InP is used to replace CdSe in hybrid polymer/quantum dot solar cells. Cells are fabricated using concentrated organic based quantum dot and polymers blends. Current and voltage characteristics are determined using a home built Arduino-based instrument. Solar cell functionality is determined relative to a standard silicon based solar cell.

This work is funded, in part, by the National Science Foundation Award CHE-1506995.

Changes in Thin Film Metallic Glass Microstructures upon Annealing in the Supercooled Liquid Region

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Yanhui Liu, Department of Mechanical Engineering and Materials Science, Yale University

Bulk metallic glasses (BMGs) are great candidate materials for many technological applications because they have high strength, ductility, corrosive resistance, and tuneable properties. We are applying an approach using thin film metallic glass (TFMG) where we simultaneously create many different TFMGs and measure their properties. We then develop the BMGs with the same composition as the TFMGs with the best properties. In this approach microstructures form in TFMGs that prevent precise measurements of some properties. We believe that without these microstructures TFMGs properties can be measured more accurately. We studied changes in TFMG microstructures upon annealing near their glass transition temperature (T_g) to see if we can eliminate them. We used two films, $Mg_{74.5}Cu_{15}Y_{10.5}$ (T_g of 149.9°C) and $Au_{59}Cu_{21}Ag_8Si_{12}$ (T_g of 135.7°C) made via magnetron co-sputtering. The films were cut into 1 cm^2 samples and annealed in a vacuum furnace $Mg_{74.5}Cu_{15}Y_{10.5}$ at .95T_g, T_g, and 1.05T_g, and $Au_{59}Cu_{21}Ag_8Si_{12}$ at .88T_g, .92T_g and .97T_g all for 10, 20, and 30 minutes. The samples were then characterized using x-ray diffraction (XRD), and scanning electron microscopy (SEM). Our findings indicate that the diameter of TFMG microstructures increased when annealed at temperatures above T_g and how much the annealing conditions affected its atomic structure.

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Identification of Possible Demethylases for H4 Lysine 5 Methylation in *Saccharomyces Cerevisiae*

Oluwagbotemi Igbaroola, *Deepika Jaiswal, Omolayo Fatola*
Erin Green, Assistant Professor, Biological Sciences

Post-translational modification of histones, especially H3 and H4, is an epigenetic mechanism for regulating gene transcription by altering chromatin structure, which has been linked to several human pathologies. Although long considered a permanent modification, histone methylation is a dynamic process, which can be reversed by demethylase enzymes. While many histone demethylases have been characterized, the functions of other demethylases remain unknown. This study aims to identify possible demethylases for lysine residues 5, 8, and 12 in histone H4. We examined the methylation patterns of five strains of yeast with deletions of the Jhd1, Jhd2, Ecm5, Gis1, or Rph1 demethylase genes. Proteins from purified nuclei were analyzed by Western bloting with antibodies against methylated H3, H4 and H4 K5. We will present results showing enrichment of histones H3 and H4 in our nuclear extracts, and potential signal for H4 K5 demethylation [LL1] [TI2]. This procedure will be followed by a mass spectrometry analysis to establish precise patterns of methylation. Ultimately, improved molecular understanding of these dynamics may highlight new areas of epigenetic control that can become dysregulated in the progression of many diseases.

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

CK Barlow and her Influence in Electronic Music

Karena Ingram
Anna Rubin, Associate Professor, Music

CK Barlow is a Baltimore-based composer and producer whose works have been featured in many large media outlets, such as ABC, NBC, MTV, and CNN. While she has an extensive career in media music production, Barlow also experiments with electronic music. She is known for manipulating sampled sounds with software such as Max/MSP and other digital tools. In works such as *Elevator Music*, featuring processed elevator and machine noises, and *eFfeM: Short Pieces for Vibrators and Radio*, sampling radio signal noises and vibrator sounds, Barlow's sources of inspiration are extensive and full of variety. The influence of Pauline Oliveros has a strong presence in Barlow's work, through use of techniques such as layering multiple textures and sounds while using electronic manipulation to create distortions, as well as

pairing these distortions with sounds created from synthesizers. Barlow is interested in expanding the presentation of acousmatic music beyond the parameters of simple speaker playback. In analyzing her compositional process of her piece *Elevator Music*, written in 2015, I will be focusing on Barlow's use of technology and algorithmic processes in its application of creating live improvisational performances of her electronic music and how it innovates the practice of live performances today.

Characterization of the HIV-1 U5:DIS Interaction

Aishwarya Iyer
Michael F. Summers, Professor, Professor, Chemistry and Biochemistry, and Investigator, Howard Hughes Medical Institute

Human Immunodeficiency Virus Type 1 (HIV-1) is a retrovirus that targets helper T cells, compromising the immune system. Multiple drugs target various points in the viral replication cycle but are combined into a drug cocktail due to viral mutations that contribute to drug resistance, consequently causing physiological side effects. However, no drug targets the translation or genome recognition portion of the replication-cycle, which is characterized by an equilibrium between monomer and dimer conformations of the highly conserved 5′-Leader (5′-L) of the HIV-1 RNA genome. The 5'-Leader contains a pseudo-knot interaction between the U5 and DIS hairpin loop is characteristic of the native monomer conformation. Unfortunately, this interaction is difficult to study in the full-length leader due to the excess amount of resulting signals. We plan to characterize this interaction using a small oligo control that mimics the U5:DIS interaction in the 5′-Leader. We have isolated and purified the U5:DIS hairpin. We are currently collecting NMR data, specifically on A-279, which produces an outlier peak away from clustered signals. We can then see whether this easily identifiable peak occurs in the 5′-Leader, giving us the first evidence of a novel structural element within the monomeric conformation.

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Development of a CRISPR/Cas9 Genome Editing System for Green Algae

Robyn Jasper*, Jose Ortega*
Stephen Miller, Associate Professor, Biological Sciences

Genome editing is a tool implemented to test gene function through targeted mutations. The CRISPR/Cas9 system is simpler and more precise than previously developed genome editing systems. The high precision is due to the CRISPR associated (Cas) endonuclease's ability to bind DNA via associated guide RNAs. Cas endonucleases can delete or add bases to the genome,

which permits not only knockouts to determine mutant phenotypes, but also tagging genes with reporters. However, a Cas9/CRISPR system has not been adapted for use with green algae. In this project, we adapted an existing Cas9 vector for use in the alga Volvox using molecular cloning techniques to insert species-specific regulatory sequences and guide RNA sequence targeting a test gene with known mutant phenotype. Biolistic transformation of the vector resulted in viable transformants, which were tested for guide RNA expression and Cas9 protein expression via RT-PCR and Western blots, respectively. RT-PCR confirmed that guide RNA was made. Cas9 expression is being tested currently. Once transformants that express both components are obtained, we will characterize them for mutations. Ultimately, this system will be used to edit genes related to multicellularity in Volvox and to improve the alga Chlorella as a biofuels and neutraceuticals production organism.

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Characterization of the Bacteriophage CR30 Homolog (gp140) of HarP

Da'Kuawn Johnson
Christine Jacobs-Wagner, Director of Microbial Sciences Institute, Yale University; Rodrigo Arias Cartin, Yale University

A Highly conserved protein of Alphaproteobacteria and related Phages (HarP) has a homolog, gp140, in the phage, Φ CR30, which infects *Caulobacter crescentus*. gp140 varies in two regions that appear to be conserved across many bacterial homologs. With the variance, we hypothesized that gp140 is incapable of substituting for the Caulobacter's native copy and may even interfere and disrupt the activity of HarP when coexistent in the cytoplasmic space. We challenged this hypothesis by imaging *C. crescentus* containing GFP protein fusions of gp140 to assess different aspects of the homolog's behavior in *C. crescentus* including: gp140's localization pattern, morphological effects on the host if expressed, possible interactions with HarP, and gp140's ability to compensate for loss of HarP. Surprisingly, gp140 appears to be capable of compensating for loss of HarP in a prevention experiment. These data suggest that gp140 has similar activity in the host cell, which is exactly the opposite of our prediction. Future work will investigate gp140's ability to rescue the host from HarP depletion phenotype, as well as continued efforts to visualize the localization of gp140 in *C. crescentus* to improve our understanding of the role the protein plays in the phage's genome and life cycle.

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Irony and the Historia Ecclesiastica: The Sarcastic Bede

Graham Johnson
Molly Jones-Lewis, Lecturer, Ancient Studies

The Historia Ecclesiastica Gentis Anglorum is one of the most analyzed texts in British history, and one of the most important documents for studying the English Early Middle Ages. However, aspects of this seminal work have gone unnoticed. Bede's effective use of classical poetic techniques like chiasmus, synchysis, and zeugma as well as specific stylistic similarities to earlier writers indicate extensive education in Latin. Not only does he demonstrate his considerable learning with these hallmarks of classical style, but he also showcases his broad knowledge of the source material by subverting his audience's expectations in sarcastic or ironic ways in order to create instances of humor. Bede is funny, and this aspect of his work has largely gone unnoticed. The opening section of the Historia reads more like a paid advertisement written by an enthusiastic board of tourism than a sober geographical description. It effectively uses irony to counter the traditional image of a cold, damp, terrifying Britain advanced by classical authorities like Pliny the Elder and Caesar. Therefore, instances of humor and a sarcastic tone should not be written off as an inept medieval-era monk's imperfect command of the language, and appreciated as the deliberate choices that they are.

Interests or Champions? Political Advertising, Racial Priming and Support for Congressional Action to Address Inequality

Chanelle Jones, Jada Oglesby, Arnita Heathington, *Belawoe Akwakoku*
Tyson King-Meadows, Associate Professor, Political Science

Previous research has documented a strong relationship between racial conservatism and opposition to policies tailored to address the economic conditions of America's racial minorities. Outrage over income inequality calls into question whether whites would support black congressional 'anti-inequality' candidates, those who champion legislation that specifically addresses racial, class, or gender inequality. We hypothesize that response to political advertisements depicting these candidates is shaped, partly, by partisanship, racial attitudes, economic perceptions, and the visual-verbal content of the advertisement. We also hypothesize that whites will be less inclined to support black candidates regardless of the championed legislation. Next, we hypothesize that conservatives will be more likely than liberals to support class-conscious policies advocated by black candidates. We use data from a 2 x 3 visual-verbal priming experiment, conducted on a sample of adult white Americans (N=1000) via Amazon Mechanical Turk, a crowd sourcing survey platform. Respondents view two political advertisements: a general-control advertisement and an advertisement featuring a fictitious white or black candidate who addresses gender, racial, or class inequality. We analyze respondent evaluation of candidates and support for targeted policies. Results further underscore why voters do not equally reward or penalize candidates, and the effects of political advertisements on election outcomes.

This work was funded, in part, through an Undergraduate Research Assistantship Support (URAS) Award from the Office of the Vice President for Research, a CAHSS Dean's Research Fund Award, and support from the Africana Studies Department.

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

***Manpreet Kaur**, Sarah Luttrell*
Bernard Lohr, Assistant Professor, Biological Sciences

Grasshopper Sparrow (*Ammodramus savannarum*) adult song is well studied, but little is known about the early vocalizations that are critical to the survival of chicks from hatching to post-fledging. Previous analysis of recorded vocalizations of wild Grasshopper Sparrow nestlings from hatching (day zero) until fledging (day eight-nine) have demonstrated how the early vocalizations change as the nestling grows into a mobile, full-sized juvenile. Our work extended this study with captive- reared chicks from shortly after hatching (day three onward), which allowed us to follow their development once they had left the nest (day 10) until they were fully independent of adults (day 23). We measured four variables in this study: frequency, duration, frequency modulation, and amplitude modulation of nestling calls. Results showed that over the nestling period, calls followed a similar progression as in wild chicks. By day 10, however (after leaving the nest), chicks developed a new vocalization, most like the double chi-ip call of adults originally described by Smith (1968). This change may signal the transition of fledging calls into adult vocalizations.

Persuasive Writing in Advanced Placement German

Matthew Kelly
Jonathan Singer, Associate Professor, Education

Teaching students to write argumentatively is a fundamental practice inherent in the Common Core College and Career Readiness Standards. Students must be capable of supporting claims in an analysis of substantive topics or texts, using valid reasoning and sufficient evidence. Argumentative writing skills are also valuable in the acquisition of foreign language where it is important for students to be able to form and express an opinion both orally and through writing. This study investigated the growth of nine Advanced Placement (AP) German students in their ability to present their viewpoints in various German persuasive essays. Student growth was promoted through explicit instruction in close reading strategies. Such strategies help students to determine the meanings of words, phrases and structures, and allow students to examine and respond to various types of texts. Student growth was measured in accordance with the AP German writing rubric. The goal of this student learning outcome is for all students to improve by at least one point on the AP rubric during the instructional interval of the 2015-2016 school year.

External Locus of Control is Associated with Hallmark Symptoms of Psychosis in Patients at Clinical High-Risk

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Jason Schiffman, Professor, Psychology

Among people with psychosis, an external locus of control (LOC), or the belief that life's circumstances are outside one's control, has been associated with worse symptoms. Little is known, however, about LOC among youth at "clinical high-risk" (CHR) for psychosis. We hypothesized that LOC is more often external in youth at CHR relative to youth not at CHR, and that external LOC is associated with symptom severity. We used the Structured Interview for Psychosis-risk Syndromes to determine risk-status and symptoms, and the Behavior Assessment Scale for Children, Second Edition, to measure LOC among 45 youth at CHR and 65 help-seeking control participants ages 12-22. Analyses revealed higher external LOC among participants at CHR. Further, external LOC correlated with increased hallmark symptoms of psychosis, but only in the CHR group. No significant associations were observed between LOC and other symptoms. Youth at CHR tended to possess an externally oriented LOC, which in turn was associated with more severe psychosis-risk symptoms. Secondary analyses will examine correlations between LOC and specific hallmark symptoms (e.g., suspiciousness, unusual thoughts). As one part of a comprehensive evaluation, identification of external LOC as a risk factor for psychosis could contribute to early identification and treatment.

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Mastering the Purposes, Principles, and Structure of U.S. Government Through Scaffolded Instruction

Naureen Khan
Linda Oliva, Assistant Professor, Education

Comprehending the principles and powers of United States government is vital to becoming a responsible and informed adult. However, high schools struggle with comprehending the structure of U.S. government because they cannot make personal connections to their lives. This study investigated the effectiveness of differentiating and scaffolding instruction to promote students' abilities to evaluate how the principles of government are demonstrated in today's society. Examples of instruction include formative assessments like scenario exit tickets, newspaper headline classwork, debates, quote jigsaw stations, jeopardy games, and close-reading activities. The study population was twenty-two students enrolled in standard government classes. The target was for each student to achieve a fifty-percent improvement between their

initial score and the maximum score, in order to track growth and mastery. The results indicate twenty students reached the target.

The Influence of the Gwangju Art Biennale on Cultural Life of the City

Su Hyoung Kim
Preminda Jacob, Associate Professor, Visual Arts

The Gwangju Biennale is a major, national-art event, founded in 1995, to commemorate those who died for the Gwangju Democratization Movement in South Korea in 1980. This research investigated how the Gwangju Biennale influenced Gwangju society, and specifically how Gwangju has changed since the Biennale opened. The research included interviews, literature research, and photo documents. I traveled to Korea in January 2016 to interview artists who participated in the Biennale and staff members who organized the Biennale. Interviewees gave conflicting reports about the impact of the Biennale on Gwangju. Staff members said that the Biennale has influenced Gwangju to become more active in cultural life, but some artists did not agree with this. My presentation is also supported with photo documents collected to compare the layout and appearance of the city before and after 1995. Before the Biennale was founded, people were not familiar with arts appreciation. Since the Gwangju Biennale opened in 1995 however, Gwangju has been recognized as the cultural hub of the country. Through this research, I was able to see the impact of the arts on people and Gwangju and how Gwangju and the arts have been maintaining a mutually beneficial relationship.

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

I Was Here: Roman Coins in the Third Century AD and their Role in Immortalizing Emperors

Flora Kirk
Melissa Bailey, Visiting Professor, Ancient Studies

In a time when literacy was limited and the empire vast, the coins of third century Rome served as real-time biographies and communication tools for emperors. In numismatics (the study of coins), the connections between different kinds of coin imagery are often overlooked, with each coin image and its symbolism examined in isolation. But analyzing image trends over the course of the century reveals patterns that shed light on the emperors' propagandic interactions with the populace. While cataloging coins of the third century Beau Street Hoard at Bath, United Kingdom, during summer 2015 (as well as through subsequent research during fall 2015), I discerned a number of such trends and tracked their implications. The shorter, more unstable reigns of the third century yielded coin imagery that focused closely on the emperors themselves and their immediate policies. Trends of the previous century celebrating Rome's monuments,

prosperity, and eternal qualities slowly gave way to rising themes of military, conquest, and personal biography. Emperors, seemingly knowing their time might be limited, sought more than ever to enhance their images and communicate vivid, strong, and above all contemporary messages to users.

Effect of Sleep on Children's Pain Tolerance

Dana Kobrin, Chad Byrd
Lynnda Dahlquist, Professor, Psychology; Samantha Bento, Psychology; Julia Zeroth, Psychology

Previous studies have compared hours of sleep adults receive to their pain tolerance. In a study by Ødegård et al. (2015), adults whose sleep was restricted (i.e., four hours per night) had a lower cold pain threshold than did subjects who slept for nine hours. The purpose of the present study is to see if children's sleep is related to their pain tolerance. In the present study, the cold pain tolerance of children aged 6-13 (N = 81) was assessed by timing how long children were able to keep their hand submerged in uncomfortably cold water (7 degrees C). Both the children and their parents reported on the children's sleep quality and quantity. Although analyses are underway, preliminary findings suggest that hours of sleep are correlated with cold pressor pain tolerance. These findings could give insight to whether or not children's sleep could affect their ability to cope with acute or chronic pain.

This work was funded, in part, by the Graduate Student Association.

Optimization of a Shell and Tube Heat Exchanger for Wort Chilling

Matthew Kovarek
Mariajose Castellanos, Lecturer, Chemical, Biochemical, and Environmental Engineering

This study encompassed the effective thermal design and build of a shell and tube heat exchanger for single phase fluid flow. This exchanger was to be used to cool wort in the making of beer to present an alternative solution for the home-brewing market. For this market, there are relatively few solutions available for chilling wort. The available options are immersion chillers and plate chillers. The chillers have both advantages and disadvantages. The immersion chiller is inexpensive and easy to clean but inefficient; the plate chiller is more expensive and efficient, but not easy to clean. A well designed shell and tube heat exchanger was expected to combine the benefits of both. The minimum heat transfer area was designed based upon an optimized configuration which considered number and layout of tubes, tube length, number spacing, cut of baffles, and shell diameter. A MATLAB program was created and implemented to size a test heat exchanger. Upon completion of optimized design, construction and testing occurred to determine if the heat exchanger performed to design specifications. The exchanger performance

was compared against the immersion and plate chillers, respectively. It was expected that the shell and tube exchanger would outperform existing solutions.

Mill Girls in 19th-Century Print

Brittney Kramer, Elizabeth Chen, Alexa Abee
Lindsay DiCuirci, Assistant Professor, English

This digital exhibition examines the lives of nineteenth-century mill girls, American women who left their rural homes to work in the first industrial factories, by recovering pieces that were published by and about these women in American newspapers and magazines. The exhibition is composed of archival holdings from the American Antiquarian Society (AAS), on whose website the exhibition is permanently housed. We conducted primary-source research in digital archives to select exhibit items and the AAS located the items in their stacks, supplying images of the items and metadata. The goal of our research was to understand the conditions and challenges that Mill Girls faced by curating the writings they produced and examining how they were viewed by society. We organized our exhibit into three sections based on prevalent themes: Culture, Working Conditions, and Activism and Reform. By presenting our findings as an online exhibition, visitors to the site can navigate through a range of texts, such as engravings, song lyrics, and newspaper columns. This research provides access to archival texts from a critical era in labor history and challenges us to consider how, two centuries after the fact, women in the workforce still face inequities today.

Detection and Mitigation of Anomalous Behavior in Embedded Automotive Networks

Sekar Kulandaivel
Nilanjan Banerjee, Assistant Professor, Computer Science and Electrical Engineering

Safety and security for drivers becomes crucial to the future of the automotive industry as advanced electronics permeate a vehicle's control systems. Electronic and wireless components within an embedded automotive network expose vulnerabilities to malicious attacks from internal and external sources. In order to combat a malicious attack on a vehicle’s network, this work focused on using physical sensors embedded in a vehicle to classify normal driver behavior versus behavior resulting from an infiltration by an external agent. To investigate this method of intrusion detection, we accessed the raw communication data between various electronic control units (ECUs) and gathered pedal depression and steering wheel angle data from textile-based capacitive sensors. Our model for typical driver behavior includes comparison of the physical sensor readings of the steering wheel, brake pedal, and accelerator pedal to the data received from the ECUs. The resulting deployable attachment for an automobile’s on-board diagnostics port detects and mitigates a variety of infiltrations from external agents, which serves to protect drivers from dangerous attempts to disrupt or disable electronic systems within their vehicles.

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

Characterization of Biodegradable Polymers Using TGA-GC/MS

Chloe Kwon
William LaCourse, Professor, Chemistry and Biochemistry

Polymers play an integral role in the biomedical field. Applications include drug delivery systems, tissue engineering, and heart valve replacements. In order for biodegradable polymers to be utilized in an efficient manner, it is important to know the physical and chemical properties of the compounds. The goal of this experiment is to depict the correlation between thermal gravimetric analysis and polymer degradation in the human body using a PerkinElmer Pyris 1 TGA and a PerkinElmer Clarus 600 GC/MS, a combination of instrumental techniques designed to increase characterization and reduce sample preparation. Thermogravimetric Analysis (TGA) allows the mass of a sample to be observed as the temperature changes in a controlled atmosphere as a function of time or temperature. Heating in the TGA causes the sample's gases to be released and transferred to the gas chromatography (GC) instrument. The sample's components are separated in the GC, and the peaks identified by mass spectrometry (MS). Teflon was used as a non-degradable control. Standards of polybutyl methacrylate, polyvinyl acetate, and polyvinyl pyrrolidone were the biodegradable polymers of interest that were analyzed for the comparison of polymers in a commercial coronary stent.

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 an Enhanced Method for Ions in Seawater

Margaret LaCourse*, Ian Shaffer*
William LaCourse, Professor, Chemistry and Biochemistry; Joshua Wilhide, Molecular Characterization and Analysis Complex Manager

Aquariums are an important part of modern society, providing a way to explore the wonders of the ocean and a platform for aquatic research. Most aquariums require the production of artificial seawater with a formulation of various salts in order to match their composition to that of natural seawater to provide aquatic life with the proper nutrients needed to thrive. The goal of this project is to develop, optimize, and validate a robust method for the determination of halide ions (F^-, Cl^-, Br^-, I^-) in aquarium water with the purpose of maintaining a healthy ecosystem for marine life in captivity. In this study, ion chromatography with in-line conductivity and UV detection is used. Multiple standards are made from certified reference materials with ions in the ratio of natural seawater, allowing for the creation of linear calibration curves. Method development consists of instrument configuration and adapting previous research to optimize a

method for accurate and high-throughput results. Finally, validation is performed to establish important analytical figures of merit (i.e., limit of detection, limit of quantitation, linear range, reproducibility). The research provides a high-throughput and validated method for profiling halide ions in seawater, essential for maintaining the health of aquatic life.

This work was funded, in part, through an Undergraduate Research Award from the UMBC Office of Undergraduate Education. Additional funding and support came from the Molecular Characterization and Analysis Complex (MCAC) at UMBC and the National Aquarium in Baltimore.

Building and Painting the Cloud Rubik's Cube: Cloud Security Data Analytics and Visualization

***Matthew Landen**, Julio de la Cruz Natera*[1]
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Michaela Iorga, Computer Engineer, National Institute of Standards and Technology

Cloud computing is a model for enabling on-demand access to configurable information technology resources. Computing benefits include innovation enabler, the backbone for rapid deployment of applications, and more available, secure, scalable and flexible operations. However, using cloud-based solutions requires government agencies to perform a risk assessment, identify threats and develop appropriate security requirements. To promote secure adoption of cloud systems by government agencies, the National Institute of Standards and Technology (NIST) provides a methodology for architecting secure cloud environments, allowing cloud consumers to identify functional capabilities necessary for their particular cloud-based information system and associated security controls. We enhanced NIST's methodology by developing the Cloud Rubik's Cube (CRC) that helps agencies visualize the cloud security data for their cloud-based systems during the risk assessment process. The CRC consists of a manager that aggregates and analyses data. Agencies can then generate reports with different views of this data. The CRC also has a visualization center that displays aspects of NIST's cloud security methodology by coloring capabilities according to legends specific to each type of visualization. This tool augments the cloud adoption process by displaying customized information to help agencies determine the appropriate security for their specific requirements throughout the adoption process.

Grassroots Alternatives to the Global Corporate Food Regime in Baltimore

Melina Latona, Isabel Geisler
Felipe Filomeno, Assistant Professor, Political Science

In the contemporary world, the global corporate food regime is the hegemonic system of food production, distribution and consumption. Driven by transnational agribusiness corporations

based in the Global North, the global corporate food regime relies heavily on the exploitation of land and labor in the Global South. Following world-systems analysis and food regime theory, this study argues that grassroots organizations have reacted to inequalities generated by the global corporate food regime through the creation of alternative methods of production, trade and consumption of food. To support this argument, the study presents a qualitative comparative analysis of two organizations in Baltimore: the 32nd Street Farmers Market and Thread Coffee. As successful grassroots projects created out of the resistance against the global corporate food regime, these cases suggest a potential for socially and economically just food systems, offering a significant alternative centered on the rights of farmers and consumers. These findings are based on data collected through in-depth interviews with managers and participant observation in those two spaces.

Sponge

Simon Lee
Corrie Parks, Assistant Professor, Visual Arts

What if people could SEE what is going into their heads; what they are learning and experiencing? When do these mental tasks grow to be too much? *Sponge* is a live-action, stop-motion animation showing how stressful these experiences and bits of knowledge become as they are forced into our brains. The scene consists of a figure, represented only by hands, conducting surgery and continually forcing different objects (meant to represent knowledge and experiences) into a head, eventually causing the head to overload. To express this process, a model of a head was created using clay, model foam, and paper, allowing the head to hold unique facial expressions and emotions. The small surgical setting utilized claustrophobia and stress, similar to what one feels when life's experiences seem to be too much to handle. I also used Foley sound effects and sound effect clips, giving each action another layer of realism. The animation itself was captured using a mounted camera set up and a wireless remote, which took pictures of every movement. These shots were played back in rapid succession, and then compiled in Adobe Premier. The finished product is an animation that depicts the struggles of mental overload.

A Scene and Monologue Rehearsed for the Irene Ryan Scholarship Auditions

Brielle Levenberg, Chaz Atkinson
Colette Searls, Associate Professor, Theatre

I was nominated to compete in the Irene Ryan Scholarship Auditions which gives participants the opportunity to receive feedback on the professional audition process. My partner Chaz Atkinson and I performed a scene with a monologue from *After Ashley* by Gina Gionfriddo, who has earned numerous playwriting awards. With a time limit of two minutes, we had to tell a rich, engaging, and honest story. Chaz and I used specific techniques learned in the BFA Acting

program at UMBC to accomplish this task. The monologue I chose from *The Food Chain* by Nicky Silver demanded a great deal of vocal support to healthfully reach vocal extremes. I used Catherine Fitzmaurice's Voicework to warm up for, rehearse, and perform the monologue. This vocal production technique also helped me prepare for my performance in Voracious by Susan McCully. I played an androgynous French chef--a role which earned me the nomination to compete in these auditions.

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

The Cliff

A.J. Loayza
Corrie Parks, Assistant Professor, Visual Arts

The Cliff is a self-portrait piece depicting a creature made of rock who tries to follow his father up a cliff, but struggles to figure out how his father made the climb. This is a short film, 1:26 minutes in length, made using cutout paper animation. I found this kind of animation was much faster to do than hand-drawn animation, and consequently chose to do more than a minute of it. All the animation was captured in DragonFrame and edited together Adobe Premiere. The sound effects were original and were edited and synced in Adobe Audition. The music, "Bumbly March" by Kevin Macleod, was picked for the combination of its tuba and drums creating an impression of a slow march, contemplation, and a sense of achievement at the end. The music was chosen after the story was animated since it connected to the story so well. In my original storyboard, the main character was to run into several obstacles to prove that he is a slow learner, but to my peers, it only proved that he was an excellent problem solver. Therefore, it was decided to give a rock creature one formidable obstacle, getting up a cliff.

Roman Glass Production and Identification in Antiquity

Deirdre Lohrmann
Esther Doyle Read, Adjunct Professor, Ancient Studies

My research is concerned with the identification of item #278 in the UMBC Spiro collection. The piece is described in the donation catalog as a Roman bottle with applied flowers. However, the place of origin is unknown, as is the exact date of manufacture. Historical information suggests that the bottle dates to the first four centuries CE, which is when the Romans began mass production of glass ware for domestic consumption. These objects were part of an empire-wide trade network. Understanding the context of this object within a larger network enables us to explore the beginnings of mass production, which is still part of today's global economy. In order to create a historical context for the bottle, I used data from various identification sources, including books, journal articles, and museum catalogs to determine the manufacturing process,

possible place of origin, approximate time period, and the function of the bottle in daily Roman life. This identification methodology is standard archeological and museum practice and is important because it will allow us to better document the objects in the collection for long term study.

High-voltage, High-power, Inductive Load Drivers with IGBT-based Circuits

Julian Loiacono
Fow-Sen Choa, Professor, Computer Science and Electrical Engineering

High-voltage high-power (HVHP) switching systems, like multi-phase inverters, induction ovens, and more recently transcranial magnetic stimulators (TMS), all need HVHP switching devices. Traditional high power metal oxide semiconductor field effect transistors cannot provide sufficient performance to cover the ever-increasing demand in voltage and power. The insulated gate bipolar transistor (IGBT) has recently become an ideal candidate for such applications. The designer of an IGBT circuit will likely encounter the following issues: 1. IGBT gate drivers with insufficient power, 2. kick-back voltage spikes caused by rapidly switching off the inductive load, and 3. skin effects caused by excessive inductive load in wiring. In building coil drivers for a new type of TMS tool, we solved all three problems by 1. implementing a bipolar totem-pole structure gate driver to control the gate of the HVHP IGBTs, 2. designing and implementing a snubber circuit in parallel with the IGBT to tame inductive voltage spikes, and 3. using specialty Litz wire in the high-frequency path to mitigate the skin effect. Neglecting any of these efforts will lead to insufficient delivery of power to the load, IGBT damage caused by spiking voltage, circuit oscillation, and/or self heating. All have been successfully implemented.

This work was funded, in part, by the Maryland Psychiatric Research Center and 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

Astrocyte cells use adenosine triphosphate (ATP) to transfer signals. This process is suggested as a novel therapeutic target in Fragile X Syndrome (FXS), one of autism's few known genetic causes. Our aim is to develop a carbon fiber electrode aptamer-based sensor capable of single cell and *in vivo* measurements of ATP to determine the release mechanism and spatial location of ATP. Aptamers are short nucleotide sequences that select for target analytes and translate binding into an electrochemical signal. Carbon fiber is very robust, enabling sensitive measurements while eliminating background processes like oxygen reduction that plague existing measurements. We are developing the linkage chemistry to covalently attach the aptamer to the carbon surface. Specifically, we have electrochemically grafted several

compounds (4-aminobenzoic acid and ethylenediamine) to the surface of glassy carbon electrodes and have found 4-nitrobenzene diazonium is best suited for further development. To test for successful grafting, we have employed the positively charged hexaammineruthenium (III) chloride (RuHex) as a redox reporter. Using cyclic voltammetry, changes in observed peak current caused by electrostatic repulsion of RuHex with the grafted electrode surface report on the grafting's success. With the attached diazonium, we are now poised to fabricate our aptamer sensors on carbon surfaces.

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

Charge Transfer from Single Semiconductor Nanocrystals to Single Molecules

James Loy
Matthew Pelton, Assistant Professor, Physics

A rising idea for solar-cell technologies is to create a cell using quantum dots, which are nanometer-scale semiconductor crystals. Such structures have the potential to be fabricated at a lower cost than current silicon based photovoltaic cells. To convert light energy into current, electrons must be photoexcited out of the quantum dot, and the physics of the resulting charge separation on the nanoscale must be understood to control such a device. This project investigated the time an electron remains excited in a quantum dot, called the excited-state lifetime, by studying a model system. Our model used organic molecules adsorbed to the surface of a quantum dot to accept excited electrons out of the crystal. The quantity of surface molecules shortens the excited-state lifetime by offering electrons more pathways out of the excited state. We were able to examine our model structures individually to sort out each dot by the number of surface molecules on the crystal. By measuring the excited-state rate, the inverse of the lifetime, we found a discrete change in the rate linked to the number of surface molecules, and determined that the rate is increased by $9 \pm 3 \times 10^{7}$ s^{-1} per surface molecule.

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

Gesture Recognition using Textile Capacitive Sensors for Individuals with Mobility Impairments

Sheung Lu
Nilanjan Banerjee, Assistant Professor, Computer Science and Electrical Engineering

Individuals with mobility impairments represent a significant portion of the population. This project focused mainly on individuals who have spinal cord injuries, specifically those who are

able to move their arms, but have paralysis in their hands. These people lack the dexterity to use and control objects around them, from simple light switches to their computer keyboard. In this project we wanted to provide an easy-to-use interface that will make these tasks simple to do. To address this issue, we designed a touchless, low-power, assistive gesture-recognition system that utilizes textile capacitive sensors as an array to control a smart-home automation system. We constructed the sensor array using conductive fabric and thread to create flexible capacitive differential proximity sensors. Our gestures include intuitive swipe and hover gestures that are comfortable and approachable for users with mobile impairments. The prototype is paired with a home automation system that allows the patients to control simple appliances. The evaluation demonstrates that the system achieves high accuracy (> 90%) while maintaining low latency (< 1s) and low energy consumption (< 750uA). Additionally, we evaluated the system on a subject with upper extremity mobility impairment to verify its usage as an accessibility device.

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

Synthesis of Chlorin-Bacteriochlorin Energy Transfer Arrays for Multicolor Imaging

***Melissa Lucero**, Joshua Akhigbe*
Marcin Ptaszek, Associate Professor, Chemistry and Biochemistry

Chlorins and bacteriochlorins are tetrapyrrolic macrocycles with deep red/near-IR absorption and emission spectra windows. These colored pigments have found use in a number of technical and biomedical applications such as fluorescence probes and photodynamic therapy. These light-activated fluorophores are a promising platform for development of efficient energy transfer arrays for multicolor *in vivo* biomedical applications. Recently, a 3-monobrominated chlorin with meso-phenyl-2,4,6-triazole polyethylene glycol chain at the 10-position was synthesized and its solubility in water was determined. We found that the attachment of the polar motif of 2,4,6-triazole polyethylene glycol on the 10-position of the chlorin resulted in a water-solubility architecture. Herein, we report the design, synthesis and photo-optical properties of chlorin-bacteriochlorin energy transfer arrays with a deep-red absorbing chlorin at ~650 nm, as the energy donor and a near-IR emitting bacteriochlorin at 732-748 nm, as the energy acceptor. Each chlorin donor is equipped with a different set of phenyl and phenylethynyl auxochromes at the 3-positions to evaluate the electronic effect on the fluorescence efficiency of the acceptor. In addition, the redox properties of both the chlorin (metal complexation) and bacteriochlorin motifs were evaluated. Photochemical properties of the resulting dyads have been determined in both polar and non-polar solvents.

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Understanding the Mysterious Energy Content of the Lobes of Radio Galaxies through Numerical Simulations

Jonathan Luckin
Markos Georganopoulos, Associate Professor, Physics

For almost half a century, astronomers have assumed that in radio galaxies the energy density of the relativistic electrons and the magnetic field producing the observed synchrotron emission are in equipartition. Although this has no physical justification, it is widely used as it is the most efficient way to produce a given synchrotron spectrum. In our work we addressed the question of the actual equipartition distribution observed in a synthetic flux-limited sample given radio lobes with an equipartition ratio of any arbitrary distribution. This is important as flux-limited samples do exist. We produced synthetic samples of radio galaxies for arbitrary equipartition distributions and for a constant or power-law distribution of lobe energy content. We found that, assuming random equipartition distribution, the outer half of the volume of the sample will only contain galaxies within a factor of four from equipartition and about 80 percent of these would be within a factor or two of equipartition. Our work supports that radio galaxies found in the outer half volume of complete samples are close to equipartition. This is important as astronomers can now be confident in existing studies of radio galaxies, an important field in studies of galactic evolution.

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

Developing a Real-Time Representation of Parking Availability at UMBC

Gaurav Luthria
John Park, Lecturer, Computer Science and Electrical Engineering

Searching for parking results in longer commutes and causes a significant amount of additional traffic. Current approaches to model available parking locations rely on previously determined data sets to train machine learning models. For this project we explored a new approach to identifying available parking locations using crowdsourcing to provide real-time data to be inputted into a probability model for predicting the availability of parking locations. We have modeled the UMBC campus as a graph where each parking location is represented as a node on a graph with various properties depending on the location. By keeping track of GPS data and mapping the GPS locations to nodes on the graph, the commuters are essentially traversing the graph. As they traverse a node, a Bayesian update is performed and the probability that a parking location is available changes accordingly. We have developed a simulation of the model using artificially generated data. We are currently in the process of developing a mobile application that will be used as a crowdsourcing platform. In the future, historical data will be incorporated into the model to predict parking availability.

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

The Commodification of Women's Bodies: An Exploration of Transnational Surrogacy in India

Natalie Macasa
Sarah Chard, Associate Professor, Sociology and Anthropology

Since the rise of assisted reproductive technologies (ARTs), India has become a popular destination for surrogacies. Transnational surrogacy within India has impacted the lives of Indian women who become surrogates for Western couples. The commodification of Indian women's bodies poses massive health risks for Indian women before, during and after pregnancy. This paper uses India as a case study to examine the effects of globalization on transnational surrogacy. More specifically, I employ a critical-feminist lens to analyze existing ethnographic research that explores the socio-political and cultural effects of surrogacy on surrogate mothers and their families. In addition, I examine the role of capitalism in transnational surrogacy, the provision of surrogates' health care and the commodification of surrogate mothers' bodies. I conclude with recommendations of how to address and regulate transnational surrogacy within India in order to better support women's agency in decisions surrounding surrogacy and their overall health.

Characterization of an Embryonic Skin Enhancer Element from the *C. elegans pax-3* gene

Caitlyn Maczka
David Eisenmann, Associate Professor, Biological Sciences

Normal development of an organism requires correct cell fate adoption controlled by differential gene expression. In the invertebrate model system *C. elegans*, it has been shown that gene *pax*-3 influences proper cell fate choice by skin cells in early development. We wish to understand how the *pax*-3 gene is expressed in just these cells in the early embryo. The goal of this research is to identify the smallest DNA fragment that is both necessary and sufficient for expression of *pax*-3 in the embryo. PCR cloning and Gibson reactions were used to make several *pax*-3 reporter constructs (fusions to a fluorescent protein coding sequence) and injected into *C. elegans* to make transgenic strains. When the promoter piece contains the required information to turn on *pax*-3 in the right cells, we see fluorescence in cells of transgenic animals. Thus far in the experiment, none of the various fluorescent proteins were bright enough to produce a usable strain. Once a bright enough fluorescent reporter is found, it will be used to find transcription factors that bind to this DNA sequence regulating expression of *pax*-3. This knowledge will extend our understanding of how nematode skin cells adopt their specific cell fates during normal development.

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

Assessing the Stress-Dependent Role of AMPK on OGT and OGA Activity and Localization

Austin Maduka
Natasha Zachara, Assistant Professor, Department of Biological Chemistry, The Johns Hopkins University School of Medicine; Kamau Fahie, Department of Biological Chemistry, The Johns Hopkins University School of Medicine; Jennifer Groves, Department of Biological Chemistry, The Johns Hopkins University School of Medicine

Acute enhancement of O-linked-β-N-acetylglucosamine (O-GlcNAc) modification on intracellular proteins activates an endogenous protective program in numerous models of injury, including cardiac ischemia reperfusion injury (IR/I). The O-GlcNAc transferase (OGT) and the O-GlcNAcase (OGA) enzymes are responsible for adding and removing the O-GlcNAc moiety from proteins, respectively. This project aims to understand how cells regulate OGT and OGA in response to oxidative stress to promote cell survival and cardioprotection. To date, we have demonstrated that mTOR interacts with OGA in response to oxidative stress, suggesting that mTOR may regulate OGA and thus O-GlcNAcylation. Literature also suggests crosstalk between OGT and AMPK, an enzyme known to inhibit mTOR. To explore these interactions, we have utilized AMPK wild type and null mouse embryonic fibroblasts (MEFs) as well as the AMPK inhibitor Compound C. Suppression of AMPK expression or activity resulted in lower basal and stress-induced levels of O-GlcNAc. Previous reports suggest that AMPK activity regulates the expression and localization of OGT. Our data supports an independent model, as suppression or inhibition of AMPK had no effect on the expression or localization of OGT. Currently, we are investigating the molecular mechanisms by which AMPK regulates O-GlcNAc levels during injury.

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The Role of the Transcription Factor Nrf2 in Regulating the Function of MDSC

Amry Majeed
Daniel Beury, Biological Sciences; Suzanne Ostrand-Rosenberg, Professor, Biological Sciences

Understanding the components of the tumor microenvironment is essential in cancer immunotherapy. Myeloid-derived suppressor cells (MDSC) are a large component of the tumor microenvironment and inhibit anti-tumor immunity by suppressing T-cells partly by producing reactive oxygen species (ROS). ROS inhibit T-cell expression of IL-2 and IFNγ, essential cytokines for activating the immune system. Our purpose was to determine how MDSC survive

in an environment of high ROS. We hypothesized that MDSC resistance to ROS is regulated by the transcription factor, Nrf2. Activation of Nrf2 leads to production of antioxidants that reduce the activity of free radicals. To test our hypothesis, BALB/c Nrf2+/+ and Nrf2-/- mice were injected with mammary carcinoma cells. Mice were bled and MDSC in the blood were identified using fluorescent antibodies to MDSC markers Gr1 and CD11b. MDSC from Nrf2+/+ mice were more suppressive and less apoptotic than MDSC from Nrf2-/- mice. However, there was no difference in the MDSC levels in the blood of Nrf2+/+ and Nrf2-/- mice, because MDSC differentiated more rapidly from Nrf2-/- bone marrow progenitor cells. Additionally, Nrf2 decreased MDSC oxidative stress. Because Nrf2 has been correlated with increasing tumor burden, treatment with Nrf2 inhibitors may decrease tumor burden and MDSC levels.

An Increase in Musical Literacy through Establishment of Tonality

Jillian Mardesich
Brian Kaufman, Assistant Professor, Music

A critical skill for introductory choral student is the ability to read music. Initial observations associated with a middle-school chorus indicated that students could read a musical example in the key of C, but not other keys. A pre-assessment was administered to 59 seventh- and eighth-grade students to determine their understanding of such concepts as note names, sharp and flat pitches, and ten different key signatures. This baseline data was used as a resource for identifying high-achieving students who could be used as student peer leaders. Through a mixture of mnemonic phrases, discovery, and resource creation, the students were introduced to, and taught to identify, all key signatures in a scaffolding manner. The process first covered note names, sharps and flats in the creation of major scales, and key-signature identification and creation. The students then received a post assessment at the end of March, with the goal that eighty percent of the students would improve their overall score on the assessment by at least five points.

The Influence of Accelerated Photoperiod on Molt, Fat, and Body Weight in Grasshopper Sparrows *(Ammodramus savannarum*)

Corrin Markey, *Sarah Luttrell*
Bernard Lohr, Assistant Professor, Biological Sciences

Migration and molting in many birds are key stages of their lives that are essential for their survival. Birds that migrate typically rely on their physiological clocks to keep their bodies synchronized with environment changes and to provide them with necessary cues about when to begin the processes of migrating and molting. Physiological clocks, for example circadian rhythmicity, are often dependent on the photoperiod that a bird experiences. Here we investigated the effects of an accelerated photoperiod on physical changes in a captive flock of Grasshopper Sparrows (*Ammodramus savannarum*). We manipulated the birds' photoperiods in

the laboratory by speeding up the rate of change of day length of "spring" and "fall," and adjusting the luminance of the flock room accordingly. Over the course of three years we measured the birds' weight weekly, which is indicative of overall condition and migratory stage. In the last year we also scored detailed fat and molt data on a weekly basis. Based on these data, we found correlations between photoperiod alterations and physical changes in the birds in molt rate, fat deposition, and weight gain/loss that paralleled those normally occurring at more gradual photoperiod transitions typical of seasonal changes in the wild.

This work was funded, in part, by The United States Fish and Wildlife Service.

The Little Ice Age and the Contact Period

Margaret Marzolf
Esther Doyle Read, Adjunct Professor, Ancient Studies

Until recently analyses of cultural clashes between Chesapeake Region Indigenous peoples and colonial populations have failed to take into account the effect of climate change associated with the Little Ice Age (1430-1850 CE). In order to consider these effects, I consulted recently published dendrochronological data from North Carolina and Europe, climate data from Jamestown, data recovered from floral remains found on three Maryland archaeological sites, and first-hand accounts about Contact Period (1492-1650) climate. Recent dendrochronological research in Europe and in the Mid-Atlantic region of North America demonstrate that significant climate change occurred, which increased glaciation in Europe, decreased precipitation in North America (causing long-term droughts), and significantly lowered temperatures on both continents. Archaeological floral analyses indicate change in dominant tree species and food stuffs that were prevalent in Native American diets. Documents from the Contact Period indicate that initial European attempts at colonization were difficult because colonists anticipated similar New World climatic conditions to occur along the same latitude lines as those experienced in Europe. The Jamestown colony experienced severe food shortages during its early years due to drought. Competition for limited resources between Indigenous populations and colonists caused conflict and contributed to Indigenous cultural change and population decline.

A Data Management Planning Tool for Understanding and Reporting Data About Data

Joshua Massey
Kimberly Tryka, Research Data Librarian, National Institute of Standards and Technology

In the spring 2015, the Office of Data Informatics (ODI) of the Material Measurement Laboratory (MML) of the National Institute of Standards and Technology (NIST) released Minerva, a data management planning (DMP) tool that provides a uniform method and location for MML researchers to store information about data related to their projects. This tool also allows MML management to stay up-to-date on the data-related activities of their respective

groups. During summer 2015, I worked with staff in the Information Services Office (ISO), as well as ODI staff, to better understand what information is typically entered into this tool and how users interact with it. I first explored the data set, becoming familiar with its structure and contents. I then wrote a Python algorithm to query the tool's MySQL database, compute statistics about the data, and output basic reports. After discussing the initial results with ODI staff, I revamped the algorithm to be more flexible – including more detailed reports and allowing parameters to be specified.

Behavioral Examination of the Role of Mouse Olfactory Microvillus Cells

Kenechukwu Mbonu, Julianna Sun*, Kayla Lemons*
Weihong Lin, Associate Professor, Biological Sciences

The olfactory system is a complex system that plays a role in survival by detecting odors in our environment, which can provide information that helps with finding food and avoiding toxic environments. Understanding the function of this system is very important. Our project focuses on learning more about the main olfactory epithelium (MOE), a specialized organ that detects odors in our environment. The MOE has microvilli cells whose function is still unknown. In order to learn more about the microvilli cells, we performed a behavior test, the dig test on wild-type mice. The mice were dieted to 80 percent of their body weight and went through a training period where they were conditioned to associate one odor with a food reward and one with no reward. The mice were then tested by being put in a cage with both odors buried, neither with a reward, and the time spent sniffing each odor was recorded. Data from this test shows that the mice spent more time sniffing the odor that was initially presented with the reward. We would like to repeat this test on Skn-1a knockout mice, which lack microvilli cells, and look at the morphology of the MOE.

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

***Torn*: An Animation**

Caitlyn McCaulley
Corrie Parks, Assistant Professor, Visual Arts

Torn is an abstract animated short film, 1:09 minutes in length, which combines hand-drawn and paper-cutout styles of animation. The purpose of the project is to explore my interests in both art and science. The film starts with the notion that one must choose between the two fields. However, the character finds herself happy only she accepts both. This film adds to the body of animated work utilizing abstraction and stream-of-consciousness approaches to express conflict and resolution. For this project, I used an overall story arch with checkpoint goals for the hand-drawn animation. I carefully followed the plan and met the checkpoint goals. I created the cutout

animation using Dragonframe. It took many hours to hand draw each frame. The frames were then each transcribed into Photoshop. In order to convey my internal struggle of art vs. science through the body language of my animated character, I acted out each specific motion. My abstract visuals were made by individually crafting each frame with several cutouts and watercolor paintings. In the end, the animation shows that I am only whole when I engage both parts of my mind.

Applications of Light Microscopy Principles in Building a Smartphone Microscope

Natalie McDonald, Victoria Davenport*, Oluwafolabomi Shonubi*
Minjoung Kyoung, Assistant Professor, Chemistry and Biochemistry

Compound light microscopy has been widely used in scientific and medical research to gain a better understanding of certain organisms, cells, or tissues. Because of this, there is interest in developing an affordable imaging solution. Our goal was to build a simple but powerful compound light microscope with the ability to view/image items from everyday life. We developed a portable and adjustable cellphone microscope with interchangeable objective lenses and a large diameter condenser lens (50 mm) to collect and transfer light efficiently with the cost of less than $200. Particularly, the mobile platform of the objective lens can be adjustable so that it can meet the optimal focal length for each lens and each sample image. The combinations of objective lenses and several convex lenses enabled us to image cotton, silk, wool, nylon, Nitrile gloves, cardboard, Kimwipes, and human hair with 40.7x and 153x magnification. This project allowed us to explore the basic principles behind the compound light microscope, including Köhler illumination, through building our own stable and affordable microscope which achieves a magnification comparable to the other expensive professional microscopes. This project can be carried further with some mechanical and physical improvements.

This work was funded, in part, by Department of Chemistry and Biochemistry, UMBC.

Addressing Location, Literacy, and Cultural Barriers for a Prenatal Health Intervention in Haiti

Maureen McGowan, Priya Surapaneni, Danielle O'Neill
Jasmine Abrams, Assistant Professor, Psychology

Maternal and infant mortality rates in Haiti are the highest in the Western hemisphere. However, group prenatal care can be utilized to reduce mortality and improve birth outcomes. The goal of group prenatal care is to improve health outcomes via pregnancy education, appropriate prenatal care, and community building. This approach results in prenatal care attentiveness, pregnancy healthcare knowledge, and decreased frequencies of premature births. There are many challenges associated with foreigners implementing such interventions in Haiti, including access to the intervention, cultural differences, and high rates of illiteracy. This review has identified several

strategies for overcoming implementation barriers by synthesizing related literature and data on the topic. To address the barrier of access, we researched geographical data (i.e., location, terrain, available community centers) to determine the most accessible settings for pregnant women. To address culture, we gathered information on Haitian values and customs to adapt the intervention. Finally, we identified intervention materials used with illiterate societies to address the barrier of illiteracy. We present our literature review to provide suggestions for solving the previously mentioned issues. Our research can assist health professionals implementing interventions in Haiti and other developing countries by offering strategies for overcoming location, literacy, and cultural barriers.

The Cultural Connection of Antiquity and Modernity: A Photographic Examination

Brian McMullen
Timothy Phin, Lecturer, Ancient Studies

This project demonstrates how sites of Greek and Roman antiquity continue to occupy a powerful space in the modern world. In an effort to explore the intersection of antiquity and modernity, I compiled a photographic portfolio that situates and problematizes ancient sites in their modern contexts. In contemporary Rome and Athens, the Colosseum and the Parthenon have been integrated and adapted into the fabric of the identity of the city. The ruins of Pompeii, on the other hand, provide an altogether different window into the past, permitting a comparison between sites that have been folded into their modern locations and those that have been preserved for archaeological study. In the summer of 2015, I traveled to Italy and Greece and composed photographs that examined this intersection between time and space. The photographs probe and express how these sites are connected to the spaces they occupy. An essay situating the sites or monuments in their historical and contemporary environments accompanies each photograph. The combined effect of the images and the essays conveys the continued cultural importance of antiquity.

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

Corporal Punishment in Schools: Exploring Competing Discourses on Physical Violence

Katlyne Meade
F. Chris Curran, Assistant Professor, School of Public Policy

Compared to foreign school systems, where the use, effect and long-term ramifications of corporal punishment, both in-school and at-home, has been extensively studied, the United States is noticeably scarce in related work. Therefore, we draw on data from a nationally representative set of school student handbooks and codes of conduct to conduct a critical policy analysis in which we examine the policy documents for the presence of policies pertaining to corporal

punishment and contrast these with discourse around physical violence between students. We also utilize data from the U.S. Department of Education's Office for Civil Rights (OCR) data collection which includes school-level data on the use of corporal punishment, and we examine the OCR data to determine the predictors of the use of corporal punishment. With many current issues rooted in the excessive violence exhibited in U.S. media, the mixed signals provided to youth who experience corporal punishment could play a contributing factor, and therefore this is a topic worthy of more extensive research.

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

Dyadic Adjustment Among Parents of Children with Food Allergy

Mariana de Matos Medeiros
Lynnda Dahlquist, Professor, Psychology

Childhood chronic illness poses challenges to family life and dyadic relationships. Parents of children with food allergy may be impacted by the stress of avoiding allergens. This study aims to examine the impact of a child's food allergy on marital relationships by comparing the marital adjustment of parents of healthy children versus parents of children with food allergy. Participants were 133 parents of children diagnosed with food allergy. Mothers completed the Dyadic Adjustment Scale (DAS) scale about their current relationship. Overall, mothers of children with food allergy reported experiencing less satisfaction in their current relationship than did mothers of healthy children, $t(104) = -2.31$, $p = .022$. The DAS score of mothers of children with food allergy did not differ from those of mothers of healthy children with respect to the Consensus subscale, $t(99) = -.63$, $p = .527$, the Cohesion subscale, $t(103) = -.09$, $p = .527$, or the Affectional Expression subscale, $t(103) = -.09$, $p = .928$. Similarly, the total score of the DAS did not yield statistically significant group differences, $t(98) = -.99$, $p = .323$. These findings suggest that parents of children of food allergy experience the same amount of dyadic adjustment as parents of healthy children, except for relationship satisfaction.

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

Quantification of Carbon Emissions in the Baltimore Area

Joshua Mele
Christopher Hennigan, Assistant Professor, Chemical, Biochemical, and Environmental Engineering

Aerosols are fine particles present in the atmosphere; this research characterized the seasonal and diurnal trends in elemental carbon aerosols (EC) and organic carbon aerosols (OC) in Baltimore,

Maryland across a year of measurements. These aerosols have negative effects on human health and play an important role in Earth's climate system. Carbonaceous aerosols were measured using a Sunset Laboratory Inc. Semi-Continuous OC-EC Field Analyzer, which is an automated instrument that measures the concentrations of organic and elemental carbon aerosol every 45 minutes. These data were used in conjunction with traffic flow from major highways in Baltimore. The similarities between the diurnal average of EC and the traffic count data suggest that traffic is a primary source of EC. Large reductions in EC concentrations on the weekend compared to weekdays indicate the dominant contribution of diesel vehicles to EC levels in Baltimore. OC was apportioned to primary and secondary sources based on the OC/EC ratio using the EC tracer method. In the winter months, the highest concentrations of OC and secondary OC were observed, indicating the important role of household heating (wood burning) as a source of secondary OC and a contributor to air quality in Baltimore.

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

Armor from the Armoire: *Gone with the Wind* and American Fashion

Madison Meyer
Anne Sarah Rubin, Professor, History

This research project examines how the costumes from the film *Gone with the Wind* shaped 20th-century fashion and the memory of the Civil War and Reconstruction. The character Scarlett O'Hara, played by Vivien Leigh in the film adaptation of the novel by Margaret Mitchell, wore costumes which have since been woven through fashion trends of the 20th century. Even today, the costumes hold significance for the public, with the Harry Ransom Center going so far as to raise thirty-thousand dollars to fund the preservation of some of the original costumes to save them from disintegrating into rags. The elaborate costumes enticed the American public, allowing them to visualize life during the Civil War. For example, the iconic green curtain dress, worn by Scarlett exemplifies the struggles and self-determination of the time, shaping not only how the public imagined southern belles, but how a woman's strength and perseverance could be portrayed through her wardrobe. Both primary and secondary historical sources were used to unpack the influence of the costumes from *Gone with the Wind*.

Student Learning Objective: Supporting a Claim with Evidence

Julia Miller
Linda Oliva, Assistant Professor, Education

Using evidence from a variety of sources is a required skill for all social studies students. Students can often identify what pieces of evidence can support their claim, but they neglect to address how it supports their claim. This is crucial for argument writing, a key skill for success

in social studies. This study investigated the scaffolding used to help students develop their skills in supporting claims and using a variety of sources in argument writing. The subjects of this study are 10, ninth grade students who are low-performers in a Middle Years Program for Individuals and Societies, which is a part of the International Baccalaureate program. The interventions provided to these subjects were an increase in argument writing assignments, required use of graphic organizers by the students and writing-focused lessons. This objective requires further analysis of content to strengthen the argument that is being made and requires the student to make solid connections between claim and evidence. The data included uses the IB rubric to evaluate how effective a student can communicate through an argument essay. The data has been collected over a period of time from October 2015 to March 2016.

Remembering Randolph: Race and the Fight Against World War II Segregation in the Civil Service

Jennifer Montooth
Michelle Scott, Associate Professor, History

Asa Philip Randolph is known by most as a Civil Rights activist, but his specific accomplishments are not well-addressed. Randolph was a lifelong leader who fought for decades, particularly during World War II, to achieve racial, social, and economic equality for all Americans. His strategic fight to have racial and class equality, as well as his determination to end segregation in the military, should be widely recognized. Randolph held a meeting with President Roosevelt, the Secretary of War, and the Secretary of the Navy in September of 1940 to address segregation and unfair treatment in the armed forces. When this meeting did not successfully end segregation, Randolph took matters into his own hands and planned a March on Washington for Jobs and Freedom that inspired 100,000 African Americans to be ready to come to Washington and fight for the jobs they deserved. Because of this effort, FDR signed an executive order in 1941 to end segregation in the military. This paper explores refocusing Randolph in the narrative of Civil Rights History for non-specialists that too often begins with the *Brown v. Board of Education* decision in 1954, when the 1940s was a pivotal point in the classic Civil Rights struggle.

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

Coptic Identity and Traditions as Seen Through their Artwork

Catherine Morrill
Esther Doyle Read, Adjunct Professor, Ancient Studies

Object #273 in the UMBC Spiro Collection is a piece of carved bone that was once part of a cane decoration. It is an example of Coptic art, produced by an early Christian group centered in

Egypt. Although the Coptic Church and other aspects of Coptic culture survive to this day, it is an often overlooked part of Egypt's history. My research focuses on the religious background, Near Eastern and Hellenic influences, and ancient Egyptian traditions that formed the art and culture of the Copts. I focused on examples of traditional Coptic art and the imagery seen in these carvings in order to establish the identity of the piece and its symbolic significance within the culture that produced it; as well as the significance of this art form for modern Copts who still emphasize their unique ethnic, religious, and cultural identity in a majority Muslim nation. In order to achieve this, I used histories, art catalogs, museum exhibits, journal articles, and other scholarly works to create a context for the piece and its importance to the Coptic people.

Storyboarding the Creative Process: An Interdisciplinary Look into the Collaborative Production of *Bartleby*

Daniela Mujica-Martorell, Alison Kreckmann, Lindsay Glang
Sally Shivnan, Senior Lecturer, English; Guenet Abraham, Associate Professor, Department of Visual Arts

At URCAD, *Bartleby* will offer a new perspective on the creative processes of both contributors and staff through the presentation of a large, comic book-styled storyboard. Unlike the published journal itself, which in its text-based format requires an individual's attention and time to read, this storyboard, with its stimulating graphic-novel style visuals and engaging large format, will offer a new, immersive experience for viewers to gain insight into the interdisciplinary creative work that is *Bartleby*. Some panels will portray contributing authors' perceptions of their own creative processes, which, being often of a uniquely solitary nature, will thus shed light on the writing process, a journey that is just as significant as the final work itself. Other panels will feature staff members' commentary on the importance of understanding such creative processes when engaging in the reviewing, critiquing, and discussion of submitted student works, a fundamental portion of *Bartleby's* production process. While each storyboard panel will be designed differently according to each individual featured, the final composition will ultimately serve as a representation of the complex level of cooperation that is required from both *Bartleby* staff members and student writers and artists in order to produce a work of a cohesive nature.

This work was funded, in part, by the student SGA, as well as the Office of Undergraduate Education.

Between the Lines

Daniela Mujica-Martorell
Preminda Jacob, Associate Professor, Visual Arts; Dominique Zeltzman, UMBC, Department of Visual Arts

Between the Lines, a two-minute-long stop-animation short, is a hand-drawn project including hundreds of drawings and photographs. Set to French composer Yann Tiersen's *Toujours La*, this project's main concept arose from my self-image as an artist. The film is about the common thread connecting all my artwork, from a rough sketch to an elaborated final project, despite the unique context and stylistic approach of each creation. The story line revolves around two little characters, who, as children, share a similar kind of gentle and innocent personality. While both are simply drawn, the characters live in different worlds: one has been sketched into a class notebook in a rough, doodle-like format, while the other has been drawn more carefully into a sketchbook, and has been colored in fully. I purposefully chose a seemingly simplified approach to animation style in order to embody the sweetness of the relationship not only between the characters, but between artist and artwork. This project was created with Adobe Premiere Pro.

Wildfire: A 3D Strategy Game about the Discovery of Fire

Savannah Myers, Michael Ihde, Ciaran Cain, Chris Vaughn, Yaakov Weinstein, Ben Shaffer
Eric Jordan, Adjunct Professor, Visual Arts

Wildfire is a game that focuses on how to balance life, death, and natural preservation. Playing a caveman discovering fire, you must protect the lives of your people. Fire, as the center point for the game, is a tool for keeping wolves from attacking your tribe. However, the more fires you start, the more firewood your tribe must collect. The farther you set out to chop wood, the more likely wolves will be tempted to strike. The player must balance controlled expansion with limited resources. Build too many fires and you may start a forest fire endangering everyone's lives. The design of Wildfire allows for programmers to directly apply and challenge their skills in new, creative ways. This project requires complex programming tasks, specifically non-player character AI interactions with other non-player characters. Individual concepts learned in classes are put to the test through simulating real-life game design. The artists are challenged to unify their work as a team to represent one, cohesive visual style, and to address new ways of creating animations and environment assets. Techniques like interlocking animations, optimizing assets, and lighting design are all vital for communicating with the player.

Immobilization of the Glutamine Binding Protein (QBP) onto the Surface of Transparent Microbeads for use in a Biosensor

Sean Najmi
Leah Tolosa, Research Professor, Chemical, Biochemical, and Environmental Engineering; Sheniqua Brown, Chemical, Biochemical, and Environmental Engineering

There are over 29 million people in the United States who are diagnosed with diabetes, of which most have type 2 diabetes. Because glutamine concentration circulating through the blood is reduced significantly in patients with type 2 diabetes compared to healthy ones, there is a need for a method to determine glutamine levels in the blood circulation. The goal of this study is to immobilize the glutamine binding protein (QBP) onto the surface of different types of transparent beads for use in a biosensor. QBP was purified from *Escherichia coli* and labeled with the fluorophore acridine. The labeled QBP was purified on a DEAE column and separated from excess dye. For comparison, the QBP will be tested in an assay in order to see its response to glutamine. After this, the QBP will be immobilized onto the surface of the gellan and Ni-NTA beads for testing with the actual biosensor.

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Cannabis Use in Relation to GABA and Glutamate Levels in Schizophrenia

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Laura Rowland, Associate Professor, University of Maryland, School of Medicine, Department of Psychiatry

Marijuana is the most widely used illicit drug. Heavy cannabis use can lead to brain alterations and early adolescent use is a risk factor for the development of schizophrenia. The purpose of this project is to investigate the relationship between marijuana use and gamma-aminobutyric acid (GABA) and glutamate levels, major neurotransmitters known to be involved in the pathophysiology of schizophrenia. We hypothesize that schizophrenia patients who have used marijuana have lower levels of GABA and glutamate than patients who have not used the drug and healthy controls. Magnetic resonance spectroscopy was used to determine anterior cingulate concentrations of GABA and glutamate 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. Our data show (i) GABA levels are higher in healthy persons who have never tried marijuana; (ii) the younger the age of first marijuana use, the lower the GABA levels in persons with schizophrenia; (iii) glutamine levels are higher in those who have used marijuana averaged across diagnosis group and highest in the schizophrenia group. We will discuss possibly reasons for and implications of these finding.

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Imaging Three-Dimensional Space around Migratory Cells

Christina Nordmark*, Grant Wunderlin*
Michelle Starz-Gaiano, Associate Professor, Biological Sciences

Our lab ventures to understand the mechanisms and intricacies of cell migration, as modeled through *Drosophila melanogaster*. Working out the molecular mechanisms of cell migration may then open the door to better understanding processes such as embryo development, cancer metastasis and wound healing. Specifically in Drosophila, we observe the migration of six to eight epithelial cells, called border cells, as they move through the developing egg. We know there are a number of molecular pathways which mark these cells as motile and cause them to physically move, however we wish to image the space between nurse cells in order to find any connections between tissue architecture and normal/abnormal migration. In order to image extracellular space, we are employing Enhanced Green Fluorescent Protein, eGFP, by first ligating the eGFP gene to the signal sequence region of the Unpaired gene, which codes for a secreted activator for border cell migration. This will then be inserted into Drosophila cells via a transposon, and expressed near the motile cells. This work will help clarify the physical conditions influencing cell migration, which could potentially give insight on other instances of extracellular signaling during development.

This work was funded in part through an NSF CAREER (UBM) Research Award from the National Science Foundation to MSG.

Observing The Effects of pH on the Feline Immunodeficiency Virus Matrix Protein Myristyl Switch

Colin O'Hern*, Janae Baptiste*
Michael F. Summers, Professor, Professor, Chemistry and Biochemistry, and Investigator, Howard Hughes Medical Institute

The feline immunodeficiency virus (FIV) is a retrovirus, similar to human immunodeficiency virus type 1 (HIV-1) in humans, which suppresses and inhibits activity of the immune system in cats. Studying FIV is important because humans and cats have similar immune responses to these respective viruses, suggesting that felines may be a plausible animal model for development of HIV-1 therapies. The Gag polyprotein features an N-terminal matrix (MA) domain that is responsible for assembly and targeting of Gag to the plasma membrane, a process that is vital for retroviral replication. Understanding the structure and function of FIV MA is necessary to characterize the assembly process and compare it to that of HIV-1 MA.

Precipitation was observed during FIV MA purification, an observation that may be attributed to intermolecular interaction of the N-terminal myristate moiety of MA. We hypothesize that the myristate changes conformation, promoting precipitation at low pH. Expression and purification tests under variable pH conditions suggest that pH 8 promotes FIV MA solubility. Nuclear magnetic resonance spectroscopy will be applied to characterize structural changes associated with pH variation. This analysis will expand our knowledge on FIV MA structure and, ultimately, to the assembly process.

This work was funded, in part, by the Howard Hughes Medical Institute and the NIH/NIAID #5R37AI030917.

Informational Texts in the Middle School Science Classroom

Sean O'Neill
Jonathan Singer, Associate Professor, Education

In today's increasingly connected society, it has become commonplace for scientific news and research to be shared in a variety of mediums, including both formal and informal informational texts. This study investigated the effectiveness of instructional strategies which emphasize student use of claim, evidence, and reasoning while reading and annotating different texts. The focus subjects of this study included 25 eighth grade Aquatics magnet students representing a breadth of reading and writing abilities. This student outcome was chosen based on previous MAP data that indicated student reading growth was insufficient in meeting the school's standards. Intervention was aimed towards incorporating the use of claim, evidence, and reasoning within daily student activities and assignments. Students were first encouraged to support any claims they made in classroom discussion or investigative assignments with evidence or observations. Additionally, students received a variety of informational texts that required them to visualize the writer's opinion, determine the claim of the article, and support it using information from the text. Student growth in reading was determined based on their synthesis of informational texts in a brief constructed response format.

Photokinetic Determination of Environmentally Relevant Pharmaceuticals for UV-Based Applications in Treatment Facilities

Daniel Ocasio*, Kiranmayi Mangalgiri*
Lee Blaney, Assistant Professor, Chemical, Biochemical, and Environmental Engineering

Pharmaceuticals and personal care products (PPCPs) have been known contaminants of municipal water and wastewater systems in the United States since the 1960s. Drinking water and wastewater treatment plants are often equipped with UV treatment systems that are capable of transforming PPCPs into benign products. However, no regulations are in place to monitor the fate of antibiotics. The purpose of this study was to determine how antibiotic photodegradation

kinetics affect the composition of products from UV-induced degradation. Three classes of compounds (fluoroquinolones, tetracyclines, and sulfonamides) were hypothesized to yield transformation byproducts as a result of UV exposure. Due to the wide variability in water quality, the relationship between pH and kinetic parameters was studied. Samples were prepared at eight different pH values in the range 2-12 for each compound and irradiated in a photoreactor at the germicidal UV-C range, 253.7 nm. We determined the fluence-based rate constant, quantum yield, molar absorptivity, and transformation products for three antibiotics from each class. The results indicate a clear dependence on pH for all kinetics and formation of antimicrobially-active transformation products during UV treatment.

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

Kamsi Odinammadu*, Neus Sanchez Alberola, Jinal Sheth*
Michelle Starz-Gaiano, Associate Professor, Biological Sciences

Cell migration is an essential event during animal development. Understanding how cells migrate can help build information that future generations can use in the fight against disease. Steroid hormones in *Drosophila melanogaster* control the timing of key developmental events, including cell movements, so it is important to investigate how these hormones signal. The goal of this project is to study the role of the steroid hormone Ecdysone in the border cells of Drosophila egg chambers. Border cells are a cluster of cells that must migrate during egg development to fulfill their functions. Steroid hormone signaling controls the timing of border cell exit from the epithelium. Work from multiple labs has identified several factors that are regulated by Ecdysone signaling. We have identified more potential downstream targets through expression analysis. Through genetic experiments, we are determining which of these genes most significantly contribute to cell migration. Prior work has suggested that one of the potential target genes encodes a prolyl hydroxylase, which may play a role in border cell migration. Mutations in this gene that cause an abnormal phenotype are being further characterized. These results will inform us about the important signaling effectors downstream of Ecdysone steroid hormone in cell migration.

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Monster

Paul Oh, Humza Ghani, Vishnu Yogendran, Allie Meadows, Sahrish Rukhsar, Stefan Wroblewski, Dozie Oguike, Saad Javed
Christian Valiente, Program Manager, Visual Arts

Monster is a short horror film made by UMBC undergraduate students. The film is six minutes long and revolves around a young college student being confronted by her friends about her abusive relationship. *Monster's* surreal plot pays homage to the horror films of John Carpenter, known for *They Live* and *The Thing*. Taking a post-modern approach of the horror film genre, *Monster* utilizes the conventional aesthetics commonly found in these films and moves towards an alternate conclusion. These aesthetics include dim lighting, moody sound design, and hand-held filming. The dialogue was all improvisational from non-professional student actors, resulting in a quirky style of interaction among the cast. Filmed over one evening, *Monster* is the result of team collaboration with each member voicing their opinion into the creative process. With the inevitable arrival of the protagonist's abusive spouse, the film's ending contorts the audiences' expectations into absurdity. *Monster* is a self-aware narrative that questions the definition of horror in scary movies.

Ethnic Differences in Perceived Parental Psychological Control During Emerging Adulthood

Nneka Opara
Charissa Cheah, Professor, Psychology

Between 18 and 25 years of age, emerging adults encounter new challenges, including changes in the parenting they receive. Parental psychological control includes practices that induce child compliance through psychological and emotional manipulation, and undermine children's autonomy development. These practices have been found to be associated with negative psychosocial outcomes among emerging adults. However, differences in psychological control and associated child outcomes across U.S. ethnic groups have not been examined, despite potential cultural variations. This research compared self-reported responses from 98 African American, 155 Asian American and 251 European American emerging adults regarding (1) their perceptions of their parents' level of engagement in two forms of psychological control (dependency-oriented and achievement-oriented), and (2) the relations between perceived parental psychological control and emerging adults' depressive symptoms. Significant ethnic group differences were found in the levels of psychological control; Asian Americans perceived their parents as using the most psychological control. Both forms of psychological control predicted depressive symptoms for all ethnic groups. However, achievement-oriented psychological control was more strongly associated with depressive symptoms for Asian Americans. These findings illustrated the significance of culture when attempting to understand both parenting and the effects of parenting on emerging adults' psychosocial outcomes.

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

The Role of Cultural Competency and Health Information Technology Adoption in Quality Home Care

Anna Opoku-Agyeman
Gunes Koru, Associate Professor, Information Systems

Cultural competency is a key performance improvement domain for home health agencies (HHAs). This literature review focused on investigating the challenges and opportunities for cultural competency in home care and revealed directions to leverage health information technology (IT) to address those challenges and opportunities. The review followed the PRISMA methodology to retrieve the relevant articles. Race/ethnicity disparities, language barriers, and religious or traditional beliefs were found to hinder aspects of home care. Data showed that there were clear disparities between how many services African Americans and Hispanics/Latinos received as compared to their White counterparts. Literature also revealed that language barriers prevent home-care patients from receiving necessary care instruction. Moreover, religious and traditional beliefs were found greatly impact home care patients' adherence to care procedures, such as adherence to medication. Findings also revealed that patients who were unable to overcome these barriers found it difficult to receive adequate care services, such as regular nursing visits, sensitive care procedures, and interpreter services among others. Health Information Technology can be used to help make cultural awareness training available online for clinicians to access or cultivating discussions between HHAs intranets.

Development of a Low-cost Automated Sensor for the Simultaneous Measurement of Gas and Particle-phase Ammonia

Julian Paige*, Justin Thaggard, Michael Battiglia*
Christopher Hennigan, Assistant Professor, Chemical, Biochemical, and Environmental Engineering

Ammonia is the most important basic compound in the atmosphere. Ammonia participates in numerous atmospheric chemical reactions including the formation of particulate matter, which has significant implications for air quality and human health. Agriculture is the largest emitter of ammonia, however the emissions of ammonia are not predicted well by state-of-the-art models. Existing atmospheric ammonia sensors are very expensive, costing at minimum, tens of thousands of dollars, which limits their deployment on a widespread basis. This has motivated efforts to develop new methods to measure atmospheric ammonia at significantly reduced cost. This project is based upon an automated system to capture ammonia from the gas and particles phases, with subsequent measurement of ammonia in the aqueous phase using UV-Vis spectroscopy. The detection of ammonia is achieved by initiating the modified Berthelot

reaction, which produces a green color at 660nm. Absorbance measurements of this reaction product serve as the basis of the ammonia measurement. This phase of the project focuses on the development and optimization of the automated mixing system, which is a critical component of the ultimate automated ammonia sensor.

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Mathematical Modeling of Cancer and Enzyme Cluster Formation

Jane Pan
Hye-Won Kang, Assistant Professor, Mathematics and Statistics

Glucose metabolism is a reversible process that involves the breaking down of glucose into energy. Previous studies have suggested that metabolic enzymes of glucose metabolism form clusters that hold a direct relationship to cancer cells. This project focused on creating a mathematical model which would provide novel insight into the metabolic function of the clusters in cancer cells. Using this model, we analyzed different cases that revolved around two attributes: the size of the enzyme clusters and the type of cell involved. We simulated a set of cases that enabled us to see how variations in these attributes play a role in the amount of products formed after undergoing glycolysis, including ribose-5-phosphate, serine, and lactate. Modifying initial values and efficiency parameters of our model allowed us to simulate four specific cases, with our main interest lying in cancerous cells that contained large enzyme clusters. Other sub-cases included normal cells that have small enzyme clusters, cancer cells with small enzyme clusters, and normal cells with no enzyme clusters. Results of these sub-cases were subsequently compared to our primary case of interest, cancerous cells with large enzyme clusters.

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

Sons of Erin: The Irish Brigade and Becoming an American

William Parry
Anne Sarah Rubin, Professor, History

How did members of the Irish Brigade and the Irish-American community combat nativist and other stereotypes about the unit's service to the Union Army in order to present the Irish as worthy of full inclusion in post-war American society? As millions of Irish immigrants entered the United States prior to the Civil War they faced harsh discrimination, yet they supported and fought valiantly for the Union cause and their new homeland. These men chose to fight in order to prove their loyalty to the United States while also maintaining a source of ethnic pride. From

1860 to 1863 the Irish gained recognition as loyal and successful soldiers, it was not until the New York Draft Riots that the Irish role, and thus memory, became an unflattering one. Through the use of diaries, memoirs, monuments, and reunions during the period of 1865 to 1920, I show how these immigrants reflected on the war and how they constructed their own memory of the war that conflicts with the "nativist" memory of Irish soldiers as deserters, traitors, and ungrateful. Today the soldiers of the Irish Brigade are honored for their contributions to Union victory.

Tanagra Figurine: Faked or Real

Ashley Patchett
Esther Doyle Read, Adjunct Professor, Ancient Studies

Object # 366 in the UMBC Spiro Collection is a head that was formerly part of a Tanagra figurine. These figurines originated in the village of Tanagra in Greece, during the Hellenistic Period (323-31BCE). My research focuses on how the figurines were made, what they looked as a whole piece, as well as their purpose in Ancient Greek culture. In order to do this, I will consult journal articles, books, and museum catalogs that deal with Ancient Greek art as well as visiting exhibits of Tanagra figurines at the Walters Art Museum and other museums in order to gain an insight into these objects. However, there is a chance that this Tanagra could be a counterfeit since there was highly lucrative market for fake figurines in the late 1800s, shortly after their discovery. Understanding the significance of the item to both the ancient Greeks and the 19th-century art world is important because it illustrates how the classics influence our daily lives. This research is also an important part of a long term project to document the Spiro collection's objects and to establish a context for the piece in the 21st century.

Bmore Than Dance

Erin Patterson, Brendon Thach
Alan Kreizenbeck, Associate Professor, Theatre

Bmore Than Dance is an aspiring non-profit organization that promotes local dance styles as a positive outlet for creative energy, and as a tool for empowering children and young adults in Baltimore. We sought to aid Bmore Than Dance by recruiting students to assist them. We founded and managed three teams of student interns from four universities in the area and implemented Design Thinking, a strategic method for applying business creativity and innovation. We then brought the student groups together with Bmore Than Dance to problem solve, carry out user research (field research empathizing with the intended customer), create ideas, and prototype and implement solutions. These solutions included multi-media marketing strategies,such as building and branding Bmore's online presence, finding and maintaining relationships with sponsors/partners, planning and organizing fundraisers/events, and conducting research on the effects of the arts in inner-city Baltimore. The results of these strategies were

measured through web traffic analytics, interviews conducted at events, questionnaires, and surveys. Our results of increased web traffic led to additional interest in sponsorship, performance venues, rehearsal and classroom space, and class and event attendance, supporting our belief that student intervention positively impacted the mission if Bmore Than Dance.

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

Prior Video Game Experience and the Effectiveness of Video Game Distraction

Amanda Perera, Sarah Moshman
Lynnda Dahlquist, Professor, Psychology

Research has previously examined the effectiveness of video-game distraction in reducing children's experience of pain. However, the mechanisms of the relationship are not fully understood. Research and theory suggest that cognitively demanding tasks are more effective at reducing pain than less cognitively demanding tasks. Furthermore, well-practiced tasks demand less cognitive effort than less-practiced tasks. This study examines the relationship between experience with video games and the effectiveness of video games as a distracter from pain during a cold water task. Participants were 31 children ages six to 13 and their parents. Parents reported estimates of the child's video game playing during the previous week. Experimental tasks included children immersing their non-dominant hand in uncomfortably cold (7 °C) water while playing a video game, and without video game distraction. Children's pain tolerance was measured as the amount of time that children successfully kept their non-dominant hand immersed in the cold water. Data will be analyzed using Pearson correlations to examine relations between prior experience with video games and pain tolerance. It is hypothesized that video-game distraction will improve pain tolerance for all children, but that children with more video-game experience will benefit less from video-game distraction than children with less experience.

Developing an Ensemble's Musical Vocabulary

Ryan Pilius
Brian Kaufman, Assistant Professor, Music

The ability to understand and interpret musical terminology is one of the most important skills for a performing musician. Along with reading notation and developing the mechanical ability to produce sound on an instrument, musicians must be able to understand terminology in multiple languages and apply it to musical performance. In order to measure baseline skill of terminology comprehension, a multiple choice pre-test was administered to 35 ninth grade orchestra students. The test included mixed terminology regarding tempo, style, dynamics, and articulation. The students were evaluated based on the number of correct answers. The target group was selected

from this evaluation, by selecting 16 students that scored a 60 percent or lower. During each subsequent class period, the teacher emphasized new musical terminology and discussed its function and meaning. The teacher also incorporated technology in class to help review the terms and engage the students. The post-test will be administered at the end of the term, and student growth will be measured by comparing pre- and post-test scores. The target growth for the 16 targeted students is an individual increase of at least 10 percent (one letter grade improvement).

Engineering of the FRB Domain of the Mechanistic Target of Rapamycin (mTOR) to Probe Transient Interactions

Sarah Pollock*, Erin Kennedy, Miji Jeon, Chidera Ekeocha, Vanessa Nwaiwu*
Minjoung Kyoung, Assistant Professor, Chemistry and Biochemistry

This project aims to develop a system to evaluate a novel sensor employing innovative nano-reaction chamber technology, which will track transient biomolecular interactions in real time at a single molecule level. We are evaluating this sensor by studying the interactions between the FK506-binding protein (FKBP) and the FKBP12-rapamycin binding (FRB) domain in the presence of various small molecules such as rapamycin. FKBP bound rapamycin forms complexes with the FRB domain of mTOR, which is an essential regulator of cell growth and survival. We purchased the FKBP gene from Addgene, and inserted it into the pET28b plasmid with a histidine tag for future purification. We currently perform site directed mutagenesis on the FRB domain by deleting the endogenous cysteines and exchanging an endogenous serine at a desired location to a cysteine. This will allow us to probe the FKBP and FBR domain interactions by measuring fluroescence resonance energy transfer (FRET) efficiency. The mutated FRB and FKBP proteins will generate a FRET signal upon binding to small molecules. These tertiary interactions between a single FKBP, FRB domain, and a small molecule in our nano-reaction chamber will allow us to evaluate the sensor by analyzing the binding mechanisms and affinity.

This investigation was supported in part by a MARC Undergraduate Student Training in Academic Research (U-STAR) National Research Service Award (NRSA) Institutional Research Training Grant (2 T34 GM008663) from the National Institutes of Health, National Institute for General Medical Sciences and UMBC startups and UMBC-Special Research/Assistantship Initiative Support (SRAIS) award.

Evaluating Primary Source Documents: Using Evidence to Support Claim Writing in the Social Studies Classroom

Sayre Posey
Linda Oliva, Assistant Professor, Education

Historical documents are direct and relevant links to the past. When given a primary or secondary source document, students have trouble making their own claims about the information. Instead, they often cite direct quotes or repeat the text in their answers. This study investigated the effect of a range of instructional techniques selected to assist students in developing their claim- and evidence-writing skills in the social studies classroom. Using the processes outlined in the Howard County Public School System (HCPSS) Historical Thinking Skills, students wrote claims to interpret primary source documents and provided textual evidence to support their claims. The subjects were 21 eighth-grade students in on-level U.S. History who had both minimal experience and a lack of skills necessary for claim and evidence writing. Students were given five in-class exercises to practice and refine their writing over a period of three months, including specific targeted lessons in each unit. They should exhibit growth toward mastery of drawing and supporting evidence-based conclusions, and demonstrate content understanding. The data included a baseline writing sample, several document-based questions and assessments collected throughout the year. Writing was scored using an HCPSS claim- and evidence-writing rubric.

Children's Awareness of Task Distraction and Task Persistence

Asma Qaiyumi, Aman Sajid*, Cassandra Simons*
Susan Sonnenschein, Associate Professor, Psychology

Children’s abilities to ignore distractions and persist on tasks by using learning strategies predict academic performance. However, few studies have addressed children’s understanding of these strategies. This study had two goals: (1) to identify and categorize children’s self-reported barriers to ignoring distractions and persisting on tasks; (2) to compare children’s definitions of ignoring distractions and persistence to researcher/expert definitions. The sample (N =113) consisted of mainly White (58.6%) and Black children (19.8%), 54% boys and 46% girls, from grades one to six. They completed a learning-strategies questionnaire asking about strategies children use to complete tasks. Responses were coded for barriers to strategy use and the extent to which student definitions of learning strategies aligned with researcher definitions. Results showed 75.2% of children reported auditory distractions (people talking) as common distractors, followed by visual distractions (32.7%); 47% of children reported general distractions as common barriers to persisting, followed by difficulty of material (40%). Results indicated that children are not fully aware of available strategies for ignoring distractions and persisting on tasks. School curriculum should include lessons on awareness of learning strategies to foster academic success.

Acoustic Beamforming Techniques for Standoff Detection

Brandon Quade, Tyler Quade, Mark Murnane, Mahesh Shirole
Charles LaBerge, Professor of the Practice, Computer Science and Electrical Engineering; Fow-Sen Choa, Professor, Computer Science and Electrical Engineering

Beamforming techniques generally used in radio frequency applications such as phased-array radar can also be employed in acoustic applications with comparable success. Beamforming is a signal-processing technique that uses the interaction of multiple sensing elements to improve the overall characteristics of the sensor. We researched various techniques in microphone array design and signal processing to enhance the quality of received audio signals. One application of acoustic beamforming is Photo-Acoustic Sensing (PAS), the process of using controlled light pulses to excite an acoustic response from a material, detecting those signals with a microphone array, and properly identifying the material though spectrum analysis. When operated in noisy environments, PAS applications require a highly directive response pattern. With such a response, PAS is useful in standoff detection of hazardous substances in airports, military installations and public places. We simulated and constructed a 32-element microphone array with an FPGA-based signal processor, which successfully discriminated a target in a typical environment at a range of 10 meters. The directivity of our design results in a significant improvement in signal-to-noise ratio compared with a single traditional microphone element.

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

Exploration of College Students' Dietary Habits and Differences in American Dietary Guidelines

Rafay Qureshi
Dena T. Smith, Assistant Professor, Sociology and Anthropology; Jamie Trevitt, Assistant Professor, Health Administration and Policy Program

Despite an increase in scientific knowledge about healthy diet, Americans on average do not meet healthy dietary guidelines. Multiple groups have created dietary guidelines to help Americans achieve healthier dietary behavior, including the government's Choose My Plate and the American Heart Association. Using a survey of undergraduate students at a large public university, this study focused on students' dietary behavior and whether the students meet guidelines depending on the guidelines used. This study was conducted through an electronic survey and had 510 participants. Participants were contacted through departmental listservs and university groups. Results showed that students were, overall, not meeting dietary guidelines for fruits, vegetables, grains, and dairy. Using the McNemar Test, the study also found that the two different guidelines resulted in statistically significant differences in terms of percent of students meeting dietary guidelines for all groups. The recommendations from the two guidelines are

inconsistent with one another. This study seeks to influence policy regarding nutrition on college campuses, especially given the poor diet of American college students.

This research was funded, in part, by the UMBC McNair Scholars Program and by the Department of Sociology and Anthropology at UMBC.

Ribosomal Protein Binding During Ribosomal RNA Maturation

Rebekah Rashford
Lasse Lindahl, Professor, Biological Sciences; Jesse Fox, Biological Sciences

Genetic and biochemical studies of the ribosome show that ribosome formation is a complex process of synthesis and assembly of individual components, namely ribosomal proteins (rp) and ribosomal RNA (rRNA). However, the exact timing of individual rp addition to ribosome assembly RNA intermediates is not fully understood. This project was designed to develop a method for determining these binding patterns without interrupting ribosome biogenesis. Individual tagged rp's were expressed and co-immunoprecipitated, along with the specific rRNA segment to which the rp binds. RNA was extracted from the immune precipitate and loaded onto slot blots. The blots were then probed with segment-specific oligo-probes loosely corresponding to rRNA cleavage sites (a process we termed "slot-northern"). When a signal showed the slot-northern indicating a probe had bound to the rp/RNA complex, it was viewed against the known specific probe-segments of the binding probe and used to deduce the location of binding for that individual rp onto the maturing rRNA. By gaining this information about ribosomal proteins, we may better understand the ribosome in its entirety and add to the foundational understanding of the important process of translation.

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.

Improving Students' Abilities to Summarize and Speak Publicly

Sierra Reeb
Cheryl North, Assistant Professor, Education

The two objectives of this study were to increase students' ability to accurately summarize a text, and for students to become more proficient when presenting. These are both valuable skills necessary for student achievement. The study population consisted of 15 tenth graders from a suburban Mid-Atlantic high school who had difficulty summarizing and were identified as having poor speaking skills early in the school year when asked to present. These presentations served as the baseline data and were graded using a standardized rubric. Interventions included direct instruction, regular practice with summarizing, and increased opportunities for public speaking with extensive feedback. Using a standardized rubric, students were assessed

throughout the year on their ability to summarize and speak proficiently. Baseline data was compared to subsequent data and end-point data to examine growth. The target for improvement was for students who demonstrated a base score of 1 to improve their skills to the next level, 2 to improve their skills to the next level, and 3 to maintain mastery on a similar assignment by the end of the course. Participants will be shown which instructional practices benefited students the most and how growth was measured throughout the school year.

The Association Between Intimate Partner Violence and Financial Stress in Newlywed Couples

***Allison Reichard**, Rupsha Singh*
Robin Barry, Assistant Professor, Psychology

Intimate partner violence (IPV) causes physical and psychological harm. There is some evidence that indicators of financial stress, such as unemployment, are also risk factors for IPV, because it has been shown to increase relationship stress. However, previous research has not examined whether perceived financial stress (i.e., perceiving one is unable to pay one's bills, pay for basic necessities) increases risk for IPV. This study used a sample of N=114 couples, who were in their first year of marriage, and examined whether indicators financial strain: income, perceived financial stress, and employment were associated with IPV using actor-partner interdependence modeling (APIM). We expected that IPV would be higher in couples with higher financial strain. Our hypothesis was partially supported, in that, personal income was negatively associated with injuring one's spouse over the prior year. However, perceived financial stress and unemployment were not associated with IPV.

The Effect of State Unemployment Rate and Existence of a Capital Gain's Tax on Income Inequality among the U.S. States

Zuhair Riaz
Carolyn Forestiere, Associate Professor, Political Science

How do the unemployment rate and capital gains tax influence income inequality in the United States? Income inequality has been growing in America for the past few decades and has become a significant political issue because of its potentially destabilizing effect on the middle class. To understand how income inequality has increased, we need to understand the factors that have caused it. One potential causal factor is the unemployment rate of a state; if there are more individuals who are not earning income, the gap between those who have no income and those who earn a higher income widens. Another factor is the tax policy of a state, which matters because its regulations come at the expense of the lower class. Using regression analysis and two brief hypothesis-confirming case studies (North Dakota, and Washington D.C.) to study 2015 data from the Bureau of Labor and Statistics and the American Council For Capital Information,

this research finds that a state's unemployment rate has a positive relationship with income inequality, that is, as the unemployment rate increases, inequality decreases.

Using Nuclear Introns to Assess Gene Flow between Old and New World Common Ravens

Hayley Richardson*, Anna Kearns, Matthias Gobbert*
Kevin Omland, Professor, Biological Sciences

Genome sequences from our extinct close relatives have shown that modern human genomes are a mixture of three distinct lineages. To better understand the evolutionary process of interbreeding between formerly distinct lineages, we study the Common Raven (*Corvus corax*), whose range spans across North America, Europe and Asia. Within the species, there exist two distinct DNA lineages: the California clade (present only in the western United States) and the Holarctic clade (which is found throughout the entire range). Our goal is to determine the origin of the Holarctic clade. Lower genetic variation in New World ravens would indicate a recent colonization of the New World, suggesting the lineage originated in the Old World. We collected nuclear data from seven Old World and twelve New World ravens. The Isolation with Migration program was used to estimate divergence time and amount of gene flow between the two populations. Ravens illustrate a dramatic case of speciation reversal, so understanding the Holarctic clade's history will help us elucidate this process. Since similar evolutionary processes occurred in both raven and human history, understanding speciation reversal in ravens could help understand the details of human evolution.

This work was funded by an Undergraduate Research Award from the UMBC Office of Undergraduate Education, the NSF Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences (UBM), and the Research Council of Norway.

Impact of External Visual Stimuli on the Perception of Flavor Identity

Alexis Rubin
Shuyan Sun, Assistant Professor, Psychology

It is well known that color of food significantly affects the perceived taste of food items. An unknown liquid colored red is more likely to be perceived as a flavor derived from red foods such as cherry, rather than orange. However, whether the same effect occurs when one's surroundings are colorful rather than the food item has not yet been investigated. In this experiment, 28 UMBC students were provided with three samples of unknown, uncolored fruit juice, and asked to identify the flavor experienced and how intensely they perceived the flavor under two conditions. In the control condition, the participant faced a blank white screen during tasting, whereas in the experimental condition, participant sampled the juices in front of a saliently colored red screen. It was hypothesized that the red color presented on the screen would influence the subjects to perceive "red" flavors such as watermelon. Preliminary data analysis

indicates that there is no significant difference in flavor or intensity perceptions between the blank control condition and the red experimental condition. Findings from this study may inform interventions for individuals with abnormal eating habits.

Benzoxazole-Based Metal Chelators for Hepatitis C

Bren Runge
Paul Smith, Associate Professor, Chemistry and Biochemistry

Our lab has synthesized several novel compounds shown to inhibit replication of Hepatitis C virus (HCV). Three viral proteins (NS2, NS3, and NS5A) required for HCV replication contain or share structural zinc ions in order to maintain their function. Disruption of zinc binding within these proteins has been shown to inhibit their function, which has led to the hypothesis that inhibition results from the chelation of one or more structural zinc ions. Previously identified HCV inhibitors contain three Lewis-basic groups that have been shown to bind zinc. The specific goal of this research is to improve the efficacy of our lead compounds by synthesizing a series of analogs with an additional Lewis-basic group of an amine of varying length. With the additional Lewis-basic group we expect to see an increased affinity for zinc and, if the hypothesis is correct, increased HCV inhibitory activity.

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

Evaluating Accuracy of the Algorithm/Formula Used in Store-brand Digital Thermometers to Predict Body Temperature

Amirreza Saharkhiz
Liang Zhu, Professor, Mechanical Engineering

The objective was to evaluate whether a single exponential function formula used in store-brand digital thermometers is accurate to predict body core temperature. A thermistor bead temperature sensor was used to measure the transient temperatures at either the oral or the axillary site of 20 human subjects. The transient temperatures were later curve fitted with a proposed formula of two exponential functions with two time constants. We found that it was necessary to measure the temperatures for at least 40 minutes at the axillary site, and 10 minutes at the oral site to establish a steady state. The transient temperatures clearly demonstrated two phases of the thermal environment. Even though at the oral site, the first exponential term is dominant, it would have underestimated the body temperature by up to 1 °C using only the first function in 65% of the participants. This result is accentuated at the axillary site. If a single exponential term was used to fit the temperature transients at the axillary site, the resulting average error would have been as large as 2 °C. We conclude that single exponential function based digital

thermometers relying on the first several seconds of measurements greatly underestimate the body temperature.

This work was funded, in part, through an Undergraduate Research Award from the UMBC Office of Undergraduate Education, by an NSF S-STEM grant and the FDA.

Investigating RLS1 Protein Localization and the Evolutionary Origins of Cellular Differentiation

***Rima Sakhawala**, Jose Ortega*
Stephen Miller, Associate Professor, Biological Sciences

Cellular differentiation is a key attribute of all multicellular organisms, but little is known about the molecular mechanisms that drive its evolution. The goal of this work is to understand a gene named *RLS1* (*regA*-like sequence), that is believed to have been important for the evolution of cell types in the volvocine green algae. This family includes unicellular *Chlamydomonas reinhardtii*, which has no cell differentiation, and multicellular *Volvox carteri*. RLS1 is the closest *C. reinhardtii* homolog of RegA, a Volvox protein essential for cell differentiation; however, little is known about RLS1. Our immediate goal is to learn more about the accumulation and localization of the RLS1 protein during the *C. reinhardtii* life cycle by developing a construct that expresses mCherry-tagged RLS1 protein. We PCR-amplified a hygromycin-resistance-encoding gene fragment, which was subcloned into an *RLS1*-containing plasmid. An mCherry fragment was synthesized and will be subcloned to create the completed construct. That construct will be transformed into *C. reinhardtii* and western analysis will be used to identify transformants that express mCherry-RLS1. These transformants will be analyzed to determine how RLS1 accumulates during the *C. reinhardtii* life cycle, thus providing insights into its developmental function and the evolution of multicellularity.

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

Exploring Potential Benefits of Three-Dimensional Printing Technology in Elementary School Settings

***Gabrielle Salib**, William Easley, Dhuel Fisher, Erin Buehler*
Amy Hurst, Assistant Professor, Information Systems

With the increased availability of three-dimensional (3D) printing technologies on the consumer market, educational settings have begun to explore their use within the traditional curriculum. As part of a longitudinal study, our research team is conducting weekly 3D modeling and printing workshops at a Baltimore school. The workshops are part of an after-school education program designed to support at most 20 students in third and fourth grade who may be at-risk. Since the

school is located in an underserved area, we are able to observe the reactions and perceptions of 3D printing among students who may not be regularly exposed to the latest technologies. By observing and recording the students' reactions, collaborations, and frustrations while learning 3D modeling and printing in this setting, we are able to observe benefits and repercussions of 3D modeling and printing in an educational setting. We utilized the method of comparing students' understanding of the technology in 2D drawings from the time of their initial exposure to their understanding at the end of the school year. We foresee that the findings of this research may help to inform the design of future curriculum, and 3D modeling and printing software tools.

This work is supported, in part, by the National Science Foundation under Grant No. IIS-1451661.

Characterization of the HIV-1 5'UTR Dimerization Mechanism

Justin Leonel Santos
Michael F. Summers, Professor, Professor, Chemistry and Biochemistry, and Investigator, Howard Hughes Medical Institute

Human immunodeficiency virus type-1 (HIV-1) is responsible for a pandemic that affects roughly 35 million people worldwide. There is no known cure and antiretroviral medications only serve to reduce the progression of the disease. Current treatments target four stages of the viral life cycle: entry, reverse transcription, integration, and maturation. There is currently no treatment that targets the genome recognition and packaging phase of the viral life cycle. Our group is attempting to understand the structural mechanism behind HIV-1 packaging selectivity. Evidence shows that dimerization of the HIV-1 genome is initiated by a palindromic GCGCGC sequence at the Dimerization Initiation Site (DIS) in the 5' leader (5'-L) between two strands of unspliced RNA. However, previous studies in our lab have shown that the 5'-L dimer exhibits a more extensive intermolecular interface. We employ NMR spectroscopy using a mutagenesis strategy known as long-range probing by Adenosine Interaction Detection (lr-AID) in order to further characterize this mechanism. At short time intervals, we hypothesize that the HIV-1 5'-L dimer quickly transitions from a "kissing" loop interaction into a more extensive intermolecular interface. We hope to apply these results to the development of new therapies that target genome selection for packaging.

This research was funded by NIH/NIGMS grant 1P50GM103297 and NIGMS MARC USTAR grant T34GM00866, and was conducted at the Howard Hughes Medical Institute at UMBC with support from the Summer Biomedical Training Program (SBTP) and, in part by the Howard Hughes Medical Institute's Precollege and Undergraduate Science Education Program.

Dense Subtle Forms

Sarah Schmitz
Doug Hamby, Associate Professor, Dance

Dense Subtle Forms was created to research, explore, and creatively present the relationship between sound and dance. This dance uses the sounds created by the dancers' bodies and movements instead of music, emphasizing the physical aspect of sound. A beautifully worded quote by Alexandra David-Neel, which is used in the dance, explains that on the most basic level, "all things are aggregations of atoms that dance and by their movement produce sound," and I aimed to represent this concept onstage. I used each dancer as if he were an atom, moving through the space creating sound with the natural vibration of billions of atoms caused by their dancing. By using ideas from my research on sound, compositional techniques, and creativity aided by collaboration with my dancers, I choreographed movement to represent the interactions and movement between atoms that creates sound. In some cases, the combination of the dancers' sounds is chaotic and seemingly random, sometimes they join together to create sound patterns and music, and at other times there is little sound onstage and only dense subtle forms.

Regulation of Radioresistance of Breast Cancer Cells by Tissue Composition and Mechanics

Jordyn Schroeder
Ovijit Chaudhuri, Assistant Professor, Department of Mechanical Engineering, Stanford University; Katrina Wisdom, Department of Mechanical Engineering, Stanford University

Over half of patients with invasive breast cancer who receive tumor resection and radiotherapy suffer from recurrence. Previous studies demonstrated that extracellular matrix proteins promote radioresistance, but there has been no direct comparison of proteins in a breast cancer progression-relevant, 3D materials system. Highly malignant breast cancer cells (MDA-MB-231s) were plated on tissue culture wells (uncoated, coated with collagen-I, or coated with reconstituted basement membrane proteins) then irradiated at 0Gy, 5Gy and 10Gy doses. Metabolic and viability assays were used to assess and compare radioresistance among samples. This 2D work was extended to determine how stiffness in a 3D microenvironment containing collagen further contributes to survival of breast cancer cells post-irradiation. Interpenetrating network (IPN) hydrogels of collagen and ionically cross-linked alginate were engineered to mimic the stiffness of normal (E=100 Pa) and cancerous (E=2 kPa) breast tissue. MDA-MB-231 cells were encapsulated in these IPNs, then irradiated at 0Gy and 10Gy. Preliminary data suggest differences in cell morphology between soft and stiff gels, which could indicate future differences in radioresistance. Future work gauging metabolic rates, viability, and proliferation using this 3D system may yield insight into how the stiffness and composition of the tumor microenvironment may co-regulate radioresistance of cancer cells.

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

Alkaheist, Two-Dimensional Platformer, Explorations in Team-based Game Development

Erika Schumacher, Ryley Mayer, Claire Blevins, Christopher Lense, Roberto Melgar
Eric Jordan, Adjunct Professor, Visual Arts

Created as a part of the Capstone Games Group Project course, Alkaheist is a two-dimensional (2D) puzzle-platformer game developed within the Unity game engine. The game utilizes 2D liquid physics based upon the particle system of the Unity engine to implement a unique simulation of liquid motion that allows the player to melt their surroundings strategically to move forward through the levels. Assembled by the joint efforts of computer science and visual art majors, development of this game provided an exploratory medium for programming and art, and fostered a deeper understanding of team-based game development, physics simulation, and visual design.

Probing the Dimerization of the HIV-1 5'-Leader

Carly Sciandra*, Verna Van, Heather Frank, Sayo McCowin*
Michael F. Summers, Professor, Professor, Chemistry and Biochemistry, and Investigator, Howard Hughes Medical Institute; Sarah Keane, Chemistry and Biochemistry

Human immunodeficiency virus type-1 (HIV-1) infects roughly 35 million people worldwide. HIV-1 selectively packages the dimeric, unspliced RNA genome. It is important to characterize the dimerization mechanism of the HIV-1 5'-leader (5'-L) because it is the most conserved region of the genome and contains the major dimerization signal. Previous NMR studies from our lab have identified an extensive intermolecular dimer interface of the 5'-L after long periods of incubation in physiological conditions. Gel based studies of the 5'-L established the dimerization equilibrium to be approximately 30 minutes. However, the nature of the dimer is unknown. We used an NMR spectroscopy strategy known as long-range probing by Adenosine Interaction Detection (lr-AID) to probe the nature of the dimer interface at short time intervals. The two lr-AID mutations, UUA v. UUG, when introduced into the context of the full 5'-L, have distinct chemical shifts at 6.4 ppm and 6.7 ppm, respectively. By mixing A^d UUA 5'-L and A^H UUG 5'-L we were able to show that the 5'-L forms an extended dimer within 30 minutes, consistent with the gel-based studies. Therefore, extended dimer formation occurs on the same time scale as overall dimerization.

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.

Effects of Demographics and Risk Factors on the Elastic Strain Energy of Human Superficial Femoral Arteries

Andreas Seas
Alexey Kamenskiy, Assistant Professor, University of Nebraska Medical Center, Department of Surgery; Jason MacTaggart, University of Nebraska Medical Center, Department of Surgery

Occlusive disease of the superficial femoral artery (SFA) is associated with significant morbidity and quality of life impairment. Understanding SFA remodelling as it relates to patient characteristics could improve diagnostic and treatment modalities for peripheral artery disease. Fresh SFAs were obtained from n=27 human subjects, age 33-80 years old. Arterial morphology measurements were obtained, followed by mechanical property characterization using planar biaxial extension with multi-ratio protocols. Raw data were used to determine parameters of an invariant-based, structurally motivated model accounting for passive contributions of collagen, elastin and smooth muscle. Nonparametric bootstrapping was performed on each parameter to establish uniqueness. Elastic strain energy (ESE) was calculated at physiologic stretch conditions corresponding to 120 mmHg internal pressure and in situ longitudinal pre-stretch. Data analysis with respect to demographics and risk factors demonstrated a decrease in ESE with age and Body Mass Index (BMI). Age had a stronger effect ($r=-0.704$, $p<0.001$) than BMI ($r=-0.348$, $p<0.1$), and strongly correlated with constitutive parameters representing loss of elastin, accumulation of collagen and stiffening of smooth muscle. ESE reduction with age and BMI suggests degenerative changes in the elastic properties of the SFA likely due to degradation and fragmentation of intramural elastin and accumulation of tissue damage.

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

The Importance of Physical Beauty to the Modern American Woman

Michelle Seu
Symmes Gardner, Associate Professor, Visual Arts; Cynthia Wagner, Lecturer, Biological Sciences; Elizabeth Picciuto, Adjunct Professor, Philosophy

Artists and scholars alike have tried to define and demystify beauty for ages. Traditionally, many would attribute a woman's desire for physical beauty to mate attraction and, more implicitly, reproductive fitness; however, the answer is likely not that simple. Through my research, I developed a graphic novel that explores why various modern American women ages 18-29 place importance on their physical beauty and appearance. In order to develop the style and narrative of my graphic novel, I studied the style and construction of existing educational, interdisciplinary graphic novels, such as *Unflattening* by Nick Sousanis and *Understanding Comics* by Scott McCloud. I also conducted a literature review of works related to beauty and its appreciation as the central component of my Interpretivist approach to my research topic. This review included the work of evolutionary biologists like Charles Darwin and Matt Ridley, books by psychologists like Nancy Etcoff, assorted texts written on aesthetic philosophy, and a variety of scholarly

articles written within the disciplines of gender and women's studies and sociology. Based on my research thus far, I propose that modern American women use physical beauty as a means to enhance their social status within their respective social groups.

Roadblock

Ben Shaffer
Corrie Parks, Assistant Professor, Visual Arts

Roadblock is a two-minute cutout animated short about a man who is walking along a path guided by a bird, until a rock monster blocks the way and prevents him from going any further. The piece symbolizes the creative struggle an artist goes through when creating a work of art. Everything from the characters to the environment are designed with simplified shapes made up of only sharp angles. At least three cutout puppets were used for both the man and the rock monster. For the close up shots, much larger puppets were used in order to have more control when animating the faces. All the animation was done under a DSLR camera using the stop-motion technique. While most of the shots were completely captured on camera, some elements had to be animated separately on a green or blue sheet of paper and then composited in AfterEffects. It was extremely important to make sure that both the traditional parts of the animation and the digital elements blended together nicely to create an enhanced image. The result is an engaging short animation that draws the viewer in with increasing levels of detail.

Portable Electromagnetic Generator for Charging Mobile Electronics

Lena Shalaby
Soobum Lee, Assistant Professor, Mechanical Engineering

As the use of mobile devices increases, so does the need to charge these electronics. The purpose of this research is to design a suitcase wheel that harvests wasted rotational energy, and to perform a feasibility study on the charging of mobile devices via this method. We designed a wheel containing a specific arrangement of coil windings and permanent magnets that harvest energy created from the rotating wheel. Various configurations of coils and magnets, in both radial and axial directions, were analyzed and tested in order to find the most efficient design. Tests were implemented by simulating a wheel moving at the average walking speed of a human, while measuring the amount of power that was generated over a specific amount of time. The test results demonstrated possible power generation for a mobile device to operate in idle mode (typically 70 mW). Results indicated that there is potential to increase the amount of harvested energy allowing the use of other features, such as WiFi and SMS.

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

Answer the Question: Writing Proper Thesis Statements

Sidrah Shayiq
Linda Oliva, Assistant Professor, Education

In social studies, a strong thesis statement is the first step to a well-written essay. Answering the essay question is the essential aspect of a thesis, yet many students struggle to complete this necessary part. This study investigated the effectiveness of scaffolding instruction for students to improve their ability to construct a thesis by measuring the growth of students' writing from the baseline data to the final end point. The specific skills that were targeted include restating the question, proposing an opinion, and grouping examples. The subjects were 24 10th grade students in Honors World History. Students have to write several Document Based Questions (DBQs) throughout the year, and these students had difficulty organizing their arguments into concise thesis statements. The students were given more writing assignments, from Brief Constructed Responses to simple thesis writing drills. Students also received one-on-one instruction on how they could further develop their thesis statements. The goal of this intervention was to improve students' overall essay writing skills by focusing on refining their theses to the standard of at least directly answering the question. The data included baseline DBQ responses, individual documents that highlight student learning in the targeted areas, and a final DBQ response.

Enculturation, Identity, and Cultural Maintenance in Second-Generation Latino/a and Hispanic Immigrants

Taylor Sheldon
Anne Brodsky, Professor, Psychology

There is little research available and limited existing tools to measure enculturation, specifically concerning adult second-generation Latino/a and Hispanic immigrants. Enculturation, in this context, is the process by which an individual's family's culture is instilled in second-generation Latino/a and Hispanic immigrants. This includes how an individual's culture of origin has an impact on their values, experiences, and behaviors. The current study explored the interconnected processes of enculturation, cultural maintenance, and identity in second-generation Latino/a and Hispanic immigrants living in the Baltimore/Washington D.C. area. The analysis was based on 15 semi-structured interviews with second-generation Latino/a and Hispanic immigrants. The interviews were coded using qualitative methods and with ATLAS.ti, a qualitative analysis program. Using grounded theory, themes were found across interviews and codes that helped to increase our understanding of the role of culture and identity in the lives of second-generation Latino/a and Hispanic immigrants.

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

Flexible Nucleosides as Potential Ebola Inhibitors

Matthew Shirley
Katherine Seley-Radtke, Professor, Chemistry and Biochemistry; Therese Ku, 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 Ebola is extremely virulent. Currently, there is no FDA-approved treatment or vaccination for the Ebola virus and with fatality 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 inhibiting 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). This project's specific aim was to synthesize a flexible version of NpcA, termed *Flex*-deazaNpcA, where the adenine base of NpcA is replaced by a 1-deazaadenine base and separated into its imidazole and pyridine moieties, connected by a carbon-carbon bond. This *Flex*-deazaNpcA has been successfully synthesized. We hypothesized that base flexibility modifications will allow for increased beneficial interactions, 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, and through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.

Optimization of Biomaterials for Motor Neuron Growth

Sadjo Sidikou, Vani Ravichandran*, Elise Adamson*
Jennie Leach, Associate Professor, Chemical, Biochemical, and Environmental Engineering

Genetic engineering and transplantation have been performed in an attempt to regenerate or repair injured parts of the central nervous system, however, both of these methods can give rise to potentially harmful consequences for the central nervous system. Tissue engineering strategies can be employed to combine appropriate biological cues with responsive biomaterial architectures with the aim of improving neural viability and regeneration. A motor neuron-like cell line derived from embryonic mouse spinal cord cells and neuroblastoma cells, NSC-34, is available but has not yet been characterized for tissue engineering applications. The goal of this project is to systematically characterize NSC-34 cells and optimize biomaterial microenvironment and culture conditions. The NSC-34 cells were cultured within a panel of 3D hydrogel environments containing varied concentrations of extracellular matrix (ECM)-native proteins such as collagens I, IV, laminin and combinations thereof. The cells were cultured for three days, after which they were dual-stained for actin and nuclei, with fluorescently-labeled phalloidin and 4',6-diamidino-2-phenylindole (DAPI), respectively. Cell images were captured under fluorescence microscopy, and growth patterns were qualitatively assessed. Current results

suggest that high laminin concentrations are favorable for NSC-34 neurite outgrowth. Ongoing work focuses on rigorously characterizing neuronal morphologies and neurite lengths in 3D cultures.

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

Playtime: A Three-dimensional Multiplayer Computer Game Designed to Create Competition

Nicole Simke, Kevin Jones, Hope Kretz, Katherine Bobby, Joseph Nelson, Austin Roberts
Eric Jordan, Adjunct Professor, Visual Arts

Inspired by the concept of living toys and the classic horror trope of the killer doll, our group took on the task creating a multiplayer video game prototype with these in mind. We created a virtual environment with two toy characters that draw players into a fun competition. The idea was to create one level modeled after a little girl's bedroom. The room would be filled with furniture that could be used as platforms for the players and items that could be picked up for the players to use as weapons. For this prototype, we set up the core game play aspects of the game: movement, weapons, player objectives, and multiplayer. All of the code for this abstract was written in C++, and all of the three-dimensional assets were made with Maya. We put it together for a functioning prototype using the Unreal Editor and a git repository from Sourcetree. We met all of our goals for the prototype and believe our game will be able to entice players as well as prove our abilities in the growing game development industry.

Is Cognitive Inflexibility Associated with Physical Aggression, Emotional Abuse, and/or Sexual Abuse in Relationships?

Tracee Simms
Robin Barry, Assistant Professor, Psychology

The present study examined whether or not cognitive inflexibility is associated with being more physically aggressive, emotionally abusive, and/or sexually abusive in romantic relationships. Cognitive inflexibility is defined as the brain's inability to transition from thinking about one concept to another and is measured in the present study by the degree to which an individual is a consistent-hander. Consistent-handers use only their dominant hand to perform everyday tasks. In contrast, inconsistent-handers use their non-dominant hand for some of those everyday tasks. Previous research has shown consistent-handedness is an indicator of cognitive inflexibility and is associated with having trouble with belief-updating and greater authoritarianism. Nevertheless, previous research has not examined associations between consistent-handedness and abusive and aggressive behavior towards others. We surveyed 110 undergraduate students from a Mid-Atlantic University about their handedness and behaviors in romantic relationships. Correlations

between handedness and each type of abusive behavior will be presented. Implications for theory and interventions focused on relationship abuse will be discussed.

Negative Modernism: Djuna Barnes, Theodor Adorno, and the Problem of Nightwood

Archie Slade
Jessica Berman, Professor, English

The purpose of my research is to investigate how Djuna Barnes, a groundbreaking woman modernist, used - and subverted - modernist conventions of literature to portray love between women early in the 20th century. Her 1937 novel *Nightwood* is a mostly forgotten and often misunderstood work of fiction that has evoked wildly divergent responses from critics. The language of the book is at turns thorny and poetic, and its social message seems self-contradictory and indeterminate. How can we, in the 21st century, look back on *Nightwood* and understand it as a barometer, a diagnostic of the modern age? To that end, I use the philosophy of Theodor R. Adorno to investigate negation and negativity, the gears on which the novel turns. Queer theory, deconstruction, postmodernism, animal studies: all these theoretical approaches try to encompass the peculiarities of *Nightwood* but in my opinion fall short. This talk will try to find ways to think through *Nightwood* without letting its purpose fall to the wayside.

Using the HPCG Benchmark to Analyze Performance of the Intel Xeon Phi

Jack Slettebak
Matthias Gobbert, Professor, Mathematics and Statistics

Parallel computing lies at the forefront of high-performance computing as a method of making computations faster by combining the power of multiple computational cores. Computers can contain multiple central processing units (CPUs) and each CPU can contain multiple cores (usually eight to 16 cores). Heterogeneous computing combines the power of such multi-core CPUs with many-core accelerators that have even more computational cores, each of which are less powerful than the core of a CPU. The supercomputer maya in the UMBC High Performance Computing Facility (HPCF) contains several heterogeneous nodes with accelerators. This report focuses on the recently developed 60-core Intel Xeon Phi 5110P accelerator and uses the newly developed High Performance Conjugate Gradient (HPCG) benchmark from Sandia National Laboratories which runs a standardized test problem to explore the Phi's capabilities. My research uses the HPCG benchmark to investigate various setups that are available with the Intel Phi and the advantages and disadvantages of each setup. I then compare these results to results obtained in a traditional non-heterogeneous computing setup and contrast the performances of each. My results indicate that the Intel Phi has potential to be more powerful than a single host CPU when using the right setup and environment.

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

Investigating the Function of the *shep* Gene in Cell Migration

Amelia Smith
Michelle Starz-Gaiano, Associate Professor, Biological Sciences

Cell migration is an important process as it is necessary for proper immune function, embryonic development, and injury repair. Border cell migration in *Drosophila melanogaster* is used as a model to study cell migration due to similarities between fly genes and human genes, the ease of manipulating gene function in flies, and the fact that migrating cells can be observed in their native tissue. During border cell migration, a group of cells travels from one side of a developing egg chamber to the other. Previous investigations into a *D. melanogaster* gene called *shep* have indicated it may have a role in this important developmental process. We tested this hypothesis using immunohistochemistry, RNA interference, and a transposase experiment. A GFP reporter insertion in the *shep* locus showed specific expression of Shep protein in the border cells. Knockdown of *shep* via RNA interference caused delayed migration in developing eggs. The transposase experiment to generate *shep* alleles is ongoing but has not yet yielded affected offspring. Thus, another method to generate mutant alleles, CRISPR-Cas9, will be used. This work may reveal that Shep regulates cell migration in *D. melanogaster* and lead researchers to investigate the functions of similar proteins in humans.

This work was funded, in part, by an NSF-Career Research Award from the National Science Foundation to Dr. Michelle Starz-Gaiano.

An Ideal World

Kristina Soetje
Corrie Parks, Assistant Professor, Visual Arts

An Ideal World, 1:36 minutes in length, is a two-dimensional cut-out animation telling the story of a little robot who doesn't enjoy the bleak and geometric world in which he lives. After coloring the world in his coloring book, he discovers that he is able to color in his own world with crayon and sets off to make it ideal: organic, bright, and fun. He even takes the liberty to color himself in to match. The animation was shot over the course of two days in segments using DragonFrame, and put together in Premier Pro CC 2015. I executed a layering process when animating. I drew the background and taped it down, and afterwards layered a sheet of glass over this to prevent smearing. The robot's individual body parts were animated on top of the glass. I chose to use Jason Shaw's royalty free song, "Rubix Cube" for the background music because it provided the peaceful feel to the animation I was looking for, and certain points of the song

matched the movement of the robot. After editing the animation twice for lighting and frame issues, the animation appears the way I first envisioned it.

Geographic Variation in Composition and Body Size of Drosophila Species in North America

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

Ecological interactions among species are one of the most important processes driving adaptive evolution and diversification. 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, focusing on *Drosophila melanogaster* and *Drosophila simulans*, two closely related host species, and their major parasitoid predator, *Leptopilina boulardi*. In this component of our study we document patterns of geographic variation in relative abundance and body size in *D. melanogaster* and *D. simulans*. Body size is perhaps the most fundamental property of an organism and is related to many biological traits, including abundance. The body size of *Drosophila* hosts may also affect the body sizes of parasitoids thus influencing the outcome of host-parasitoid interactions. *Drosophila* and their parasitoids are an ideal group to study as they are commonly used lab species, yet very little is known about their natural environment, processes, and biodiversity. Characterizing the body sizes, abundances, and distributions of these interacting species across different geographic locations allows us to generate testable hypotheses about the factors that determine species distributions and coexistence, central questions of ecology.

This work was funded, in part, by the Smithsonian Institution and the USDA through Chia-Hua Lue's doctoral fellowship.

Nurture their Growth: Non-Traditional Women Students at UMBC

Imani Spence
Deborah Rudacille, Professor of the Practice, English

Non-traditional students are typically defined as students over the age of 24 who are pursuing their first collegiate degree. This population of students is growing rapidly. These students often face difficulties due to family commitments, work obligations and lack of institutional support. Non-traditional women students often face these issues in greater number given the low representation in STEM fields, the wage gap and issues with childcare. During this research, I have contacted many women who are a part of the UMBC Women’s Center Returning Women’s forum. These women included mothers and women with disabilities as well as those who experience language barriers. I composed short audio pieces on each woman as well as a longer

text piece focusing on the institutional difficulties they face as non-traditional women students. These pieces reflect the challenges of non-traditional students and give a voice to these women. I researched statistics as well as anecdotal stories about how institutions can support non-traditional students. The audio pieces will be housed on my website as a gallery for anyone looking to further understand challenges facing non-traditional students.

Cracked Messiah: Parody and Parable in Kurt Vonnegut's Troutean Novels

Sarah Spicer
Piotr Gwiazda, Associate Professor, English

The focus of my English Honors Program Thesis is the function of Kilgore Trout in four of Kurt Vonnegut's novels: *God Bless You, Mr. Rosewater* (1965), *Slaughterhouse-Five* (1969), *Breakfast of Champions* (1973), and *Timequake* (1997). I explore postmodern ideas of metafiction, parody, and fabulation to show that Vonnegut's use of Trout as a thematic unifier renders his role indefinite in many ways. By introducing Trout, Vonnegut problematizes binaries such as popular science fiction vs. literary fiction and author vs. character. Through his ambivalent rendering of Trout as an unfortunate messiah or holy fool, he couches his didacticism in parable and parody to make grim themes seem more lighthearted. My exploration of Trout contributes to conversations about how authors construct and reinvent narrative spaces to portray their ideas. It can be used as a sort of model, perhaps for Vonnegut's other recurring characters, or perhaps for the construction of character and narrative self in other authors' works. Ultimately, the goal of my research is to contribute to scholarship concerning the Vonnegut canon, but also to address broader contexts of narrative inquiry. Specifically, I show how recurring characters function inter-textually to bring the author's thematic trends and inconsistencies to light.

A Flexible Approach to Treating the Ebola Virus

Natalie Steenrod*, Matthew Shirley, Therese Ku*
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 nucleosides. The proposed mechanism of action for these compounds 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 heterocyclic base in several carbocyclic nucleosides has been "split" into its imidazole and pyridine or pyrimidine components, remaining connected by a

single C-C bond to give the corresponding flexible analogues. This allows the base to adjust and reposition to form non-canonical binding interactions, without losing the integrity of the functional groups required for recognition, hence adopting an optimal conformation within the enzyme binding site. It is hoped that this strategy will prove strategic in terms of increased potency against Ebola. The synthesis of these structurally unique analogues is described.

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

Mapping the Specific Molar Extinction Coefficients of Organometallic Compounds

***Savannah Steinly**, Mamatha Hopanna, Kiranmayi Mangalgiri*
Lee Blaney, Assistant Professor, Chemical, Biochemical, and Environmental Engineering

Organometallic chemicals are used for a variety of applications, including agriculture, medicine, and electronics. This project focused on four organometallic classes (i.e., organo-arsenic, platinum, -selenium, and -tin). These compounds are introduced to the environment through wastewater treatment plants (Pt, Sn), the shipping industry (Se), and agricultural runoff (As). The unique properties of these compounds, and the corresponding inorganic metals, present distinct environmental and human health concerns; however, few studies on the photolytic transformation of these organometallics in the environment have been undertaken. One critical aspect of photolysis is determination of molar extinction coefficients across the solar irradiation spectrum. In this study, we used the Beer-Lambert law to measure the apparent UV-visible absorbance for 190-900 nm along a pH gradient for organometallics. With these data, we mapped molar extinction coefficients and deconvoluted the apparent molar extinction coefficients with respect to pH to determine extinction coefficients for protonated/deprotonated species. The results of this study provide insight into how organometallics absorb solar irradiation. That information will be used in ongoing work to identify the photodegradation kinetics of organometallics in environmental systems.

This work was funded, in part, by a grant from the National Science Foundation (CHE 1508090).

The Costs of Good Karma: The Effects of Fangsheng on the Chinese Environment and Society

Caitlin Stone
Constantine Vaporis, Professor, Asian Studies

Since the end of the Cultural Revolution in 1976, a resurgence of religious practices had unintended environmental consequences across China. The Buddhist practice of fangsheng, releasing captive animals to obtain good karma, has been on the rise. Fangsheng has introduced large quantities of non-native species to China's environment and heavily influenced the likelihood of a non-native species becoming invasive, which has caused numerous problems. An example from 2015 is one fangsheng association's singular liberation of thousands of loach into the Shanghai's Huangpu River. Given that there are 281 different fangsheng organizations in China, with at least one in almost every province, the potential for environmental damage is great. In Hong Kong, too, liberation of non-native bird species has raised environmental and health concerns, including the disappearing of native bird populations and the spread of different avian flu strains. Fangsheng has also impacted the economy, causing an increasing demand among practitioners of Buddhism wishing to liberate animals. This activity is often quite expensive; many young people spend upwards of 5,000 yuan (about 765 dollars) per year on animals to release. Utilizing previous research of other scholars, this paper addresses these and other effects of fangsheng and proposes solutions for them.

Comparing Measures of Inhibition among College Students with and without a Reading Disability

Zane Stump
Linda Baker, Professor, Psychology

This independent study is part of a larger study on metacognition and executive function in college students with and without a reading disability. One of the study's measures is the Stroop Task, an assessment of inhibition that some researchers say may not be accurate when used with participants with a reading disability because it involves reading. The purpose of the current study is to compare the Stroop Task to the Spatial Incompatibility Task, an assessment of inhibition that does not involve reading. It is expected that students with a reading disability will show different patterns of performance on the two tasks, whereas students without a disability will perform similarly on the two tasks. Also of interest is whether students with a reading disability will show greater difficulty overall in their ability to inhibit inappropriate responses. The results of this study will help future researchers choose appropriate measures of executive functioning when studying cognitive skills in individuals with a reading disability, which could lead to better interventions to help them succeed in academic settings.

Southern Fried Identity: Southern Rock and the Rebirth of White Male Masculinity in the 1970s

Daniel Sullivan
Anne Sarah Rubin, Professor, History

What do Lynyrd Skynyrd and Neil Young have to do with the American Civil War? Over the course of the last 151 years since its conclusion, the memory of the war has shaped popular American culture. Movies, novels, and art have all played important roles in how the conflict between the North and the South has been remembered. Nowhere has this memory been more affected then in the realm of music. Following the stormy decade of the 1960s, the 1970s spawned a music genre directly connected to America's turbulent past. Southern rock music's rise to prominence thrust a polarizing Civil War symbol, the Confederate battle flag, into mainstream American popular culture. Southern rock music was the soundtrack for a resurgence of southern identity in white males, and the Confederate battle flag was their unifying symbol. However, the misinterpretation of the flag's meaning directly influenced southern white males' sense of identity and masculinity following the civil rights era.

The Ears of Consciousness

Hannah Sunday
Anna Rubin, Associate Professor, Music

Visual art, new media, digital music, composition, and writing are all explored by East German native Antye Greie. I will be doing in depth exploration of how she utilized the idea of deep listening as a focal point for her project, "Sonic (Wild) Code." *Deep Listening* is a concept spearheaded by foundational composer of electronic music Pauline Oliveros. *Deep Listening* entails people (in this case composers and musicians) listening to each other and sounds around them without rejecting or ignoring anything they hear (consciously or not). Essentially, Oliveros' idea of *Deep Listening* deals with the relationship between the involuntary nature of hearing and the voluntary, selective nature of listening. For Greie's project, multiple musicians traveled to the wilderness with her and simultaneously composed and performed music with acoustic and electronic devices. Findings from this research and the effects of *Deep Listening* will be discussed via Greie's project as an example. I will examine any social and healing effects. These findings will be analyzed and compared within Greie's "Sonic (Wild) Code" project, and the experience surrounding the performers and their performance.

French Laïcité and the Centrality of Religion to Muslim Identity: Is Coexistence Possible?

Ghislain Tapsoba
Brigid Starkey, Senior Lecturer, Political Science

The past fifteen years have seen a great deal of turmoil in French society that must be better understood in the interest of peace. The notion of the public sphere was at the center of this research project that considered how established ways of life in the Arab-Muslim community seem incompatible with the French legal principle of laïcité or secularism. With a focus on sets of laws governing public education, housing, and citizenship, the paper used a socio-legal methodology to explore this contemporary clash at both the philosophical and policy levels. Looking at a sample of specific laws, the research focuses on the spirit and then the consequences of each in contemporary French society, as observed by academics and journalists. The findings highlight contradictions between legal dispositions and immigrant assimilation as the source of the conflict itself.

Burnt Bridges over Troubled Waters: A History of Territorial Disputes in the South China Sea

Julian Tash
Meredith Oyen, Assistant Professor, History

Over half of East Asia's oil and 5.3 trillion dollars of trade travel annually through the South China Sea, a body of water to which eleven countries lay some claim. Underlying many international anxieties is China’s policy in the area, which includes military maneuvers and the illegal creation of artificial land. This research gathered sources to analyze how patterns in Chinese territorial disputes indicate future action in the South China Sea. One major facet of Chinese policy is historic claims to ownership. An investigation of China’s history, however, reveals that the term “China” did not carry nationalistic undertones (and claims of ownership) until the twentieth century. China’s dubious ownership claims are not the product of lazy Chinese scholarship; questions of Chinese sovereignty are intimately connected to the country’s reduction to a semi-colonial state in the nineteenth century and the need for adventurism to create internal stability during economic uncertainty in the twentieth and twenty-first. The use of such arguments as rhetorical tools reveals how the Chinese construct their past. With a rising China soon to displace US hegemony in the area, it is crucial to understand how history shapes China’s current policies.

The Middle Kingdom's Middle Ground: Understanding China's Conciliatory Policy in the Mekong River

Julian Tash, Jennifer Christhilf
Constantine Vaporis, Professor, Asian Studies

Though China's development policy has been relatively cooperative, its dam building on the Mekong river will still profoundly impact the 245 million people who live between Vietnam and China in the Greater Mekong Subregion. Some analysts fear China's situation as an upstream riparian state emboldens it to execute projects unilaterally, with considerable international repercussions. Other scholars use certain multilateral discussions and relatively generous data sharing as evidence of China's friendly relationships with fellow riparian countries. By combining models of riparian state behavior made by political scientists with historical analysis, this research revealed a nuanced middle ground: China's relations with its downstream neighbors are friendlier than those of other countries (e.g., Turkey) with similar power imbalances. Current trends, however, indicate that China will not uniformly adhere to multilateral regulations on dam building; its economic power and upstream position make it unlikely to compromise its interests or freedom of action. This analysis indicates that future dam projects undertaken by China, in spite of international agreements, will intensify fluctuations in seasonal water flow and imperil downstream riparian states such as Vietnam. It will also embolden upstream countries to undertake similar, unilateral actions such as Laos' construction of the Xayaburi dam.

Understanding Gold Nanoparticle Drug Delivery Systems for Therapeutic Use

Devin Taylor
Marie-Christine Daniel, Associate Professor, Chemistry and Biochemistry

Cardiovascular disease is the most prevalent chronic illness of the American population. One major complication involved with the disease is the increased mortality from subsequent myocardial infarctions after an initial one occurs. To alleviate this issue, our research group aims to synthesize a novel nanoparticle system that will serve as a monitor to measure the progression of cardiovascular disease. This system was created using a variety of synthetic chemistry techniques. Our monitor consists of a pegylated gold nanoparticle carrier that is composed of Angiotensin-Converting Enzyme (ACE) inhibitors such as Lisinopril (Lis) and MRI-contrasting agents, such as Bn-DOTA-Gd. This project involved synthesis of each component, as well as characterization for each component to ensure proper synthesis. After each component had been properly synthesized, each component was combined to create our nanoparticle system. This system will then be used to target ACE, an enzyme whose expression is increased in patients with impending myocardial infarction. Using Lisinopril, the gold nanoparticle system should specifically bind to ACE while this interaction can be visually monitored with the Bn-DOTA-Gd. The hope is that with this nanoparticle system, physicians can better monitor cardiovascular disease and decrease deaths due to myocardial infarction in the United States.

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

Assisting the City of Baltimore in Maintaining and Upgrading its Aging Water Distribution Network

Justin Taylor, Aakash Bajpai, Matthew Bleakney, Nicholas Rabuck
Panos Charalambides, Professor, Mechanical Engineering

The City of Baltimore, Department of Public Works (DPW) oversees the operation of an aging water distribution network that has presented the City with costly water main ruptures with the consequences of urgent repairs associated with disruptions of traffic, commerce, electricity, telephone, cable and internet services. To help mitigate this, a predictive model can provide the DPW critical diagnostic/failure predictive tools needed to enable systematic proactive maintenance thus minimizing disruptions to the city and cost to the DPW. As part of the research, a mechanics of materials model designed to predict the failure of an aging water pipe was developed to address specific challenges faced by the DPW. The model incorporates evolution laws to account for changes in the material constitution, geometry as well as operating conditions, changes in loading and environment. Additionally, failure criteria due to shear stress, shear strain, fracture toughness, and fatigue are incorporated. The enhanced model will conduct parametric studies needed to establish failure maps capable of exploring the effects of several agents leading to degradation and failure of water pipes.

Anteriority of Consonant Tongue Position in Controls and Post Glossectomy Patients

Ange Lydie Tchouaga
Maureen Stone, Professor, University of Maryland, School of Dentistry

Approximately 48,250 people in the United States will be diagnosed with oral cancer in 2016. One of the most efficient treatments for oral cancer is glossectomy, a surgical procedure that removes all or part of the tongue. Glossectomy patients may be left speech impaired. This study analyzes tongue anteriority, which is the percentage of the tongue anterior to the 1st molar. Tongue anteriority reflects the difficulty of patients to position the tongue forward in the mouth after surgery. Cine MRI was used to measure anteriority. The goal is to assess the difference in anteriority between controls and patients and also determine the effect of consonant type (s vs sh) on anteriority in an adjacent vowel.

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Pure Harmony, for a Modern Pianist

Zachariah Thomas
Joseph Morin, Music

Modern instrument tuning, called equal temperament, is designed to compromise perfection of tuning (just intonation) to allow all intervals to sound tolerably close to being in tune in all keys. Software designed to re-tune digital piano intervals during performance could eliminate the imperfections inherent in equal temperament, unlocking more intense and satisfying harmony. In the 1980's Harold M. Waage designed such a system, which re-tunes each interval and chord based on the particular combinations of notes played on the keyboard; however, its practical application was undocumented and the physical device's whereabouts are unknown. This research recreates Waage's system using the programming language Max/MSP. The new program renders a wide variety of harmonies in nearly perfect tuning. Applied to conventional repertoire, certain re-tunings of melodic notes may sound alien to musicians trained in equal temperament, and could therefore be difficult to accept. It is conceivable that refinements could be made to the program to give the performer control over the more drastic pitch changes or to limit them to less noticeable musical contexts. On the whole, the newly programmed system provides a way to experience conventional repertoire with a refinement of tuning otherwise unavailable to keyboard players.

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

Remote Sensing Monitoring of Canadian Wildfire Smoke and its Impact on Baltimore Air Quality

Shelbi Tippett
Ruben Delgado, Assistant Research Scientist, Joint Center for Earth Sytems Technology

High spatial and temporal resolution elastic light detection and ranging (lidar) measurements allow monitoring of long-range transport of particulates, such as dust and smoke, that impact local and regional air quality. These lidar measurements enhance current knowledge and understanding of how vertical layering and long-range transport of natural and anthropogenic particle pollution may alter the relationship between column aerosol optical depth and surface particle pollution concentrations. We examined the impact of a strong haze event in June 9-11, 2015. Particle pollution associated with this event yielded a 245% increase in aerosol optical depth values compared to the average mean June values for the last decade. We present how air mass back trajectory analysis, aerosol intensive and extensive parameters from lidar, sun-photometer and satellite observations revealed the presence of Canadian wildfire smoke impacting the Baltimore air quality during those days.

This research is supported by NOAA-CREST/CCNY Foundation CREST Grant-NA11SEC481004.3 and the Joint Center for Earth Systems Technology.

The Role of the Myristate Group on the tRNALys3 - Matrix Complex

***Emre Tkacik**, Christy Gaines, Amalia Rivera-Oven, Ally Yang*
Michael F. Summers, Professor, Professor, Chemistry and Biochemistry, and Investigator, Howard Hughes Medical Institute

Human immunodeficiency virus-1 (HIV-1) packages host tRNALys3 into viral particles. The tRNA then acts as a primer during the reverse transcription process of the HIV RNA genome into DNA. Studies have found binding between HIV's matrix domain of the Gag polyprotein and tRNA. The matrix protein has a myristate group that can either adopt a sequestered or exposed conformation. The position of the myristate group on the matrix protein may influence the interactions between tRNALys3 and matrix. We created a histidine-tagged unmyristyolated matrix [myr(-)MA] construct with a TEV cleavage site. This construct will allow us to determine the role of the myristate group in matrix-tRNA interactions by comparing the myr(-)MA to wild-type myristyolated protein using size exclusion chromatography (SEC) and isothermal titration calorimetry (ITC). ITC studies with myristyolated protein indicate a pH dependence for matrix-RNA complex formation. However, this effect is not replicated in myr(-)MA. Further studies are needed to determine the role that the myristate group plays in tRNA-matrix interactions. Understanding this effect will allow us to design experiments to determine the structure of the tRNALys3-matrix complex. Structural work of this kind can help develop potential drug targets that can disrupt this interaction and disturb HIV's membrane binding.

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.

Value Function Approximation Mapping Creation for Knowledge Transfer

Nicholay Topin
Marie desJardins, Professor, Computer Science and Electrical Engineering

A reinforcement learning (RL) agent learns by exploring a domain (i.e., environment or scenario) to improve its performance on tasks in the domain. Our research proposes a method to transfer this learned knowledge to similar (target) domains, reducing the need for further exploration. Previous research on RL transfer requires knowledge to be represented as an enumeration of states (situations), along with the best action to perform in each of those states. Value Function Approximation (VFA) representations provide a function-based representation of learned knowledge that is more suitable for domains with large numbers of states or continuous (real-valued) variables, for which an enumeration of states is not feasible. VFA models allow RL agents to generalize across similar situations within a domain, which makes learning more efficient. Our VFA-based method therefore allows the use of knowledge transfer in larger and more complex domains. In particular, we provide a method that automatically identifies the corresponding portions of the VFA representation for the source and target domains. Our modified transfer techniques can then be used to leverage this knowledge to decrease learning time in the target domain.

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

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

Ngochan Tran
Jeff Leips, Professor, Biological Sciences

In common host-parasitoid relationships, parasitoids use host larvae to complete their development, killing them in the process. Parasitoids are an important agent of natural selection in host populations, and should favor the evolution of host-defense mechanisms to avoid attack by parasitoids. We used the host-parasitoid relationship between *Drosophila melanogaster* and their parasitoid wasp, *Leptopilina boulardi*, to validate the influence of specific candidate genes on the ability of host larvae to avoid parasitoid attack. The genes tested were a subset of those identified in a previous Genome Wide Association Study and were selected based on their potential influence on locomotion and behavior in *D. melanogaster*. The candidate genes were *pumilio*, *nAcRalph 30-D*, and *Tor*. Mutations in these genes are known to affect the function and anatomical structure of larval neurons and muscles of the nervous system. To validate the influence of candidate genes, RNA-interference techniques were combined with the GAL4-UAS system in Drosophila to downregulate the expression of these targeted genes in neuronal and muscular tissues. By understanding the importance of these genes for host larvae ability to avoid attack, we can understand the genetic basis of larval host-defense traits in *D. melanogaster* and their potential role in adaptive evolution.

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

Parental Warmth Moderates the Association between Parenting Practices and Chinese-American Children's Academic Outcomes

Queenie Tran*, Charissa Cheah, Merve Balkaya, Jia Shen, Kathy Vu*
Charissa Cheah, Professor, Psychology

Parents can significantly enhance children's educational success in different ways. The specificity principle predicts that specific educational practices that parents engage in motivated by specific goals would be most strongly associated with related specific child academic outcomes. However, the overall parenting emotional climate, such as warmth, may moderate the impact and effectiveness of these specific practices on child outcomes. These theories have not been tested among Chinese-Americans (CA) despite the growing population and public interest in their parenting and children's academic achievement. Thus, this study examined (1) the associations between parental warmth and specific parental educational practices of teaching counting (TC) and spelling (TS) with children's performance on calculation and spelling tests,

and (2) the moderating role of parental warmth in the association between TC and TS and children's calculation and spelling abilities. CA mothers (N=78) in Maryland with five- to nine-year-old children reported on their parental warmth and educational practices. Their children were administered the Woodcock-Johnson III academic achievement test. Parental warmth moderated the association between specific educational practices and children's academic outcomes. Thus, both specific parenting practices and the larger parenting emotional climate were important for CA children's academic outcomes. Implications of these findings will be discussed.

Proteomic Analysis of Chromatin-Modifying Enzyme Set5

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[1]Scripps Research Institute
Erin Green, Assistant Professor, Biological Sciences

The goal of this ongoing project is to investigate the biological activity of the methyltransferase Set5, an enzyme responsible for the methylation of histone H4 in *Saccharomyces cerevisiae*. DNA normally associates with histones, forming a structure called chromatin, and the modification of chromatin through histone methylation is one of many tools that cells use to regulate gene expression. Other methyltransferases have been shown to work in large complexes with proteins that guide their activity, making it likely that Set5 is similarly aided and regulated. Using immunoprecipitation to isolate Set5 from cells, followed by proteomic analysis by mass spectrometry, we have been able to identify several proteins with which it is physically associated. Among these potential partners are proteins involved in the assembly of chromatin, which is important for regulation of gene expression. These interactions are currently being tested with a variety of biochemical and genetic assays. Because regulation of gene expression is vital to the well-being of cells, it is important to understand the activity of Set5 and other methyltransferases. This understanding could lead to greater insight into diseases such as cancer, which can be caused by deficiency in similar enzymes in humans.

Biocompatibility of a Self-Powered Glucose Biosensing System

Joel Tyson*, Tanmay Kulkarni*
Gymama Slaughter, Assistant Professor, Computer Science and Electrical Engineering

Novel, self-powered biosensing systems have been developed with the potential to establish revolutionary continuous sensing of medically relevant biomolecules. This study focuses on a self-powered glucose biosensor developed by UMBC's Bioelectronics Laboratory which is intended for subdermal use. This system is built from both standard materials like tungsten and novel materials, such as multi-walled carbon nanotubes and immobilized enzymes pyroquinoline quinone glucose dehydrogenase and laccase. The enzymes function as the anode and cathode of a buckypaper fuel cell. The system has been shown to operate consistently *in vitro*, displaying an

open circuit voltage of 302.1 mV with a power density of 15.1 µW/cm2 at a cell voltage of 166.3 mV in normal glucose concentrations. *In vivo* biocompatibility has not been yet been shown. As a step toward *in vivo* testing, PC 12 mammalian cells have been cultured in order to perform cytotoxicity tests. PC 12 cells will be incubated in the presence of the systems various materials and with the biosensor itself. Cell count assays over time will be recorded in order to determine viability, survival, metabolism, mutagenesis and irritancy. It is expected that cytotoxicity will fall under the expected FDA guidelines when given the proper coating.

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

Composition and Concentration of Particulate Matter During a Summertime DISCOVER AQ Study in Denver

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

Measurements of inorganic aerosol composition (Na^+,$NH4^+$, K^+, Mg^{2+}, Ca^{2+}, Cl^-, $NO3^-$, and $SO4^{2-}$), aerosol organic carbon (OC) and elemental carbon (EC) were carried out in Golden, Colorado during summer 2014 as part of the DISCOVER AQ campaign. The overall goal of the NASA-funded mission was to improve satellite measurements of ground-level air pollution. Over the course of the measurement period, July 14 to August 10, 2014, 60% of the $PM_{2.5}$ (particulate matter) mass, on average, consisted of organic matter. The dominant fraction of this organic aerosol - approximately 76% - was secondary (SOA). The diurnal average of the SOA suggests a regional source, with minor local influences. The strong diurnal behavior of EC indicates local source influences. A consistent daily wind pattern contributed to a 30% increase in $PM_{2.5}$ starting around 10:00 AM, likely from transport of emissions from oil and gas fields and highways to the northeast. Two fire and dust events were also encountered during the measurement period. Elevated levels of OC and potassium were observed from Canadian wildfires over a two-day period, which had the highest $PM_{2.5}$ concentrations. Calcium and PM_{10} were transported from dust originating in the Sonoran Desert in a separate two-day event.

*This investigation was sponsored by NIH/NIGMS MARC U*STAR T3408663 National Research Service Award to UMBC and and Undergraduate Research Award from the UMBC Office of Undergraduate Education.*

Sandwich Algorithm

Tory Van Dine
Corrie Parks, Assistant Professor, Visual Arts

Sandwich Algorithm is a 55-second hand-drawn short film about a sheep attempting to fix a peanut butter and jelly sandwich. The sheep struggles to perform his task since he does not have fingers. He eventually settles on a roundabout solution that is successful, but excessive. My inspiration for this story was my own tendency to overthink problems, causing me to come up with needlessly complicated solutions. I composed a jazzy piano track and sound effects for the project. In recording my own studio sound work instead of using stock, I had the freedom to supplement the onscreen action exactly as I wanted. The music is a peaceful yet mischievous backing, while the sound effects, having been made to match the sheep's interactions, help punctuate and add believability to the animation. The strongest element of this animation lies in the characterization of the sheep. His facial expressions in reaction to roadblocks he encounters make him amiable and engaging. I took special care to make the sheep effectively convey what he's thinking through his expressions, and make him as likable as I could, since the effect of the animation and message depends on these aspects.

The Role of Neuronal Chaperone proSAAS in Blocking α-synuclein Cytotoxicity

Nevin Varghese
Tim Jarvela, Department of Anatomy and Neurobiology, University of Maryland School of Medicine; Iris Lindberg, Department of Anatomy and Neurobiology, University of Maryland School of Medicine

In Parkinson’s disease, abnormal aggregation of α-synuclein is toxic to dopaminergic neurons and result in serious neuronal dysfunction, impairing motor skills. Recent research suggests that molecular chaperone proteins can be cytoprotective against neurodegenerative biochemical processes including protein aggregation. ProSAAS is a widely expressed secretory chaperone in the brain. We hypothesize that proSAAS is cytoprotective against the aggregation and fibrillation of α-synuclein in Parkinson’s disease. The purpose of this research is to determine the ability of proSAAS to decrease α-synuclein cytotoxicity. Full length and truncation constructs of proSAAS were affinity purified and tested for cytoprotective effects. Addition of recombinant proSAAS to SH-SY5Y neuroblastoma cells overexpressing α-synuclein rescued the synuclein-mediated cytotoxic effects. To see if protection was specific for α-synuclein cytotoxicity, proSAAS was tested against other forms of cytotoxicity. ProSAAS had no effect on cytotoxicity due to oxidative stress (H_2O_2) or to endoplasmic reticulum stress (Tunicamycin). We conclude that proSAAS cytoprotection is specific for synuclein-mediated cytotoxicity. Ongoing research aims to determine the specific protein sequence responsible for cytoprotection, using purified truncated constructs of proSAAS, as highly conserved amino acid residues 160-180 have been shown to be critical in blocking *in vitro* fibrillation.

Limitless

Nerissa Vasconcells
Doug Hamby, Associate Professor, Dance

My creative project merges elements of both modern dance and classical ballet through a dance performance piece titled *Limitless.* In the summer of 2015, my studies at Maryland Youth Ballet gave me the opportunity to take professional dance classes in ballet and pointe. Alternatively, while at UMBC, my primary focus has been to learn modern dance methods, e.g., Graham, Horton, and Limon. Classical ballet has its origins in the 18th and 19th centuries, emphasizing elegance, beauty, and regimentation, and has a choreographic process directly related to a musical score. Modern dance, a product of the 20th century, is often abstract and uses a wide variety of choreographic processes not linked to the musical score. Combining these varied techniques has been a personal challenge and a pursuit of self-exploration. In creating this piece, I emphasized beauty as a classical ballet choreographer, while using choreographic methods commonly found in modern dance. My work in progress piece, *Limitless,* is the culmination of this creative process combining modern dance with classical ballet. The intention of this fusion of styles into one piece is to motivate others to embark on their own exploration of movement modalities to create one that is uniquely their own.

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

Overweight among Salvadorian Children: An Exploratory Examination of Food Patterns and Cultural Influences

Sophia Venero
Claudia Galindo, Associate Professor, Language, Literacy, and Culture; Rhonda Canham, Lecturere, Sociology and Anthropology

There are major disparities across racial/ethnic groups in childhood overweight and obesity. One in three Hispanic children are obese or overweight. Because people of Mexican origin account for the majority of Hispanics (more than 60 percent), statistics may predominantly reflect weight problems in Mexican American children and not be relevant for other Latino subgroups.
In Maryland, one in three Hispanics are of Salvadorian descent. The purpose of this study is to describe the weight status of a small sample of 12 Salvadorian children (ages seven to 13) born in the USA, and analyze their food patterns and few cultural behaviors that may be associated with weight status For this study, parents completed a seven-day dietary recall questionnaire on behalf of their children. In addition, questions on nutrition knowledge, eating habits, body and cultural perceptions were also asked. Results indicated that 58 percent of these Salvadorian American children were overweight or obese. The Salvadorian American children with weight problems added extra salt to their plates and snacked more when compared to their peers with normal weight. There were no differences in body perceptions or cultural behaviors between obese/overweight and normal weight children. Findings identified potential mechanisms to reduce Hispanic children's obesity.

MAP1B Impacts on Neuralation and Microtubule Stability

***Eudorah Vital**, Sharlene Brown*
Rachel Brewster, Associate Professor, Biological Sciences

Brain development is a stepwise process that begins with neurulation, which is the process by which the neural tube develops, the precursor to the central nervous system. An important and conserved event in neurulation is neural convergence extension (NCE) of the neural ectoderm. During NCE, neuroepithelial cells elongate mediolaterally and migrate towards the midline, thus narrowing and lengthening the neural plate. An important cellular component that drives NCE are microtubules (MTs). Without properly functioning MTs, NCE cannot be successfully completed. Microtubule Associated Proteins (MAPs) help regulate the action of microtubules during this process: they facilitate microtubule dynamics and stability. Based on previous literature and work done in our laboratory implicating the role of MTs in neural development and NCE, we hypothesize that the proteins, specifically map1b, that regulate microtubule function are essential to neural morphogenesis. To better understand map1b and its impacts, we knocked out the map1b protein through the use of a splice blocking morpholino (MO) and RNA Dominant Negatives (DN). MO and DN experiments showed that impaired map1b caused a decrease in detyrosinated (stabilized) microtubules and no change in tyrosinated (destabilized) microtubules, changes in cell morphology, and delayed NCE, implicating map1b's prevalence in neural development.

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.

Rhythm and Meter Comprehension

Sidney Wagner
Brian Kaufman, Assistant Professor, Music

Understanding of rhythm and meter is important to musical performance and is relevant to national and state standards regarding music performance in ensembles. Ten sixth-grade percussion students are engaging in activities designed to improve their comprehension and performance of rhythm and meter. A pretest was administered in October 2015, when students began to acquire knowledge of rhythm. A second pretest was administered in January 2016 after providing instruction in related concepts. The pretests included writing counts to rhythms in familiar and unfamiliar meters using a standard counting system, rhythm creation, and dictation. Student understanding was then rated using a rubric scaled from one to five. A score of one indicates that the student is developing their knowledge, and a score of five indicates that the student has a comprehensive understanding. Following pretesting, various rhythm and meter activities were completed by students. These activities included student creation of meters and rhythms, exploration of common rhythmic patterns, and rhythmic dictation. Student progress was periodically assessed through observation in class as well as through brief written tests. The

rubric is applied to these assessments. The goal of these activities is for each student to advance at least one tier on the rubric.

Seeing Science

Hao Wang
Stephen Freeland, Associate Professor, Interdisciplinary Studies; Viviana Cordova, Assistant Professor, Visual Arts

The purpose of this project is to utilize artistic skills and knowledge to visualize scientific research, thus providing an enhanced method for researchers to communicate with their audience. The process of this project involves the cooperation with Sarah Auer who researches medieval gynecology from ancient Greek scripts, focusing on Soranus' studies about female reproductive organs. In this project three organs are illustrated digitally according to Soranus' scripture: uterus, placenta, and didymi which are in pairs with three objects that Soranus uses to describe each shape: kylix, egg, and silphium seeds. Each illustration is artistically interpreted to assist readers' understanding of the texts without distorting the original content. The process of visualizing science also involves a research poster design in which artistic principles are applied to direct the viewers' eyes for a better reading experience. With texts, illustration, and design combined, Auer's research poster is to stand out from traditional research posters.

This work is supported, in part, by "Seeing Science: Science, Photography, and Visual Culture," a public programming project organized by the Center for Art, Design and Visual Culture and the Interdisciplinary Studies Department.

Sustain-O-Scope: Simple Compound Light Microscope

Mashhood Wani, Natalie Steenrod, Poornima Patel*, Hye Min Baek*
Minjoung Kyoung, Assistant Professor, Chemistry and Biochemistry

Microscopy is utilized in many different fields in science, yet high costs prevent collection of high-quality images. We attempted to design and construct a microscope with a cost of $200, starting only with objective lenses. Our aim was to design the microscope to be cost-efficient, portable, sustainable, and easily constructable. We used Kohler illumination in our design, preventing the light source from being imaged onto the sample. Our design only required two additional lenses, minimizing the cost. We designed our microscope for under $100, employing cost-efficient and environmentally friendly items such as plywood, plexiglass, and threaded bolts. Our Sustain-O-Scope has comparable magnifications and resolution to those of a conventional, laboratory-grade microscope. This microscope design can be used in regions in which there are not many resources and could be helpful in STEM education.

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

How Different Regimes and Levels of Perceived Corruption Impact Terrorism in Islamic Countries

Aasim Waqaar
Carolyn Forestiere, Associate Professor, Political Science

Over the past few years, the number of terrorist attacks has consistently increased each year, especially in Islamic countries. In 2013, over 80% of terrorism-related deaths occurred in just five Islamic countries. Given these statistics, it is crucial to understand the conditions that are related to increased terrorism around the globe, and in Islamic countries in particular (i.e. countries in which more than 50% of the population identifies as Muslim). The purpose of this paper is to determine how regime type and levels of perceived corruption impact acts of terrorism in countries with predominantly Islamic populations. A highly authoritarian government coupled with a perception of high corruption suggests that the government has low accountability, which could foster the growth of terrorism. A mixed-method design, utilizing both quantitative and qualitative analyses was employed, to determine if there were correlations among the variables. Brief case studies of Iraq and United Arab Emirates are presented to further confirm the research hypotheses. Overall, this study finds that the level of perceived corruption in each country is significantly correlated with the number of terrorist attacks, which suggests that minimizing corruption could be key to preventing terrorism.

A Place in Infamy? Baltimore's Memory and Monuments of the Confederacy

Sumner Weiss
Anne Sarah Rubin, Professor, History

Recently, there have been discussions in regard to renaming Robert E. Lee Park in Baltimore and taking down the four Confederate statues located within the city limits. Do these recent developments in Baltimore reflect a larger anti-Confederacy sentiment in the Border States? And more specifically, how does large urban environment with a diverse populace, like Baltimore, remember the Confederacy? By analyzing books, newspapers, and journal articles on the subject, as well as attending town hall meetings and public forums, this research project will delve into these questions: Has public memory about the Confederacy changed in Baltimore since the war and its immediate aftermath? Why are there four Confederate monuments but only one Union monument in the city? What has changed since the erection of the Lee and Jackson monument in 1948 to now? Is there currently enough anti Confederacy sentiment in the city to take down these monuments?

Temple

Caleb Williams
Doug Hamby, Associate Professor, Dance

Temple is an abstract dance performance work that explores how people worship individually and as a community. *Temple* is a piece for five women, structured in three sections. Using photos by surrealistic photographer Ronen Goldman, the dancers and I collaborated to create kinetic poses which I then connected with movement. The piece is an exploration of how the physical body is connected to the spirit and how movement can inspire a spiritual state of the mind. It explores many different religions as well as utilizing religious gestures. The piece relies on the process of ritual. The soundscape amplifies the journey of religious introspection through various pieces of music in conjunction with the dancers' voices. The piece tries to inspire the audience to question what they believe as well as how they participate in their belief system. Originally performed at the UMBC Fall Showcase and Senior Dance Concert, it was presented at the American College Dance Mid-Atlantic Conference in March of 2016.

Skeletal Muscle Atrophy

Matia Wills
Viviana Cordova, Assistant Professor, Visual Arts

The purpose of this project is to apply visual concepts to a scientific research project that involves mathematical models, in order to provide the public with a better visual understanding of skeletal muscle cells. Data visualization will allow the viewer to understand the dynamics, concepts, and development of this information in a simplified manner. The main focus of this research is to analyze how 'Akt' affects skeletal muscle atrophy, which is a degradation of cells within muscles caused by age, cancer, diabetes, or heart disease. The scientist has observed, recorded, and plotted data that need to be understood by the general public. By organizing the research and documenting the data using a readable sans-serif typeface, the data will be pleasing to the eye because of legibility and the content will extend to a wider variety of people. My goal is to use a system of colors, symbols, and icons to revised and redesigned graphs to revamp the scientist's original content into a reader-friendly poster. Simplifying is a key component in this poster, allowing the average person to understand the scientist’s research. The hierarchy developed through form and scale will arrange a transparent timeline allowing information to become understandable.

This work is supported, in part, by "Seeing Science: Science, Photography, and Visual Culture," a public programming project organized by the Center for Art, Design and Visual Culture and the Interdisciplinary Studies Program.

Romani Lachrymose Performance

Samuel Winnie, Chanel Whitehead
Linda Dusman, Professor, Music

The National Student Electronic Music Event (N_SEME) is a conference of performances of works by young American undergraduate and graduate composers and scholars. The N_SEME team invited cellist Chanel Whitehead and me to perform one of my works, *Romani Lachrymose*, as part of the conference. *Romani Lachrymose* is an exploration of the expressive and improvisatory nature of the Romani style. The lugubrious melodies and dissonant interruptions in this tone poem place listeners directly into the mind of the one who is spiraling into depression. The use of electronics in this piece adds a new dimension, engulfing listeners in sounds of lament as achievable only on the cello. *Romani Lachrymose's* first iteration was composed solely for electronics and was written to be the sound track to a contemporary dance piece. However, it was not until I studied in Italy in 2015 that I sought to revisit *Romani* and compose a live and interactive part for the cello. In its current state, all of the sounds present have originated from the cello, but have undergone various levels of digital processing.

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

Simulating Entanglement Dynamics of Singlet-Triplet Qubits Coupled to a Classical Transmission Line Resonator

Michael Wolfe
Jason Kestner, Assistant Professor, Physics

A quantum computer has the ability to solve certain problems exponentially faster than a classical computer. Recent advances in solid state physics have improved the fabrication of spin qubits by confining electrons in quantum dots formed by depleting the 2D Fermi gas inside GaAs - AlGaAs heterostructures. These qubits entangle electrostatically but quickly suffer decoherence due to external coupling to nuclear spins, thus limiting the time for logical CNOT operations to take place. We propose a singlet-triplet qubit system whose operation time decreases by capacitively coupling the electrons to a classical transmission line resonator. By analyzing the transient response of the transmission line, we derive a Hamiltonian that describes the energy stored in the system when the qubit's charge configuration oscillates with time. We numerically simulate the dynamics of the von Neumann entanglement entropy when the qubits are driven near resonance and investigate parameters of the coupling element that optimizes the operation time for the qubit.

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

Light Inhibits Light

Rachel Wolven
Steven Silberg, Lecturer, Visual Arts

With light pollution an ever-increasing problem, fewer people are aware of the night sky and the wonders it holds. Through a comparative study of the visibility of deep space objects and the Milky Way as affected by light pollution within the Northeastern United States and New Brunswick and Nova Scotia, Canada, Light Inhibits Light aims to bring attention to the sky in order to show what is missing from the skies above our cities. To protect this natural resource, awareness must first be raised in order for people to want to make changes and work to fight the over-abundance of light pollution. Presented as a time-lapse photography film, light pollution measurements and GPS coordinates are displayed with each night-scene, to contrast the light polluted skies with the non-light polluted skies. The materials show how far removed these dark sky sites are from us, as well as how bad the light pollution is. Attention of the general public must be brought to the issue of light pollution before this ever-fading resource is too far gone from our lives.

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

The Temple of Vesta in the Roman Forum

Abigail Worgul
David Rosenbloom, Associate Professor, Ancient Studies; Melissa Bailey, Visiting Assistant Professor, Ancient Studies

My project was originally to explain the unique circular form of the temple of Vesta in the Roman forum. I studied the remains of the temple in the forum as well as extant monuments in its vicinity. I then consulted primary authors such as Virgil and Ovid, and secondary authors such as R.T. Scott and J.W. Stamper. After mapping the temple within its surroundings, my project took an unexpected turn, as I found bordering Vesta's sacred precinct a rectangular fountain dedicated to the goddess Juturna. Upon subsequent research, I discovered an opposing yet complementary relationship between the two goddesses and their shrines. Vesta, associated with fire, contrasts with Juturna, a water nymph. Juturna is an enemy to Rome in Virgil's Aeneid; Vesta's temple contains the communal hearth of Rome. The juxtaposition of these precincts would have signified two major things for the Romans. One, it would have delineated an area symbolic of life, as, according to Ovid, fire and water together were considered life-giving. Two, placing a structure representing the goddess of the hearth and home next to that representing a former Roman enemy would have symbolized what allowed Rome to grow into an empire: embracing foreign culture and society.

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

UMBC Game Developers' Club

Andrea Wozniak, Alec Lawrie, Bryan Jarell, Savanah Myers, Eliot Carney-Seim, Conrad Etherton, Jesse Dinkin, Michael Leung
Marc Olano, Associate Professor, Computer Science and Electrical Engineering

The UMBC Game Developers' Club is presenting its 2015-2016 projects and indie titles. The club creates a unique environment for creative expression where programmers, musicians, artists, and designers work together. Members have produced games using a variety of software and programming languages, designed two-dimensional (2D) and three-dimensional (3D) games, and scratch-built game engines as well as traditional, physical experiences. Group titles include Legacy of the Shards, a 3D collectathon that juxtaposes nostalgia-inducing gameplay with a cutting-edge graphics engine and a non-linear narrative; Heart Attack, a asymmetrical 3D multiplayer experience that exacerbates the anxieties inherent in competitive play to produce a game revolving around tension and fear, and their respective mechanical representations; Puppy Simulator, a 3D puzzle platformer designed around the Unreal Engine's visual scripting language to create an immersive and graphically stunning experience; Graveyard Beat, a 2D fighting game that has decoupled itself from the continuous nature of the genre, instead embracing the discrete temporal mechanics of rhythm games to provide unique and innovative gameplay; independent projects include ACE, a Java-based 3D game engine that opposes contemporary trends and takes a programmer-centric approach to game development, and Sporbitals, the Game Developers' Club's first foray into the free-to-play mobile marketplace.

Seven by Seven

Kelly Wright
Doug Hamby, Associate Professor, Dance

Seven days of the week. Seven deadly sins. Seven dwarfs. Seven Wonders of the World. We are constantly surrounded by the number seven in our daily lives. Seven is described as a number of completeness and perfection. The study of numerology also attributes mystical, magical, and psychic qualities to this number. I have created a dance work drawing influences from the number seven and its significance. Movement phrases, transitions, and formations have been created and based on research of the number seven, including references in literature, religion, and mathematics. This project brings dance into a context that may intrigue viewers familiar with literature and religion but who may not be familiar with dance.

The Effects of the *Skp2* Gene on Cell Migration

Beverly Wu
Michelle Starz-Gaiano, Associate Professor, Biological Sciences

Cell migration underlies the fundamentals ofdevelopment, immunology, cancer biology, and many other fields. To understand this vital biological process genetically, we use *Drosophila melanogaster* to study the dynamics of migratory cells recruited to carry non-motile cells. Migration requires proper adhesion and communication between cells for them to move to their destination. From prior genetic expression experiments, we have been able to identify the *Skp2* gene as a potential player in the cell migratory process. We will investigate the idea that the *Skp2* gene has a required role in detachment and movement of migratory cells in egg chambers. To test this hypothesis, we will knockdown Skp2 expression using tissue-specific RNA interference. We anticipate a decreased efficiency of border cell migration in this case. Within the Skp2 protein lies an F-box domain, which targets proteins to be tagged for degradation or directed by sub-cellular trafficking to certain cell domains. Using immunofluorescence techniques, we will also assay the turnover and localization of adhesion molecules, such as DE- cadherin, in *Skp2* knockdown mutants to determine if this gene has a role in detaching border cells during their movement.

Ribosomal Biosynthesis after Repression of Specific Ribosomal Protein Genes

Aviva Zapinsky
Lasse Lindahl, Professor, Biological Sciences; Md. Shamsuzzaman, Biological Sciences

The synthesis of ribosomal subunits requires production of rRNA, 79 ribosomal proteins, and about 200 assembly factors. Disruption of synthesis of any component leads to nucleolar stress, and unsuccessful ribosomal assembly. We are investigating how repressing synthesis of one ribosomal protein in yeast affects the fate of other ribosomal proteins and whether during the repression of specific ribosomal proteins other ribosomal proteins are transported to the nucleus, or whether they remain cytoplasmic. If transport of ribosomal proteins is retained, we will determine whether ribosomal proteins are incorporated into the ribosomal particles and whether these incomplete particles are exported to the cytoplasm. Using a yeast strain in which synthesis of ribosomal protein L43 is controlled by a galactose promoter and therefore repressible, we inserted a GFP-tagged L25 gene under the control of an inducible beta-estradiol promoter. Confocal microscopy of this strain showed that L25-GFP does not get transported in the usual manner during L43 repression. We will further use Western analysis following sucrose gradient centrifugation to determine if L25-GFP is incorporated into ribosomes and whether the ribosomal particles are exported to the cytoplasm.

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Seeing Science

Fan Zhang
Viviana Cordova, Assistant Professor, Visual Arts

The goal of this artistic work for Seeing Science is to take the scientific information and data presented by the researcher and present it in a way that it can appeal to a larger audience. Many aspects of scientific research require specific and esoteric language that can be difficult for anyone not in that field to understand. Visual imagery can help connect the dots for many people. For Devyn Catterton's research, titled "Synthesis of CdSe and Au Nanoparticles Assemblies to Study the Optical Properties of New Hybrid Nanomaterials," a clear sequence of events that aesthetically demonstrates the research process to viewers is needed. For example, a step-by-step guide to the process through visual symbols helps. Artistic contributions to the poster design include using gold paper to represent the Au nanoparticles and using the an eye as a symbol for demonstrating changes in optical processes. I am also including simple visual explanations to some difficult vocabulary found in his abstract. Since the research Devyn is doing involves very small particles, I am including a small image, and referring to how much smaller the particles she uses are in comparison.

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Rationality and the North Korean Nuclear Program: How the International Status Quo Affects Pyongyang's Nuclear Pursuit

Benjamin Zimmer
Constatine Vaporis, Professor, Asian Studies; Julie Oaks, History

North Korea has pursued nuclear weapons for the majority of its short history. Four times - 2006, 2009, 2013, 2016 - it has conducted nuclear tests, which have brought international condemnation and sanctions. A study of the western perceptions of North Korea, based on news footage and reporting, shows the nuclear program to be an irrational pursuit; these accounts also assert that North Korea grossly misinterprets the status-quo. A more thorough study of the program, however, using sources from North Korean official media, such as *Rodung Shinmun,* Korean Central News Agency and *Korea Today* magazine, reveals that for North Korea the program is seen as the only way it can gain political attention, as well as deter a possible military attack. In order to denuclearize North Korea, the international community must acknowledge the political and security concerns of North Korea. Through this presentation, I will argue that North Korea has developed its nuclear weapons program as a rational response to the current state of international affairs on and surrounding the peninsula, and it is unlikely to abandon its nuclear weapons unless it's political and security concerns are addressed.