URCAD 2011
Student Abstracts

In Alphabetical Order by Presenting Author

How to read the abstracts

Title of Presentation

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

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

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

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

We encourage you to visit the students' presentations throughout the day. Presentation times and locations can be found in the Program section of this booklet.

Genetic Analysis of Translational Accuracy in the Bacterium *Escherichia coli*

Aleeza H. Abbasi, *Nandini Manickam*
Philip J. Farabaugh, Professor, Department of Biological Sciences

Translation is the process by which proteins are synthesized from RNA copies of a cell's genes. Transfer RNA (tRNA) molecules decode nucleotide triplets in messenger RNAs, called codons. In decoding, tRNAs specify the order of amino acids in a growing polypeptide chain. Sometimes during translation a tRNA incorrectly reads the codon and incorporates the wrong amino acid; this type of error is called a misreading error. The goal of this project is to characterize misreading errors made by a single tRNA using an enzyme-based reporter system in *Escherichia coli*. The enzyme-based approach determines how often a tRNA misreads a mutant codon that specifies an active site amino acid. Occasional misreading of the mutant codon replaces the encoded mutant amino acid with the wild type amino acid, producing a fully functional protein. The enzyme-based reporter system used in this project employs beta-galactosidase, encoded by the *E. coli lacZ* gene. The misreading rate is the ratio of the activity of the mutant beta-galactosidase to the activity of wild type. The targeted essential amino acid in the active site is aspartic acid. In ongoing research, the mutated plasmids are being used to assay the level of beta-galactosidase activity and the extent of misreading errors.

This work was funded, in part, by Research Project Grant 1R01GM029480-25 from the National Institute for General Medical Sciences of the National Institutes of Health, and Special Research Assistantship/Initiative Support at UMBC.

Studying the Role of Ribosomal Protein rps2 in Maintaining Translational Fidelity

Annam Abbasi, *Susmitha Suresh*
Philip J. Farabaugh, Professor, Department of Biological Sciences

An organism creates a protein through two cooperative processes: transcription and translation. Initially, DNA found in an organism is transcribed into complementary RNA, which is further translated into a protein by organelles called ribosomes. Ribosomes consist of ribosomal RNA (rRNA) and ribosomal proteins, and they translate messenger RNA (mRNA) into a functional protein. Although the process is well understood, the effect of a mutation in a ribosomal protein on the process of translation is unknown and must be understood in order to determine how antibiotic resistance is developed in bacteria such as *Escherichia coli*. The ultimate goal of the project is to study translation of a mutated rps9B gene -- which is translated into a ribosomal protein – in the eukaryote *Saccharomyces cerevisiae* in order to study the effect of the mutation on the accuracy of protein synthesis. To form a mutant rps9B gene, a copy of the gene is cloned into pYES2, a yeast shuttle vector, and incorporated into a strain that did not have rps2 gene, a lethal deletion that is viable solely due to the existence of the rps2 in the plasmid. The reporter system involves measuring the frequency of translational misreading during synthesis of firefly luciferase.

This research is supported by a grant from the National Institute of General Medical Sciences (R01 GM029480-25) and from a Special Research Assistantship/Initiative Support (SRAIS) grant.

Predicting Protein-Protein Interactions for Integrins and an LDL Receptor

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As our knowledge of complex cellular mechanics grows, so does the need for an understanding of the protein-protein interactions that govern most of these biological processes. This need is especially significant for cell surface receptors such as integrins and low-density lipoprotein (LDL) receptors, which are pivotal in many vital cell-signaling pathways. However, due to the vast number of proteins that have been characterized and sequenced to date, more efficient, computational techniques are required to fully elucidate the human protein interaction network. Our lab has developed a methodology that predicts these protein-protein interactions by looking at the coevolution of protein sequences. We hypothesize that proteins that interact have coevolved over time, so that changes in one sequence would be mirrored in the other. Our method, called Mirrortree, functions by taking a pair of potential interacting proteins and calculating the correlation between the evolution histories of the two proteins, which determines the likelihood that the two proteins interact. We applied this technique to two problems: determining the interacting proteins for integrins, and discovering what proteins interact with a novel LDL receptor. Using our methodologies, we were able to determine a number of potential interactors, which will be experimentally validated.

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World-wide Literature Search and Gap Analysis of Antimalarial Drug Resistance Mutations

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Christopher V. Plowe, Professor, Howard Hughes Medical Institute and Center for Vaccine Development, University of Maryland Baltimore School of Medicine

Malaria is an infectious disease that plagues many countries in tropical regions of the world. Key drugs that were once effective in treating malaria have been compromised by the development of drug resistance in the *Plasmodium* parasite. Polymorphisms conferring resistance have been identified for several drugs and can be used as molecular markers in the surveillance of drug-resistant malaria. The WorldWide Antimalarial Resistance Network (WWARN) is developing web-based tools and building a global community to track the emergence of resistance to the newest class of antimalarial drugs, the artemisinins. As part of this initiative, we are creating a comprehensive catalog of publications with data on molecular markers of antimalarial resistance to 1) locate geographical gaps in knowledge, 2) identify potential network partners and 3) provide a searchable library of relevant references as a resource for investigators studying malaria. We are currently conducting a literature search in PubMed and extracting information on the geographic regions and types of molecular markers being investigated. After completion of the literature search, we will produce maps with help from the WWARN IT team showing the geographic locations of existing data along with research gaps in malaria-endemic areas to inform targeted capacity-building efforts.

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Identification of Compounds that Bind to the HIV-1 Capsid Protein and Inhibit Capsid Core Formation

Britt J. Andersen
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In the late stages of the human immunodeficiency virus (HIV-1) replication cycle, thousands of viral Gag polyproteins aggregate at the plasma membrane of the host cell. These polyproteins trigger new, non-infectious virus particles to bud from the host cell plasma membrane. Once budding has occurred, protease cleaves the Gag polyproteins into several constituent parts, one of which is the viral capsid protein (CA). As the virion develops into a mature virus particle, the liberated capsid proteins assemble to form the virus' conical core, which is the protein case that surrounds the two strands of viral RNA. It has been shown that proper formation of the capsid core is crucial for viral infectivity. Thus, an antiviral drug targeted to disrupt capsid particle assembly would be a valuable tool against HIV-1. Previously, a compound in the CAP-1 class of assembly inhibitors was identified, but it binds too loosely to CA. The focus of this research was to identify additional compounds that could bind to the capsid protein and perhaps inhibit capsid core formation. Nuclear magnetic resonance (NMR) was used to identify multiple compounds from online chemical libraries that bind to CA. Several of these compounds showed higher affinity for the protein when compared to CAP-1.

This work was funded, in part, by the Howard Hughes Medical Institute at UMBC and an NIH-ARRA 3R37AI030917-19S1 grant.

BioBar: A Sequence Manipulation and Editing Toolkit for Microsoft Word

Laura J. Anzaldi
Ivan Erill, Assistant Professor, Department of Biological Sciences

Manipulation, editing, and basic processing of DNA and protein sequences has rapidly become a necessary skill for the practicing biologist, yet most everyday sequence manipulation tools are distributed across several programs and web applications, requiring installation and frequent switching among systems. To address this we created BioBar, a macro-enabled template for Microsoft Word documents. BioBar integrates functionality ranging from basic sequence manipulation to motif discovery and pair-wise alignment. After self-installing, BioBar will open as a tab in the Office 2007 Ribbon. Biologists can then easily work with their sequences using a familiar interface and minimize the need to switch among applications. BioBar was written in Visual Basic for Applications (VBA) as an open source, object-oriented project. This allows users with varying programming experience to expand and customize the program to better meet their own needs. BioBar has also an important educational component: by changing options, looking at and modifying the source code, students can gain a better appreciation for how certain bioinformatics techniques work. BioBar is a convenient and customizable alternative to other sequence manipulation programs and can be used for a variety of applications.

This work was funded by the UMBC Department of Biological Sciences.

Encouraging Increased Attendance among Inner-City High School Students

William J. Archer
Linda Oliva, Assistant Professor, Department of Education

Student attendance rates are a major issue in all high schools. The inner-city high school in Baltimore where I am doing my internship has a current attendance rate of 84 percent and it is not likely that we will reach our goal of 92 percent by the end of the academic year. This study investigated the effect of academic incentives on attendance rates in a ninth grade U.S. History class during the third and fourth quarters of the academic year. These attendance data were compared with attendance rates of the first and second quarter Government class, which did not receive the same academic incentives. Students' perspectives of the various academic incentives were also explored.

Second Generation UK-1 Analogs

***David L.* Bartee**, *Paul J. Smith*
Paul J. Smith, Associate Professor, Department of Chemistry and Biochemistry

The Hepatitis C virus (HCV) is a common chronic blood-bourne infection globally and the current standard treatment is not effective in a large percentage of patients. In an effort to produce potential therapeutics against HCV, we have synthesized 6-aryl-2-(methyl-4-benzoxazolate)-1-naphthols. These compounds will be tested for activity against HCV replication in HCV replicons and purified helicase enzyme from HCV. Previous analogs of UK-1, 5- and 7-benzyloxy-2-(methyl-4-benzoxazolate)-naphthols, exhibit very similar low to sub-micromolar activities in both whole cell and replicon assays. It is hypothesized that this similarity is because the two previous analogs occupy the same hydrophobic binding pocket on the helicase. These compounds place a number of different aromatic moieties directly into the hypothesized hydrophobic pocket, thus they should bind more effectively than the previous analogues**.** The aryl substituents have been specifically selected to not only affirm the existence the hydrophobic pocket adjacent to the six-position of the naphthyl ring, but also to better characterize the spatial dimensions of the pocket itself, as each substituent provides different steric demands and orientation.

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

A Novel Method to Structural Determination of HIV-1 5′-UTR

Shawn M. Barton*, Bilguujin Dorjsuren, Gowry Kulandaivel, Xiao Heng, Kun Lu*
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The Human Immunodeficiency Virus type-1 (HIV-1) RNA genome contains the highly conserved 5′-untranslated region (5′-UTR), a 356 nucleotide sequence that has been shown to regulate dimerization prior to packaging and eventual budding of the viral particle. Limited dispersion of NMR signals in RNA spectra make it difficult to assign signals for large molecules, forcing us to employ novel techniques in structural determination of the 5′-UTR. Using a segmental labeling technique on the core dimerization initiation site (DIS), a region of the 5′-UTR capable of directing packaging, we have shown that the AUG region forms a hairpin structure and is also capable of forming a long-range interaction with the unique 5′ (U5) element. Introducing mutations that stabilize the AUG hairpin favors monomer formation, while mutations stabilizing the U5:AUG interaction favors dimerization. We have also confirmed the existence of the U5:AUG in the full length 5′-UTR by introducing mutations that generate identifiable signals in NMR proton spectra shifted outside of the saturated chemical shift region. Using these techniques as well as utilizing selectively deuterated samples allow high-resolution NMR structural determination of the 5′-UTR and can be applied to assignments of other large RNAs.

*This research was supported in part by a grant to UMBC from the HHMI through the Precollege and Undergraduate Science Education Program and by NIH/NIGMS MARC U*STAR T34 08663 National Research Service Awards to UMBC.*

The Effect of the Roman Empire's Decline on the Ports of Pisa and Portus (Rome)

Katherine M. Bentz
Carolyn G. Koehler, Associate Professor, Department of Ancient Studies

Ports have always been crucial in maritime cultures for both military and economic functions. During the decline of the Roman Empire in the fourth and fifth centuries, several crises affected the micro-regions of two of its ports: Pisa, in the northwest of Italy, and Portus, near Rome. Food and economic disruptions, barbarian incursions, and civil war changed the nature of the traffic at these ports, as shipwrecks and written sources demonstrate. Archaeological remains show that pre-imperial Pisa had imported goods from around the Mediterranean. Once Portus was established as Rome's primary center for trade in the early Empire, however, Pisa served regional exchange. Then, under intensifying attacks by the Goths in the late Empire, Pisa took a more military significance. Portus remained essential for storing imports needed in the capital, but invasions in the fourth and fifth centuries resulted in its gradual abandonment as Rome's central commercial harbor. Although the roles played by Pisa and Portus in the Empire differed, each adapted to adverse conditions and survived to a surprising extent.

Inhibiting Matrix Targeting of the Gag Polyprotein towards the Plasma Membrane in HIV-1 Retrovirus Replication

Pallavi Bhargava, Deborah Girma
Michael F. Summers, Professor, Department of Chemistry and Biochemistry and Investigator, Howard Hughes Medical Institute

The Gag polyprotein is necessary for the formation of the mature HIV-1 virion. The N-terminal matrix protein (MA) of the Gag polyprotein in the HIV-1 virus is known to target the polyprotein towards the plasma membrane of the host cell in the late phase of HIV-1 replication. During assembly, Gag binds to phosphatidylinositol (PI) 4,5 biphosphate [PI(4,5)P2], located in the plasma membrane. This binding induces a conformational change of the myristate group of the matrix domain to an exposed state, allowing Gag to further bind to the lipid bilayer. Gag assembly at the plasma membrane is a potential point of intervention in the virus life cycle. Thus, the goal of this project is to inhibit matrix targeting to the plasma membrane. The methods that are used to help achieve this are to express and purify isotopically labeled HIV-1 myr-MA for NMR experiments. At this stage in the project, we are in the process of finding an inhibitor that will bind to the matrix protein and change its overall conformation by using nuclear magnetic resonance.

This work is funded by NIH/National Institute of Allergy and Infectious Diseases, 4R37AI030917.

Using Feedback to Increase Student Motivation, Effort, and Success

Michelle T. Birky
Linda Oliva, Assistant Professor, Department of Education

Student motivation is the key to successful learning. Some students may claim the material is boring or irrelevant to their lives and then refuse to do work. This lack of participation decreases what the students have learned. This study investigated the effect of using prompt, daily feedback to increase student motivation, effort, and success. Feedback was in the form of written grades for completion and accuracy, as well as constructive comments. Feedback and student work is returned the day after the work is completed. The effect of the feedback was measured in anecdotal evidence of student willingness to work (motivation), length of written work (effort), and student performance (success). Participants included 125 English Language Arts students in sixth through eighth grade at a Baltimore City school.

Body Awareness: New Discoveries in Movement

Michelle Brandenburg
Doug Hamby, Associate Professor, Department of Dance

"Body Awareness: New Discoveries in Movement" is a study in physically changing a dancer's body in order to prevent injuries and create movement efficiency. My goal was to change my own body in order to understand the process and discover new revelations to share with the dance community. I studied under Melissa Wolfe Rosebro through a series of private lessons. Rosebro combines her knowledge of *Pilates*, anatomy, and dance to create a unique set of exercises that can change a dancer's body. In my own body I have seen remarkable changes. By applying the principles I learned, my arabesque has increased extension, my pirouettes have an increased number of rotations, and I have more stability and control. I have also learned to analyze the typical aches and pains as a dancer such as knee and lower back pain. I can analyze what movement pattern might be causing the pain in order to change the habit and replace it with better (more efficient) movement patterns. My work has impacted the dancers I work with and therefore, the field of dance. I plan on continuing this research throughout my career as a dancer and eventually would like to complete Rosebro's teacher training program so I can help more dancers.

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

Preschool Children's Moral Evaluations of Aggression: Reliability, Stability, and Discriminant Validity

Angela M. Brant
David Schultz, Associate Professor, Department of Psychology

Psychologists have partitioned how children respond to provocative situations into different thinking steps. The fifth step in one theory, response decision, focuses on how children evaluate aggressive behaviors. Only four published studies have examined response decision in early childhood. The present study is the first to examine the stability and discriminant validity of moral evaluations of aggression. Ninety-nine Baltimore City Head Start preschool children participated. Children viewed six videos depicting a child's attempt to achieve an instrumental or social goal via coercive means and subsequently asked if the behavior was "okay." Children showed consistent moral evaluations of aggression across different scenarios, and these evaluations stayed relatively stable over five months (r = .50). Children with higher verbal ability accepted aggressive attempts less often. After controlling for verbal ability, moral evaluation of aggression scores related significantly to children's self-control (partial r = -.23). This study shows that individual differences in moral evaluations of aggression develop, show stability over time, and may influence how children behave.

Reclaiming Maryland: Confederate Nationalism in Popular Print Culture

Abigail Bratcher
Anne S. Rubin, Associate Professor, Department of History

Throughout the secession crisis of early 1861, politics and culture burgeoned, intertwined, and overlapped, elevating citizens of all persuasions to become responsive consumers and producers of patriotism. Citizens relied on the universal appeal of popular media to both express and affirm their allegiance to the newly formed Confederacy. For my research, I considered Confederate nationalism and print media through the lens of Maryland. Through an analysis of pamphlet literature, broadside poetry, school textbooks, newspaper editorials, and other printed material in the Confederacy and in Maryland, I corroborated earlier scholarship on the general nature of Confederate nationalism in popular media, and elucidated the idiomatic nature of popular media surrounding Maryland. I investigated the ways in which media surrounding the state of Maryland fit into a larger scheme of Confederate nationalism: the particular characteristics of popular media pertaining to Maryland which avowed Confederate nationality and also which cast Maryland as a lost or stolen state for the Confederacy to reclaim.

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

Adolescent Mothers in a Quilombo Community: Praia Grande, Brazil

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Bambi Chapin, Assistant Professor, Department of Anthropology

This exploratory, ethnographic study addressed the characteristics and meanings of adolescent motherhood in Praia Grande in Bahia, Brazil. Praia Grande is a *quilombo*, or community descended from escaped slaves in an isolated location. The participants were the twenty women of the 161 Praia Grande women between the ages of twelve to twenty who had at least one child (11 percent). Results were derived from participant observation, *Programa da Saúde da Família (*Family Health Program*)* documents, surveys, a life history and interviews. During this research, lack of employment opportunities, importance of the family support, and confusion about birth control emerged as central themes. In addition, infrastructural inadequacies, from lack of public sanitation or police to timely medical care to the practical inaccessibility of education, were commonly mentioned by these young women as impediments to achieving desires for themselves and their children, pointing to the structural violence experienced in the *quilombo* population. The study highlights the need to assess cultural contexts of adolescent motherhood before implementing public policies for *quilombo* reproductive health programs.

This study was funded through the UMBC Office of Financial Aid and Scholarships in transfer of the Premier Scholarship to conduct abroad research.

Analysis of Alternative Fuel Policy Options

Samantha Bryant
Laura Hussey, Assistant Professor, Department of Political Science

At a time when oil price fluctuations threaten our national security, exploration of alternative fuel sources becomes increasingly imperative. This research aims to help policy makers decide which alternative fuel source to support. Based on legislative documents and the first-hand observation of the policy process that I gained as a congressional intern, I was able to identify two prominent renewable fuel source options; algae and ethanol. Also, I developed specific guidelines that an alternative fuel should meet. Next, I reviewed scholarly and professional articles that indicated how each option would perform with respect to the criteria, and compared each option's strengths and weaknesses. My analysis concludes that algae-based fuel is the best option for a renewable fuel source. While this technology is less advanced than ethanol-based fuel technology, algae-based fuel assures more long-term advantages. Among other things, my research indicates that algae fuel will be less expensive to mass-produce domestically. Further, algae-based fuel lacks ethanol-based fuel's leading weaknesses, which are dependence on the weather and higher corn prices for consumers. Due to algae-based fuel being more plentiful and less expensive to consumers than ethanol-based fuel, my research suggests that it has greater potential for ending dependence on foreign oil markets.

Rat Model of Brain Injury Caused by Blast-Induced Hyper-Acceleration

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Gary Fiskum, Vice-chair Research, Professor, Department of Anesthesiology, University of Maryland School of Medicine

Over 150,000 U.S. warfighters in Iraq and Afghanistan have sustained traumatic brain injury (TBI), primarily due to explosions. Many warfighters are targeted by improvised explosive devices and can experience hyper-accelerating forces that likely contribute to their brain damage. We developed an experimental paradigm to study the effects of blast-induced hyperacceleration (BIH) on rats. Our hypothesis is that g-forces in the range of 20-40 Gz can induce mild TBI without causing lethal injuries. Explosive charges were detonated under the center of a plate at distances that generate precise g-forces. At one and seven days after the blast, rats were perfusion-fixed while their brains analyzed for evidence of neuronal degeneration (FJB and Calbindin), microglial activation (Iba-1), astrocyte activation (GFAP), and axonal fiber injury (aminocupric silver staining). Widespread silver staining was evident at 24 hours and seven days post-injury, suggesting degeneration of axonal fibers, predominantly in the internal capsule, and corpus callosum. Increased activation of microglia and astrocytes in close proximity to blood vessels and the third ventricle was observed, while FJB positive neurons rarely occurred. These preliminary results suggest that this novel blast-induced TBI model can provide insight into the pathophysiology of mild TBI caused by blast-induced hyper-acceleration.

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New Chromatography Methods for Biological Macromolecules and Carbon Nanotubes

Keisha M. Carr
Douglas D. Frey, Professor, Department of Chemical and Biochemical Engineering

This project investigates novel chromatographic methods employing focusing effects and related types of phenomena for both biological macromolecules and carbon nanotubes (CNTs). Of particular interest is the use of chromatofocusing with mixtures of buffering species instead of polyampholyte elution buffers. These types of chromatofocusing methods combine the best features of isoelectric focusing and gradient elution chromatography to achieve high resolutions of large molecules present in a feed sample. In addition to biological macromolecules, this project addresses the chromatographic separation of CNTs. CNTs are long cylindrical carbon structures that have potential uses in several fields due to their unique physical properties. There has been much research exploring properties of CNTs, but many physical aspects of CNTs remain unknown. One proposed method of studying CNTs involves individual tube separation via chromatography. This project applies chromatographic methods to CNTs in order to analyze physical and chemical characteristics that may influence CNT behavior. Using chromatofocusing, we can determine the extent of separation of CNTs in solution. The next step involves modifying various parameters used in chromatofocusing to discover the best conditions for separating CNTs. If these techniques can successfully separate CNTs, novel separation techniques can be developed for a large range of complex mixtures.

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.

Fine-tuning of Mucosal Barrier Function for Tetanus Vaccine Delivery in Mice Using the Novel Peptide Adjuvant AT1002

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The main limiting factor of the effectiveness of mucosal vaccines is in the ability of the antigen to cross the mucosal barrier. We tested the ability of AT1002, a peptide regulator of mucosal barrier function, to act as an adjuvant to elicit protective local and systemic immune responses. Specifically, we predicted that its ability to reduce the competence of intercellular tight junctions would permit the passage of antigen through the airway mucosa, initiating a greater immune response. At weekly intervals over four weeks, we administered intranasal tetanus toxoid (tt) antigen with amounts of AT1002 to C57BL/6 mice. Circulating tt-specific IgG antibodies were quantified using ELISA to measure the effect of the peptide. Preliminary results suggested that exposure to 100 nmol of AT1002 was sufficient to increase the titers of tt-specific IgG in mice after one week of treatment. Determining the optimal amount of the peptide will allow for further testing of its capacity to protect tt-immunized mice challenged with a lethal dose of tetanus toxin. Successful characterization of AT1002 as an adjuvant in this model may help propose its employment in effective protocols of mucosal vaccination, a potentially more effective, more practical, less expensive, and safer method of mass immunization.

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Capraesque America: The Great Depression Films of Frank Capra from 1934-1939

Natasha Chae
Warren Belasco, Professor, Department of American Studies

During the Great Depression, the stability of the belief in America's myth of limitless opportunity and upward mobility was at risk. As a result, Hollywood filmmakers were influential players in the effort to restore such important cultural ideals and values as the American Dream and the triumph over class into the American psyche. One of the most influential of these players was three-time Academy Award winner for Best Director, Frank Capra, who was best known for such films as *It's a Wonderful Life* (1940) and less known for his documentary propaganda films for the U.S. government. In particular, such Capra films as *It Happened One Night* (1934), *Mr. Deeds Goes to Town* (1936), and *Mr. Smith Goes to Washington* (1939) were celebrated as motivational films that consciously endeavored to reinstate classical American values within the context of the Great Depression. Although Capra's critics characterized him as a sentimental populist, this research employed textual analysis, along the axes of gender, political ideology, and socioeconomic class, to investigate and refute this claim. In doing so, this research uncovered that the values espoused by these films demonstrated Capra's conservative and traditionalist treatment of society, and, ultimately, a longing for the America of yore.

Angiotensin II Receptor Blockers (ARB) Reduce Brain Inflammation

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Juan M. Saavedra, Section Chief, Section on Pharmacology, National Institute of Mental Health, National Institutes of Health

Brain inflammation, a physiological response to factors including stress, infection, and physical injury, is characterized by the release of cytokines and other metabolites into the bloodstream. This results in the activation of transcription factors that stimulate pro-inflammatory cascades which reestablish homeostasis. However, an unregulated inflammatory reaction can result in chronic inflammation and damage to neuronal cells; this can contribute to Alzheimer's, Parkinson's, multiple sclerosis, and other neurodegenerative diseases. The neuropeptide Angiotensin II (Ang II) has been implicated in vascular and tissue inflammation through activation of its AT1 receptors. AT1 receptor blockers (ARBs) reverse Ang II – regulated vasoconstriction, as well as the inflammatory effects of hypertension, atherosclerosis, and diabetes. Using lipopolysaccharide (LPS), a pro-inflammatory bacterial endotoxin, the objective of the study was to elucidate the effect of candesartan, a centrally acting ARB, on various markers of inflammation in the area postrema (AP), a circumventricular organ and target site for circulating endotoxins. The results of these early studies showed that candesartan was able to down-regulate LPS-induced changes in expression of certain central inflammatory markers: c-Fos, IL-6, and COX-2. Further studies of candesartan on the dorsal vagal complex will explicate the mechanism by which AT1 receptors participate in the inflammatory response in this brain region.

This work was funded by the Division of Intramural Research Programs at the National Institutes of Health.

TIMP-2 Overexpression Alters the Transcriptional Profile of Human Adenocarcinoma A549 Cells

Tania Chatterjee, *William G. Stetler-Stevenson[1], Dimitra Bourboulia[1]*
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Tissue Inhibitors of Metalloproteinases, or TIMPs, are a family of proteins secreted by all cells that are natural inhibitors of Matrix Metalloproteinases, or MMPs – proteins that aid in the breakdown of the extracellular matrix. TIMP-2 also inhibits tumor angiogenesis, and therefore blocks tumor growth *in vivo*, making it a candidate to become an anti-cancer treatment. Two mechanisms associated with this property include a) TIMP-2 inhibition of MMP-2, reducing the ability of endothelial cells to degrade the ECM required for angiogenesis, and b) TIMP-2 inhibition of growth factor-stimulated endothelial cell growth via its binding to integrin α3β1 on the endothelial cells. This occurs independently of its MMP inhibitory activity as demonstrated by the mutant Ala+TIMP-2, which lacks MMP inhibitory activity, but still inhibits endothelial cell growth. Transcriptional microarray analysis demonstrates that human lung cancer cells expressing TIMP-2 or Ala+TIMP-2 have an altered gene expression profile that suggests a more differentiated, less aggressive phenotype. In addition, TIMP-2 inhibition of angiogenesis is thought to promote the apoptosis of tumor cells, while high levels of MMPs are associated with increased cancer cell migration and movement, invasion and high risk of metastasis. Thus, as the MMP/TIMP balance is shifted towards the MMPs proteolytic activities, TIMPs could potentially be used therapeutically against tumor progression.

This work was funded by the National Cancer Institute, Center for Cancer Research Grant # Z01 SC009179-20.

Chinese Mothers' Immigration Experiences in the U.S. and in their Young Children's Socioemotional Adjustment

Vanessa X. Cheng
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Between 2000 and 2006, the number of immigrant parents and their Maryland-born children accounted for thirty-five percent of the total population increase in Maryland. Nevertheless, there is very little research on this quickly growing Chinese population. The resources available in the receiving community and social attitudes towards immigrants are crucial in determining their adaptation and outcomes. Previous studies have found that parents' immigration experiences affect their children's adaptation, especially with regard to their socioemotional adjustment. However, these processes and associations have been mostly examined using quantitative approaches in the literature, which fails to capture parents' meaning-making of their immigration-related experiences and their children's adaptation. Thus, the present study utilized both qualitative and quantitative methods to examine these issues among fifty immigrant Chinese mothers with young children in Maryland, specifically, (1) mothers' positive and negative immigration experiences, (2) the association between their immigration experiences and expectations regarding their children's adaptation and success in the U.S., and (3) the association between mothers' immigration experiences and their children's socioemotional adjustment at school. Findings from this study can inform community and service providers about best practices that may promote the successful adaptation of Chinese immigrant families with young children.

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Modeling Sensory Input to the Lamprey Spinal Cord

Geoffrey D. Clapp
Kathleen A. Hoffman, Associate Professor, Department of Mathematics and Statistics

Sensory input has a profound effect on vertebrate locomotion, but how it is processed is not well understood. The lamprey is a model system for studying vertebrate locomotion because its spinal cord contains the same types of neurons as its human counterpart, except in smaller quantities. Biological experiments have revealed that the lamprey's swimming motion is modulated by input to the spinal cord from edge cells, sensory organs that measure the body's curvature. In order to better understand the role of edge cells, we develop and evaluate two types of mathematical models of the lamprey's central pattern generator of locomotion, implemented as a chain of coupled oscillators. Starting with a neural model that represents individual classes of neurons within each oscillator, we use phase reduction techniques to derive a first order phase model that represents each oscillator by a single variable. This derivation will allow for a direct comparison of neural model and phase model results. A comparison of these models will provide insight into the appropriate level of biological detail needed to study edge cell input.

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

Analysis of the Hi-MYC Mouse Model Reveals Molecular Similarity to Human Prostate Cancer

Elisia M. Clark
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Prostate cancer is the second leading cause of cancer death in men in the United States, and there is a pressing need for an animal model that recapitulates key features of human prostate cancer. The best current model is the HI-MYC transgenic mouse model, based on androgen-driven expression of the human MYC gene, an oncogenic transcription factor that plays a key role in regulating cell growth and apoptosis that is upregulated in prostate cancer. A hallmark feature of human prostate cancer is loss of expression of the prostate-specific tumor suppressor Nkx3.1 protein. Immunohistochemistry (IHC) is used for detecting antigens by means of specific binding antibodies in tissues. To determine if Nkx3.1 expression is lost in HI-MYC mice, IHC was performed. In all cases it was seen that the Nkx3.1 expression is lost in early and late cancer lesions. Another common human prostate cancer feature is the TMPRSS2-ERG fusion which engenders the incorporation of the androgen responsive receptor element to the proto-oncogene ERG. We are searching for evidence of this fusion in Hi-MYC mice, but to date have not observed evidence of fusions. Current results suggest that the HI-MYC model faithfully recapitulates certain features of human prostate cancer, but not all.

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Nostalgia for Everything

Theresa Columbus
Preminda S. Jacob, Associate Professor, Department of Visual Arts

Last summer, I traveled to Greece to make a video about memory, longing, cross-cultural communication and the emotions involved in making or interpreting a piece of art. In viewing this piece, the audience becomes the disoriented traveler and witness to the introspective musings of the artist. The montage of performance, absurd dialogue and my personal depiction of the creative process continually shift the audience's perspective, creating a richness of sensation along with the perplexity travelers often experience. The disjunction between lines of dialogue and the intimate proximity to actors' faces evokes an odd yet familiar experience for the audience. Humor is used to translate some of the disjointed communication into something that feels natural. Viewing the Cretan countryside becomes a metaphor for the instinctual process of creativity itself, in contrast to the self-consciousness and struggles that are discussed.

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Lunar Swirls: How Dark are "Dark Lanes"?

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Swirls are unusual sinuous bright markings found on the surface of the Moon. The swirls often contain "dark lanes" within the bright undulating sections. All swirls correlate with the presence of magnetized crustal rocks, but not all magnetic areas exhibit bright markings. The mechanism by which swirls form is a longstanding mystery. One hypothesis holds that a magnetic anomaly prevents solar wind protons from striking the surface and thus inhibits the normal weathering and darkening of the soil. If so, it is possible that the deflected protons will collide with the surface around the perimeter of the magnetic anomaly where the field is weaker. The resulting enhancement of ion bombardment could cause increased weathering, explaining the dark lanes. The goal of this study is to determine if the dark lanes have truly low reflectance, or instead just appear dark relative to the high-reflectance portions of the adjacent swirl. Image profiles across several lunar swirls have been analyzed to determine the relationship between the reflectance of dark lanes and that of background soil. We have identified locations where enhanced weathering may be taking place, suggesting that the solar-wind shielding hypothesis may be correct.

This work was funded by the NASA Planetary Geology and Geophysics Program.

Adaptive Learning Neural Networks for Binding Site Search in Genomic Sequences

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Ivan Erill, Assistant Professor, Department of Biological Sciences

Artificial neural networks (ANN) can be trained to become highly efficient pattern recognition systems capable of discerning non-linear features on complex backgrounds. For this reason, ANNs have been proposed frequently as suitable search tools for the identification of transcription factor (TF) binding sites in genomic sequences. Here we show that ANNs trained with the standard backpropagation algorithm have significantly lower search efficiency compared to standard weight matrix methods in TF binding site search. We observe that this is due to the ill-balanced nature of the search problem, which requires the identification of a small number of sites against a very large background. We propose a new algorithm, adaptive learning, based on a targeted sampling of the background during backpropagation learning. We validate this approach by cross-validation on an up-to-date collection of CRP sites from Escherichia coli against the original *E. coli* genome, a randomly generated genome and the genome of Paenibacillus sp. Our results demonstrate that adaptive learning of ANNs improves search efficiency for CRP against tested backgrounds. The general implications of these findings for machine learning approaches to binding site search are discussed here.

This work was funded, in part, by UMBC UBM program National Science Foundation DBI 1031420 and the UMBC Department of Biological Sciences.

Studying the *Aspergillus nidulans* Cell Wall through Plate Assay

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

The filamentous fungus *Aspergillus nidulans* is being studied via plate assay. The development of a plate assay for cell-wall integrity will allow for an efficient way to identify how a change in the environment, or in the genome, affects fungal cell wall properties. Compounds which inhibit cell wall formation are incorporated into agar plates for plate assay. Fungal deletion mutants lacking putative cell-wall-related genes are plated in varying spore concentrations on agar plates with sub-lethal concentrations. Assays determine which strains are affected by wall inhibiting compounds. Observations indicate the *rac1* deletion mutant exhibits increased resistance to cell- wall inhibitors and to autophagy induction by rapamycin. It indicates that the *rac1* gene product is important in morphogenesis and cell wall development. Autophagy deficient mutants (Δ*atg8* and Δ*atg13*) were not affected by growth in rapamycin or cell-wall inhibitors (Calcofluor White and Congo Red) by themselves. Autophagy deficient mutants showed reduced growth when grown in media containing both rapamycin and CR or CFW. This implies that with wall inhibitors, a functional autophagy system may aid in cell-wall repair.

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Forms of Positive Reinforcement in a Seventh-Grade Classroom

Casey E. Dahle
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This study investigated the effects of positive reinforcement strategies on a seventh-grade English Language Arts classroom of 28 students. Three forms of positive reinforcement were examined: whole-class, small-group, and finally individual, with which these students were most familiar. To monitor the efficacy of each, disciplinary action was tracked according to the school's disciplinary ladder, which includes warnings, time-outs, lunch detentions, minor incident reports, phone calls home, and referrals. Each strategy was tested and disciplinary action data were recorded for one-week periods. This study shows how different forms of positive reinforcement can impact the amount of disciplinary action needed in a public school environment with growing class sizes and classroom management problems.

Measurement of Aggregates Formed by the Snake Venom Protein Crotamine and DNA

Thomas Dakermanji, *Richard Karpel*
Richard Karpel, Professor, Department of Chemistry

The protein crotamine is a toxin from the venom of the South American rattlesnake (*Crotalus durissus terrificus*). It is a nucleic acid binding protein with a number of functions, including promoting necrosis of muscle cells. It has the ability to deliver DNA into cells, as well as a unique cell penetrating property that causes it to localize in the nucleus, giving it the potential to be utilized as a drug delivery device. Cell penetration is believed to follow interaction of crotamine with cell surface heparin sulfate proteoglycans. Our experiments focus on the binding of crotamine to double-stranded DNA or heparin and formation of aggregations. In our experiments we use PET-21A DNA, a vector with an N-terminal T7 tag sequence and a C-terminal His-tag sequence. To measure the size of the aggregates formed, we used the technique of Dynamic Light Scattering (DLS) to measure how frequently a specific size aggregate was observed. In doing so, we are able to determine conditions at which aggregate size is greatest, and to measure the size of aggregates at physiological conditions.

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Supertransfection of Costimulatory Molecule CD80 Decreases Expression of Inhibitory Molecule that Causes T-Cell Death

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Suzanne Ostrand-Rosenberg, Professor, Department of Biological Sciences

Programmed Death Ligand-1 (PDL1) is expressed by many tumor cells and increases tumor progression by binding to its receptor PD1 on T cells, thereby inhibiting T-lymphocyte activation and causing T-cell apoptosis. Cluster of Differentiation 80 (CD80), expressed by antigen presenting cells, provides a potent costimulatory signal needed for T-cell activation. We previously demonstrated that in human cancer cells transfection of CD80 inhibited PDL1 function, resulting in increased T-cell activation. In contrast to human CD80 transfectants, CD80-transfected mouse cancer cells expressed lower levels of CD80 and were not down regulated for PDL1. To determine if the inability to reduce PDL1 was due to low levels of CD80 we super transfected the mouse cutaneous melanoma cell line, MelF10. This line which was previously transfected with CD80 (MelF10/CD80), was transfected with an additional CD80 DNA construct, yielding significantly higher levels of CD80 (MelF10/CD80/CD80). MelF10/CD80/CD80 cells displayed less PDL1 on their cell surface as compared to MelF10/CD80 cells. Further studies will determine if the addition of a soluble CD80 fusion protein prevents the binding of PDL1 to its receptor PD1. These experiments will demonstrate if CD80 universally overcomes the immunosuppressive effects of PDL1 and has potential therapeutic efficacy.

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Investigations of *RLS1*: The Origins of Multicellularity within the Volvocine Algae

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Stephen M. Miller, Associate Professor, Department of Biological Sciences

How does multicellularity evolve? The volvocine green algae are an excellent system in which to investigate this question because they contain unicellular, colonial, and multicellular members that have been diverging from each other for a relatively short period of time. The focus of our current study is the *RLS1* gene of the unicellular alga *Chlamydomonas reinhardtii*. *RLS1* is closely related to *regA*, a gene of multicellular *Volvox carteri*, that represses cellular reproduction and is therefore essential for cell differentiation. We hypothesize that *RLS1* represses reproduction in *Chlamydomonas*, but in a conditional, not developmental context. We have used artificial micro-RNAs to knock down the expression of *RLS1* to investigate its importance under several different conditions of stress. Currently we have collected RNA samples from unaltered and knockdown organisms grown under optimal conditions so we can establish a base-line level of *RLS1* expression. In the near future RNA samples will be collected under conditions of light deprivation, and nitrogen and/or sulfur starvation. This will allow us to determine the function of *RLS1* under these conditions. This work should contribute to our understanding of the evolutionary forces that have led to multicellularity.

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Genetic Analysis of the Role of PHT4;6 in Regulating Innate Immunity of Arabidopsis

Teklu M. Dawit*, Chong Zhang*
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Successful control of plant diseases depends on a thorough understanding of the mechanisms of plant disease resistance. Previous studies by Dr. Lu's laboratory determined that the loss of function mutant *pht4;6-2* enhances plant disease resistance, indicating that PHT4;6 may be a negative regulator of plant defense. To further investigate the role of PHT4;6, we took advantage of a unique Arabidopsis mutant, *acd6-1*, whose small size is inversely correlated with the plant's defense level. We constructed a binary vector containing cloned *PHT4;6* genomic DNA and transformed the *acd6* plants in order to increase *PHT4;6* expression. Seeds from the transformed *acd6* plants will be placed on a 1/2 MS+Kanamycin selection plate in order to select the homozygous transgenic plants. In the future, we will infect these transgenic plants with *Pseudomonas syringae*, test these transgenic plants for their suppression of *acd6* conferred phenotypes, including plant size, and determine these plants' levels of defense gene expression. If extra copies of *PHT4;6* suppress *acd6* phenotypes , it can be determined that PHT4;6 is a negative regulator of plant defense.

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Optimizing Feeding Rate Methodology in Drosophila to Determine the Effect of Energy Acquisition on Life Span

Payal Daya*, Jeff Leips, Mary Durham*
Jeff Leips, Associate Professor, Department of Biological Sciences
Mary Durham, Graduate Student, Department of Biological Sciences

Dietary restriction, a decrease in nutrient intake without malnutrition, has been shown to increase life span nearly universally among many species, including humans, and is highly linked to feeding behavior. Several methods have been used to measure feeding rate in *Drosophila melanogaster*; however, it remains unclear which method is most precise. We compared two of these existing methods: labeling media with either blue dye or radioactive labels, then quantifying subsequent food uptake with spectrophotometry and isotope levels, respectively. Radioactive labeling was identified as the most effective assay. We used this method to determine if increases in life span found in flies reared on a restricted versus regular diet were influenced by differences in feeding rate or differences in dietary content. Since this work was done using a set of lines designed for genetic mapping tests, it may be used in future experiments and analysis to identify candidate genes responsible for producing natural variation in feeding rate in Drosophila. Furthermore, the results can be used to gain a better understanding of how genes function and interact to regulate feeding rates and physiological responses to dietary restriction in many other organisms.

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HIV-1 Diploid Genome Selection is Mediated By a Novel Dimerization-Dependent RNA Structural Switch Mechanism

Sai Sachin Divakaruni, Courtney LaCotti*, Atheeth Hiremath, Xiao Heng*
Michael F. Summers, Professor, Department of Chemistry and Biochemistry and Investigator, Howard Hughes Medical Institute

The Human Immunodeficiency Virus (HIV) is a retrovirus that can cause Acquired Immunodeficiency Syndrome (AIDS), a global epidemic. To understand the mechanism of genome recognition and packaging, the interaction between the HIV-1 5′ Untranslated Region (5′-UTR) and the Nucleocapsid (NC) domain of the viral Gag polyprotein was studied. Our lab obtained nuclear magnetic resonance (NMR) data showing that the HIV-1 AUG region exists in equilibrium between a hairpin (HP) monomer and a long-range interaction (LR) dimer structure. We stabilized the RNA into both conformations, incubated them in near-physiological salt conditions, and analyzed the resulting structures via gel electrophoresis. Our results showed that 5′-UTR ^{HP} remained a monomer, whereas 5′-UTR^{LR} formed a dimer. We used isothermal titration calorimetry (ITC) to characterize RNA-NC interactions. Our results indicate that 5′-UTR^{HP} contains 7 ± 1 high-affinity NC binding sites, while 5′-UTR^{LR} contains 16 ± 2 high-affinity NC binding sites. Our results strongly suggest that diploid genome selection by HIV-1 is mediated by a dimerization-dependent RNA structural switch involving the U5-AUG long-range interaction.

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The Second Green Revolution in Africa: An Assessment of its Sustainability

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This research was conducted in order to discover the effects of the Green Revolution on people's lives and the environment in Africa. The post-war development agenda of the Truman administration led to what became known as the First Green Revolution, relying on modern technology in agriculture to improve crop yields. The negative impacts of the First Green Revolution on biodiversity and the environment, as well as its failure to address the specific needs of the targeted countries, have been well documented. Yet, today, American foundations and the Alliance for a Green Revolution in Africa (AGRA) are proposing to implement a Second Green Revolution in Africa to resolve the crops crisis of the less developed countries. The proposed New Green Revolution will have a significant impact on the Sub-Saharan countries like Tanzania that have already been affected by the structural adjustments programs of both the World Bank and the International Monetary Fund. This study analyzed both the impacts of the First Green Revolution and the projected outcomes of the New Green Revolution in Africa-Tanzania. It was found that petroleum-based inputs, the use of genetically modified seeds, and Western style irrigation practices would compound the problems they claim to address. This would also imply huge and unnecessary expenditures, due to the volatility of the oil industry and the yearly expenditure of seed replacement. Real solutions to the crops crisis would involve a return to traditional farming practices, already taking place in a small scale, as well as food distribution equity.

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School Attendance Rates of Food Allergic and Non-allergic Children

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Food allergies affect one in twenty-five school-aged children (Sicherer, 2010). Previous research found that 34 percent of parents of children with food allergies reported that food allergies impacted school attendance, with 10 percent choosing to home school (Bollinger, 2006). Research suggests that children's participation in school or childcare outside of the home is important for the development of social skills and autonomy. As part of a larger study (N= 124), parents completed questionnaires on family activities. Frequency of activities outside of the home was measured, including the number of days of school attended in the past month. It was hypothesized that children with food allergies attend school less often than children without food allergies. The proportion of food allergy and non-food allergy children regularly attending school will be analyzed. Additionally, the number of days attended will be compared. Significant results will support the notion that food allergies have an impact on daily life, perhaps due to parents' concern that schools are not prepared to safely handle a severe reaction.

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Music for All: **Private Music Education in Carroll County, Maryland**

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In Carroll County, Maryland, music is traditionally underfunded within the public school curriculum and as a county-sponsored after-school activity; the recent economic downturn has exacerbated this situation. In addition, many students lack the finances and access to private music instruction needed to reach their fullest potential and achieve life-long enrichment. To determine the need for private music education in Carroll County, Maryland, research was structured in two main phases. In the first phase, a needs-based assessment was completed with data derived through a questionnaire administered at Head Start parent policy meetings and parent-teacher meetings at elementary and middle schools across Carroll County. The data indicated a need for an after-school music education program. The second phase included the creation of a two-week volunteer pilot program that took place in March in the towns of Westminster and Union Bridge where children, who lacked the opportunity to engage in learning an instrument, from kindergarten through middle school, could receive beginning private lessons on guitar, piano, and percussion. This pilot program verified the initial data derived from the questionnaire. In addition, various existing local non-profits were studied to gain insights into how to transition the volunteer pilot program into a non-profit.

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

Improving Approach in Automatic Method for Mutation Extraction and Disease-Relationship Mutation Annotation

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

Associating mutations with disease phenotypes is fundamental for understanding the molecular basis of diseases and developing novel tools for their diagnosis and prognosis. Automatic methods such as the Extractor of MUtations (EMU), developed by Dr. Kann's group, have great potential for extraction of disease-mutation relationships and for keeping up with the exponential growth of the biomedical literature. However, automatic extraction of the correct gene-mutations pairs remains a challenge for these methodologies. In this work, EMU was modified by narrowing down the text used to extract mutations from whole abstracts to sentences within full text articles. A random subset of ten articles (available Open Access from PMC) was used to evaluate EMU's gene finding when using abstracts vs. full text by sentences on breast cancer-related work. Extracting mutations by sentence in full text instead of whole abstracts increases the precision of the method from 0.55 to 0.77. Out of 5,967 articles in the breast cancer corpus, only 168 articles are available for XML download from PMC. Only 10 percent of these abstracts contained mutations, which were extracted with EMU. Thus, using full-text increases the precision of method but is severely limited by the availability of full text articles for text mining.

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Blue Over Black: Racial Parochialism, Incumbent Protection, and the 2010 Democratic Primary in Memphis

Dinah Douglas, Rhoanne Esteban, Andrew Kent, Merertu Kitila, Ebonie Riley, Donald Suica
Tyson King-Meadows, Assistant Professor, Department of Political Science

There is conflict in majority-minority districts over who can best represent constituent interests. In the 2010 Democratic primary of Tennessee's Ninth District, the state's only majority black district, the first black mayor of Memphis, Willie Herenton, challenged white Representative Steve Cohen for re-election. Herenton argued that Tennessee needed "Just One" black representative given the departure of Cohen's predecessor, Harold Ford, Jr., in 2006. Targeting the incumbent's white racial identity, Herenton accused Cohen of being unable to represent black interests in the district and in the state. He also noted that Cohen was unable to join the Congressional Black Caucus. We examined the Herenton-Cohen controversy and black interest representation by analyzing over 2400 bills that reflect Cohen's sponsorship and co-sponsorship activity in the 110th and 111th Congresses. We compared this activity to that of Ford's in the two previous Congresses. We also examined manifestations of racial parochialism by analyzing primary and secondary survey data, newspaper accounts, and campaign materials. Our findings
reveal that despite Cohen's lack of descriptive congruence with the district, he championed black interests at the local and national level. Moreover, though Herenton racialized the campaign, Cohen secured the support of prominent black leaders and won overwhelmingly.

A Comparative Study: Courtesans and Prostitutes in England and Japan during the Early Modern Period (1400 – 1800)

Ashley N. Dyjack
Amy Friode, Professor, Department of History

My research consisted of a comparative study of prostitutes and courtesans in England and Japan during the Early Modern Period (1400 - 1800). The goal for this project was to compare how two unique cultures regulated and controlled prostitution, including brothel districts. In addition, the project covered the standards, culture, and traditions of the trade. My project also included a section about the women who worked as prostitutes. The last section researched how these two cultures represented and recorded these women, and the places they lived and worked, through the arts and visual images. In order to complete this project, I used historical research methods, which included reading secondary literature on the topic and using primary sources from the cultures and time periods I was studying. This project incorporated both textual and visual primary sources, including art and maps. My findings provide a cross-cultural comparative approach to a subject that historians have studied only one culture at a time. Additionally, in order to incorporate my computer science major into this project, I created a website component to display my findings. This allowed my project and research findings to have a much wider audience.

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

A Novel Mechanism of Resistance to Apoptosis in Immune Suppressive Cells in the Inflammatory Tumor Environment

Christopher Ecker*, Olesya Chornoguz, Suzanne Ostrand-Rosenberg*
Suzanne Ostrand-Rosenberg, Professor, Department of Biological Sciences

Most cancer patients have a weakened immune system due to the accumulation of myeloid-derived suppressor cells (MDSC), thus making them poor candidates for cancer immunotherapies. Because MDSC accumulation and potency are enhanced by inflammation, we are studying the effects of inflammation on MDSC using wild type mouse 4T1 mammary carcinoma cells and 4T1 cells transfected with the pro-inflammatory cytokine Interleukin-1β (IL-1β). Previous studies from our laboratory showed that IL-1β exacerbated tumor progression by increasing MDSC resistance to apoptosis. When activated, p38 mitogen activated protein kinase (p38 MAPK) confers resistance to apoptosis, suggesting that inflammation (IL-1β) may increase MDSC resistance to apoptosis through the p38 MAPK pathway. If our hypothesis is correct, then inflammatory MDSC will have higher levels of activated p38 MAPK and be more resistant to apoptosis. Preliminary results show that upon stimulation with the p38 agonist anisomycin, inflammatory MDSC have higher expression of activated p38 MAPK compared to conventional MDSC. Defining the mechanisms responsible for MDSC resistance to apoptosis will facilitate the creation of effective, cancer immunotherapies.

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Towards Using NMR to Identify NC-RNA Interaction in HIV-1

Kedy Edme, *Xiao Heng*
Michael F. Summers, Professor, Department of Chemistry and Biochemistry and Investigator, Howard Hughes Medical Institute

When the Human Immunodeficiency Virus (HIV-1) assembles in a host cell, two copies of its genome are packaged by the Gag polyproteins. More specifically, the packaging process is mediated by the interaction of the nucleocapsid domain (NC) of Gag with a highly conserved 5′untranslated region (5′-UTR) of the genome RNA. Currently high-resolution structural information of the 5′UTR is not available. Based on preliminary study of the 5′-UTR, we have identified a156-nucleotide RNA fragment (LR-core) as the essential NC binding element that may serve as a core packaging signal during viral selection and packaging of HIV-1. Using site-directed mutagenesis we have introduced a G331, 333A mutation in LR-core. The NMR spectrum of the mutant revealed that there was no significant change in RNA folding, however, Isothermal Titration Calorimetry (ITC) experiments revealed that the mutations reduced the number of NC binding sites from 7 to 4, which suggests that this might be a potential NC binding site. Current efforts are guided towards using Nuclear Magnetic Resonance (NMR) to identify the NC binding sites on these RNA samples in order to gain more insight into the packaging mechanism.

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

A Matter of Taste: The Subculture of Vinyl

Justin Eisenstadt
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The resurgence of the vinyl record has received a great deal of attention from scholars and the media. In a digital age replete with options, what motivation could there be for seeking out an obsolete technology like vinyl? Popular depictions of vinyl collectors tend to focus on aging hipsters rather than the teenagers and young adults who increasingly populate record stores. A 2006 article in *Popular Music and Society* focused specifically on youth consumers of vinyl and concluded that young people turn to vinyl as a site of resistance against the music industry and as a way to alleviate feelings of alienation from contemporary popular culture. The goal of my research was to test these assertions. I interviewed 15 vinyl collectors between the ages of 18-30 about vinyl, taste, and the music industry. I found that these individuals, far from actively resisting the music industry, are largely apathetic about it. The preference for one format over another is motivated by a connection to the past, a desire for authenticity, and an appreciation for a specific sound. Because these collectors are hesitant to critique the musical taste of others, they are also less interested in the social aspects of their hobby.

Parameterization of Ligands Associated with the RNA Dependent RNA Polymerase Found in Hepatitis C Virus

Katelyn Erickson, Kathleen Heasley
Ian F. Thorpe, Assistant Professor, Department of Chemistry and Biochemistry

Hepatitis C virus (HCV) is a wide spread health concern and causes approximately thirty-five thousand new infections in the U.S. each year. HCV contains a positive sense single-stranded RNA genome and replicates with the aid of RNA dependent RNA polymerase (RdRp). Certain naturally occurring ligands have been found to exhibit allosteric properties towards RdRp. Our goal is to understand how such ligands are able to inhibit the activity of RdRp by using molecular simulations to examine the structure and dynamics of this enzyme and the manner in which these properties are altered by ligand binding. In order to carry out such studies, it is necessary to have accurate models of the allosteric inhibitors which can be employed in classical molecular mechanics simulations. This study describes efforts in our group to develop parameters for these inhibitors that are compatible with the CHARMM (Chemistry at HARvard Molecular Mechanics) force field. Our results identify parameters for molecular models of these inhibitors that are able to correctly reproduce their structural, energetic and electrostatic properties. These computational models will be used to gain insight into the source of allosteric inhibition in RdRp, knowledge that may help to identify new inhibitors of the enzyme.

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

Committee Power and Black State Legislators: When Perception and Reality Clash

Rhoanne J. Esteban
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Committee memberships, more often than not, are instrumental means to gain power and influence within legislative chambers. Committees are empowered to draft legislation, and chambers sometimes defer to the expertise of committee members. For minorities, committee positions are particularly important since they enable descriptive legislators to pursue policies that best represent minority interests. In this regard, popular and scholarly convention often projects that committees are definitely influential. However, because the jurisdictional power of committees and the process of lawmaking in state legislatures vary widely, the reality of power may be different than what is projected for legislators on those committees. These differences between projected and perceived influence have significant consequences for minority constituents who depend upon descriptive representatives for substantive representation. Using pilot survey data and contextual data from the 2009 National Black Legislative Leadership Study, I examine the opinions of black state legislators and their committee assignments to assess the implications of projected and perceived committee influence. The findings reveal the extent to which legislators view committees as autonomous and significant relative to rival shapers of public policy. These results further underscore the potential tradeoff between descriptive representation and the substantive representation of black interests.

Sensation Seeking, Perceived Norms and Nonmedical Use of Prescription Drugs among College Students

Bernadette Fausto, *Josh Gray, Preston Greene*
Carlo DiClemente, Professor, Department of Psychology

College students frequently overestimate peers' actual alcohol and drug use. However, few studies have examined normative beliefs and actual nonmedical use of prescription drugs. Sensation seeking is positively correlated with greater drinking and nonmedical use of prescription drugs (Arria et al., 2008; Glazer et al., 2010). The current study examines relationships between a measure of sensation seeking, normative beliefs about prescription drug abuse, and actual nonmedical prescription drug use. We hypothesize that students who are higher in sensation seeking will use more prescription drugs in ways not prescribed and that these students will also perceive less nonmedical prescription drug use among their peers. A web-based survey of UMBC students' actual and perceived substance use and other psychosocial constructs is currently underway with over 150 participants having already responded. Multiple regression analysis will be used to test these hypotheses with participants recruited through the end March. Results could provide insight into and improve identification and prevention strategies for college students at greatest risk for nonmedical prescription drug abuse.

Glutathione S-Transferases as Regulators of Tumor-Induced Myeloid-Derived Suppressor Cell Survival

Phillip J. Fitzgerald*, Daniel W. Beury, Suzanne Ostrand-Rosenberg*
Suzanne Ostrand-Rosenberg, Professor, Department of Biological Sciences

Tumor-induced myeloid-derived suppressor cells (MDSC) are a major barrier to tumor immunotherapy because they inhibit T-cell anti-tumor immunity through various mechanisms, including cystine sequestration and production of reactive oxygen species (ROS). MDSC accumulation, suppressive potency, and survival are driven by inflammation, which also increases MDSC production of ROS. Surprisingly, ROS do not adversely affect MDSC, suggesting that MDSC neutralize endogenous ROS. Because MDSC survival is likely to be controlled by the mechanisms that protect them against endogenous ROS, we are identifying molecules that regulate ROS levels with the goal of identifying potential targets for inducing MDSC apoptosis. Glutathione (GSH) is the major antioxidant that detoxifies ROS in conjunction with various isoforms of GSH S-transferase (GST) that catalyze the detoxification process. Because of their role in detoxifying intracellular ROS, we are analyzing intracellular levels of GSH and multiple GST isoenzymes in conventional and inflammatory MDSC to understand how inflammation protects MDSC and thus promotes tumorigenesis. GST isoforms that facilitate MDSC survival will be novel drug targets for reducing tumor-induced immune suppression and facilitating tumor immunotherapy.

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Modeling Optical Stretching of a Chinese Hamster Ovary Cell

Joshua J. François, *Ihab Sraj*
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Studying the elasticity of biological cells can provide insights into the physiological changes they undergo, given the relationship between cell structure and function. Optical stretching is a non-contact method used to measure the elastic properties of cells, which induces less damage than other methods. Light rays from a laser interact with a cell and transfer momentum. This momentum transfered to the cell induces optical forces that stretch the cell with no physical contact. Previous analytical models of optically stretched cells neglected the nucleus. Here we use the dynamic ray tracing method to model the deformation of a Chinese hamster ovary cell with a nucleus of variable size. The effect of the presence of the nucleus and its size on the optical force magnitudes and cell deformation, which is easy to observe, were examined. Our results showed that as the size of the nucleus increased, the net force on the cell's plasma and nuclear membranes increased. Additionally, as the size of the nucleus increased, the deformation of the plasma membrane decreased, while the deformation of the nuclear membrane increased. This work offers the potential to obtain the exact force and deformation measurements in optical stretching models.

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Fostering Social and Emotional Intelligence in the Classroom

Lian K. French
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Stress is arguably one of the largest negative factors affecting the academic and personal lives of students of all ages. High levels of stress can impede the thought process and cause adverse behavior and reactions. The fast-paced school schedule adopted by many public school systems allows students little time to take stock of their day and to evaluate and organize their thoughts and assignments. The theory of social and emotional intelligence suggests that this type of self-reflection and organizational time may be key to helping students better utilize their academic potential. This study evaluated the effects of allowing students a short period time that was quiet and structured at the beginning of each class period to organize materials, prepare for class, or simply relax. The practice was introduced to a class of 11 sophomore students during the first week of March and continued for seven consecutive weeks. Findings are discussed in terms of effect on classroom discipline and student performance in various types of testing situations, as well as overall quality of classroom life.

Increasing EMU's Annotated Disease-Related Mutations by Curating Acute Myeloid Leukemia

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Maricel G. Kann, Assistant Professor, Department of Biological Sciences

The relationship between mutations and their respective disease phenotypes provides a baseline for in-depth evaluation and the development of treatment methods, particularly pertaining to the field of oncology. A large amount of these mutation-disease relationships are textually documented in various databases of biomedical literature, such as PubMed. These databases have experienced an exponential increase in content due to growing focus on biomedical research and detection methods. Current annotated disease-relationship databases (e.g., OMIM and SWISS-PROT) obtain their information from the biomedical literature manually, a time-consuming process. To address this problem, the "Extraction of Mutations" tool, EMU, was developed previously to extract disease-related mutations for a given disease from PubMed abstracts. The present goal is to further expand EMU's mutational database by utilizing the EMU method for the curation of acute myeloid leukemia, AML. There were 220 complete protein mutations that were extracted by EMU and further curated. Out of the 220 protein mutations, only 23 (roughly ten percent) were found to be unrelated to AML. Out of 123 unique protein mutations, only 39 were already annotated in OMIM or SWISS PROT. Using EMU with manual curation, we have increased our database with AML and increased the number of AML-related mutations two-fold.

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Peer Interaction Frequency and Peer Network Size in Children with Food Allergy

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Peer interaction is essential for normal social development in preschool age children and may ward against later adjustment problems. However, parents of food allergic children may limit social interaction opportunities due to their extreme fear of exposing their children to potentially life-threatening allergens. The present study examined the frequency of peer interaction and size of peer networks in three-to-six-year-old children with food allergy (n=65). The study also analyzed the predictive validity of the Peer Interaction Record (PIR-P), a retrospective measure of the frequency of children's peer interactions and peer network size during the previous week. Agreement between maternal reports on the PIR-P and prospective daily records of the child's peer interactions (obtained via the Ladd and Golter (1988) Phone Interview and Home Record) were analyzed. Results showed that the PIR-P and the prospective data were significantly correlated in terms of total frequency of peer interaction (r =.67), but not with regards to peer network size (r = .23). This is likely due to the small number of phone interviews available for analysis (n=31). Thus the PIR-P was found to be a valid tool for measuring peer interaction frequency in preschool age children with food allergy.

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Effect of Shear Stress on the Adhesion of *S. aureus* to Collagen

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Bacterial adhesion to host tissue is the first step in the formation of biofilm, which leads to chronic infection. Since biofilm-related infections are very resistant to antimicrobials and host defenses, treating the bacteria before it adheres is the best way of preventing such infections. Understanding factors that affect this adhesion is crucial to preventing it. We use *Staphylococcus aureus*, a bacterium with collagen-binding receptors that causes infections in the circulatory system, for our adhesion experiments. Our objective is to understand how shear stress affects this surface adhesion. A parallel plate flow chamber with a collagen coated cover slip is used to flow the bacteria cells at different flow rates to simulate various physiological shear rates. The effect of the shear stress is determined by comparing the quantity of *S. aureus* that adhered to the protein at various shear rates. For the adhesion experiment, we use Phillips, the *S. aureus* strain that expresses the receptor for collagen, and PH100 (a strain that lacks the receptor) as our control group.

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Synthesis of Gemcitabine Functionalized Dendron for Treatment of Advanced Pancreatic Cancer

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Currently, pancreatic cancer is the fourth leading cause of cancer-related deaths in the United States with a five-year survival rate of only five percent. The standard method of chemotherapy treatment is the use of anticancer agents such as gemcitabine. Unfortunately, 92-98 percent of the administered drug is rapidly metabolized and excreted from the body only one week after a standard infusion. Therefore, the overall project is to create a nanoparticle-cored dendrimer functionalized with gemcitabine (drug), transferrin (targeting protein) and gadolinium-DOTA (MRI imaging agent). This specific project is to synthesize the gemcitabine functionalized poly-propylene imine (PPI) dendron using organic chemistry techniques. Thus far, our lab has been able to synthesize generations one through three PPI dendrons, and gemcitabine has been attached to the first generation compound via an imine bond. ^{1}HNMR, mass spectrometry and elemental analysis data were used for verification purposes and the final compound will be sent to our partner laboratory for biological assays.

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Alcohol Consumption and Stress-Related Outcomes in Sickle Cell Disease

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There is very little research examining alcohol use among chronic illness populations. For individuals with sickle cell disease (a chronically painful genetic blood disorder), alcohol may be used to cope with severe pain or the stress linked with that pain. However, this association has not been well described in the sickle cell literature. This study examined survey data from 321 adult patients who were part of the Cooperative Study of Sickle Cell Disease, a large, multisite study. Pearson correlation coefficients were computed, adjusting for gender. Although we generally found positive correlations between the amounts of alcohol consumed and indicators of stress (e.g., missed work days, inability to perform work/household tasks), these correlations were statistically significant only among participants who regularly consumed liquor compared to those who consumed beer or wine. These results suggest directions for further research that more closely examines the psychological, social, and physiological impact of alcohol use among young adults with sickle cell disease.

Regulation of the Prostate-Specific Tumor Suppressor NKX3.1 by Pim-1 Kinase

Eliza B. Gosc, *Achuth Padmanabhan, Charles Bieberich*
Charles Bieberich, Professor, Department of Biological Sciences

The prostate gland is a secondary sex organ that stores and releases fluids which contribute to the ejaculate. The prostate is highly susceptible to diseases including cancer. NKX3.1 is a prostate-specific tumor suppressor whose expression is diminished in prostate cancer. Phosphorylation has been demonstrated to be important in regulating NKX3.1 stability. We hypothesized that phosphorylation of NKX3.1 by the oncogenic kinase PIM-1 destabilizes NKX3.1 in prostate epithelial cells. Inhibition of PIM-1 using CX-6258 resulted in decreased steady-state levels of NKX3.1 in standard LNCaP and 22RV1 cells. The decrease in NKX3.1 from PIM-1 inhibition was rescued by proteosome inhibition, suggesting that PIM-1 inhibition results in NKX3.1 degradation through the 26S proteosome. Paradoxically, our results suggest that NKX3.1 is stabilized by the proto-oncogene kinase PIM-1 in human prostate epithelial cells. Recombinant NKX3.1 was phosphorylated by PIM-1 *in vitro.* Using mass spectrometry, the *in vitro* phosphorylation sites were identified as T89, S185, S186, S195 and S196. To identify *in vivo* phosphorylation sites important for stability we generated alanine-substitution mutants at the identified phosphorylation sites by site-directed mutagenesis. We will evaluate the effect of PIM-1 inhibition on these mutants to determine possible mechanism whereby PIM-1 stabilizes NKX3.1 in prostate epithelial cells.

This work was supported by a grant from the Congressionally Directed Medical Research Prostate Cancer Program.

Americanized Pedagogy: Journey to El Salvador

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Jean Fernandez, Associate Professor, Department of English
Lucille McCarthy, Professor, Department of English

The experience of North American teachers abroad is an understudied aspect in contemporary research on English as a Foreign Language. To concretely internalize Popular Education pedagogies and how or why they may be incorporated in the United States, I became a volunteer teacher of English and student of Spanish at the *The Melida Anaya Montes Language School* of the *Centro de Intercambio y Solidaridad.* This study analyzes in a report of teacher research the present day applications of Popular Education pedagogies in El Salvador. It also addresses how these pedagogies under the influence of globalization and North American educators can in fact limit rather than promote education as a practice of freedom. Drawing on the philosophies of theorists John Dewey and Paulo Freire, I conducted a case study which explores the effects of capitalistic ideologies on both teachers and students. Through ideologies of consumerism, the projection of absolute ignorance and deficit thinking, this study uncovers how the classroom can become a center for oppressive relationships and subordination.

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Effects of Inflammation on Accumulation of Myeloid-Derived Suppressor Cells (MDSC) in Breast Cancer

Lydia Grmai*, Olesya Chornoguz*
Suzanne Ostrand-Rosenberg, Professor, Department of Biological Sciences

One in eleven women will have breast cancer in her lifetime. Immunotherapy, activating a patient's immune system against their resident cancer cells, is a promising approach for metastatic breast cancer treatment. However, most breast cancer patients are immune-suppressed, rendering active immunotherapy approaches unsuccessful. Myeloid-derived suppressor cells (MDSC), a major cause of immune suppression, mediate their effects by inhibiting T-lymphocyte activation. Inoculating mice with a tumor that over-expresses IL-1β (a pro-inflammatory cytokine) leads to the development of MDSC that are more suppressive toward T-lymphocytes as compared to MDSC that develop in mice with wildtype tumor cells. Pathway analyses of the proteins expressed by MDSC induced by these two tumors highlighted numerous pathways that differ between 4T1 and 4T1/IL-1β-induced MDSC, including the Fas-FasL apoptotic pathway. To determine if this pathway contributed to the enhanced survival of 4T1/IL-1β-induced MDSC, we treated MDSC with an agonist antibody for Fas. Flow cytometry data revealed lower levels of apoptosis in 4T1/IL-1β-induced MDSC and similar levels of Fas expression in both MDSC types. These results suggest that 4T1/IL-1β-induced MDSC are more resistant to Fas-mediated apoptosis, and that increasing apoptosis in MDSC may reduce accumulation and promote immunotherapy in cancer patients.

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The Effects of the Focused Question Card Strategy on Student Writing

Susan Hade
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This qualitative study examined the benefit of peer revising sessions on student writing using the Focused Question Card strategy. Writers using this strategy ask targeted questions of their peer readers about specific aspects of the work they want to improve. Students in three eleventh-grade Advanced-Placement English classes used this revising technique in completing several essays. This study investigated the following questions: Which questions did students ask about their writing? Did the students see benefits of the strategy in terms of reading other's work and having their work read by peers? Did the students gain confidence about their work by sharing it with peers? The researcher examined successive drafts of writing, the focus questions asked by the writer of their reviewer, the overall success of final written work, and student reflection about using the revising strategy.

The Effects of Risk Aversion on Portfolio Asset Allocation

William d. Hanchett
Douglas J. Lamdin, Professor, Department of Economics

Standard advice for retirement investment portfolios makes use of a glide path by which the portfolio holds less in stock and more in bonds over time. This implicitly assumes a rising level of risk aversion of investors as they approach retirement. This study examined how those percentages are calculated and more specifically, what those percentages imply about both the level and path of investors' risk aversion. Through utility analysis and simulation methods, this study has shown that a one-size-fits-all glide path cannot be the optimum for all investors when their risk aversion varies. A wider variety of investment strategies would benefit investors. For example, rather than a single path for all investors, aggressive, moderate, and conservative strategies can be used. With a more individually tailored portfolio, an investor can use a more appropriate investment strategy. Implementing more congruous strategies, however, requires improved assessments of investors' risk aversion, so ways to do this were also examined.

Prewriting Strategies: Tools for Success

Maureen M. Harvie
Linda Oliva, Assistant Professor, Department of Education

Although teachers may focus on the final product when students write essays, more attention must be paid to the prewriting process. Planning the structure of an essay through prewriting strategies can help students ensure that they answer all parts of a question and stay on topic. As standardized tests move away from multiple-choice and toward written responses, students must be able to quickly organize their thoughts before jumping into constructed responses. Writing is a skill that becomes even more essential after high school; therefore, students must learn to make prewriting strategies a habit when they write essays. The structure of an outline or graphic organizer can help remind students to stay on topic and give relevant evidence to support their thesis. In this action-research project, the process of using an outline or graphic organizer was investigated to see how it affected the quality of essays written by eleventh grade students in American Government and Comparative Government classes. Essay quality was measured in terms of organization, relevancy, and completeness. Student interviews were used to determine how the use of prewriting strategies impacted the writing process.

Primary Sources and their Effect on Learning in the Seventh-Grade Social Studies Classroom

Jessica M. Henn
Linda Oliva, Assistant Professor, Department of Education

This study investigated the effect of the use of primary sources on learning at the seventh-grade level as judged by grades. Primary sources provide information gathered from the time of study, such as a newspaper article from 1863 about the Battle of Gettysburg. Secondary sources provide information collected from multiple primary sources and analyzed to give a broader picture, such as in a scholarly work. Some classes were presented with many primary sources while others were presented with many secondary sources as providers of knowledge. Both groups were standard-level students. It was postulated that primary sources would give students greater understanding of concepts while secondary sources would give students a better understanding of the sequence of events and the bigger picture.

Programmed Errors in the Ribosome of *S. cerevisiae*

Jessica L. Hopkins
Phillip J. Farabaugh, Professor, Department of Biochemistry and Molecular Biology

The site of translation within the cell is the ribosome, which reads the mRNA and generates a chain of amino acids. Sometimes the ribosome makes mistakes during reading. Codon recognition between the tRNA and mRNA is regulated by several mechanisms including reduced affinity between a codon and an incorrect tRNA, kinetic selectivity, and accommodation. However, misreading still occurs and depends largely on competition between the cognate and near-cognate amino-acyl tRNAs. The ribosome is comprised of several proteins and rRNA's that affect its "reading" ability; in particular we are interested in rpS23. Investigation of the effects of different mutations within the gene coding for rpS23 has been used to elucidate its role in translational accuracy by a reporter system that measures errors quantitatively. Mutations in the bacterial homolog of this ribosomal protein, rpS12, have been shown to result in antibiotic resistance and dependence in bacteria, thus it is of great medical interest to determine whether or not the same is true concerning similar mutations in the eukaryotic ribosomal protein. Analysis of data collected from this experiment has helped to determine a more accurate estimate of error rates of translation machinery and provide a more detailed understanding of the mechanisms entailed in translational accuracy.

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How Rare is Red? Comparing Blackbirds and Related Songbirds

Krystyna N. Horn*, Nicholas Friedman, Kevin Omland*
Kevin Omland, Associate Professor, Department of Biological Sciences

Vibrant animal coloration has fascinated biologists for hundreds of years, especially the colorful plumage of birds. Most of the striking yellow, orange and reds in feathers are produced by carotenoids. Birds cannot synthesize carotenoids *de novo*, and so must gain them from a dietary source. Red carotenoids are rare in the diets of all vertebrates, and they seem to be rare in the feathers of well-known North American birds. Work in our lab has confirmed that red carotenoid expression is rare across orioles and all other blackbirds (Family *Icteridae*); however, we do not know the proportion of reds in other groups of songbirds (Passerines). This research examined two aspects of color: first, the distribution of all carotenoid pigments in closely related songbird families, and second, specifically assessing the rarity of red expression. The systematic survey showed that reds were rare in all five closely related songbird families. Surprisingly, orange was just as rare, if not more so within certain families. In 1003 passerine species examined, 904 expressed carotenoid coloration in either plumage or the beak. Yellow was most frequently expressed at 54 percent, orange followed at 19 percent, and red at 17 percent. This broad comparative study sets the stage for ongoing work in our lab to understand how and why red is so rare.

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Blood Cell Phagocytic Ability Changes with Age in Adult Drosophila

Lucas A. Horn
Michelle Starz-Gaiano, Assistant Professor, Department of Biological Sciences
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Organisms exhibit immunosenescence, a decline in the ability of the immune system to fight infections with age. Little is known about the genetic contribution to this decline. Using *Drosophila melanogaster* as a model system, we tested the hypothesis that differences in immunosenescence result from differences in the ability of blood cells to phagocytose (engulf) bacteria. Although Drosophila respond to infection by producing antimicrobial proteins, studies suggest that clearance of bacteria by phagocytic cells may be the most important component of immunity. We developed a method to quantify the phagocytic ability of individual blood cells using fluorescent microscopy. We analyzed several different genotypes of flies at one and five weeks of age, and counted the number of bacteria per blood cell. Blood cells of older flies contained more phagocytic events than those from young flies, but there were no differences between genotypes. The increased number of bacteria per blood cell with age could be a result of an increase in phagocytic rate or changes in the ability to destroy bacteria once engulfed, and we are evaluating these possibilities. This research contributes to our understanding of the cellular basis of immunosenescence in Drosophila and potentially other organisms, including humans.

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Heterogeneous versus Homogenous Gender Groupings of High School Students

Rebecca S. Horowitz
Linda Oliva, Assistant Professor, Department of Education

Recent research has emphasized the importance of gender differences in learning. The research presented here investigated whether students work better in groupings that are heterogeneous or homogenous based on gender. To determine how gender groupings affect student learning, GT Biology students were assigned to mixed gender (heterogeneous) or same gender (homogenous) groupings. The interactions of the students were observed and their grades were recorded. After completion of the first unit, students were allowed to pick their groupings as long as they were heterogeneous or homogenous groups as instructed. The interactions and grades were again recorded to determine if groupings chosen by the teacher or student-chosen groupings made any notable difference. Students were also surveyed about their opinions on the different types of groupings. This research is designed to help teachers determine how best to group students to maximize their learning potential.

NMR Evidence of the U5-AUG Long Range Interaction in HIV-1 Genome
Azra Hosic, *Xiao Heng*

Michael F. Summers, Professor, Department of Chemistry and Biochemistry and Investigator, Howard Hughes Medical Institute

The Human Immunodeficiency Virus Type 1 (HIV-1) is a retrovirus that causes acquired immune deficiency syndrome (AIDS) by affecting the human immune system. The research in our lab has been focused on understanding the mechanism that regulates the diploid genome packaging of HIV-1, more specifically the structure of highly conserved 5'-Untranslated Region (5'-UTR). Although three-dimension structures have been determined for isolated hairpin RNAs derived from the 5'-UTR, high resolution structural information is currently unavailable for the intact 5'-UTR. It has been proposed that the U5 region forms long-range interaction with the sequence near the Gag AUG start codon. The interaction is very difficult to observe by nuclear magnetic resonance (NMR) because of the size limitations. Previous segmental labeling data from our lab suggest that the AUG exists in equilibrium between a hairpin structure and a possible U5-AUG long-range interaction. In order to obtain direct NMR evidence of the U5-AUG long-range interaction, the UUA-UAA sequence, naturally occurring in the TAR stem loop, was built into the structure. This sequence gives a set of diagnostic up-field shifted signals (~6.45 ppm), eliminating signal overlap on the NMR spectrum to probe the U5-AUG long-range interaction. Broad peaks were observed in the NMR spectrum of this mutant, indicating that the U5-AUG long-range interaction does exist in the native dimeric 5'-UTR RNA. Our data provide direct NMR evidence of the U5-AUG long-range interaction within the 5'-UTR, and suggest that the genome selection of HIV-1 is mediated by an RNA structural switch mechanism.

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Distinctive Features: Activist Linguists and the Language of Activists

Sarah E. Hovde
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The 1960s and 1970s were a time of great upheaval, not just among the youth of the era, who created a new "counterculture" of rebellion, but also in the academic community. This is especially true of the field of linguistics, which was thrown into turmoil by Noam Chomsky's theory of generative syntax. Chomsky's theory gained steady momentum throughout the early 1960s and sparked several combative factions within the field, whose leaders brought counterculture's tactics into their academic efforts. Histories of linguistics focus mainly on the evolving theories, neglecting to consider not only the individual linguists, but also their place in the wider society. An examination of the similarities between activists' use of language and linguists' activist spirit, as evidenced in their personal and professional writings, allows for a bridging of the gap between the academic sphere and the counterculture. Though the counterculture's participants cultivated a presentation of carelessness, many were in fact highly conscious of their use of language, as recorded in their personal reminiscences. This study will also consider the academic output of that core of contentious linguists, who brought the spirit of the counterculture into their examples, their publications, and even their relationships with colleagues.

Common Decency: The Evolving Socialism of George Orwell

Sarah E. Hovde
Daniel Ritschel, Associate Professor, Department of History

George Orwell's *Nineteen Eighty-Four* is regarded by critics as his “most solid, most brilliant” work, yet it is misunderstood almost as frequently as it is praised. Written as a warning against the extremes to which any governmental system could be carried, it is often interpreted to be an explicit criticism of socialism, rather than totalitarianism. The misinterpretation of his purpose in *Nineteen Eighty-Four* may be ascribed to Orwell's own mutable and idiosyncratic views of socialism. Though Orwell considered himself a socialist for the majority of his adult life, he altered his concept of socialism frequently. As such, he often found himself in opposition to the “mainstream” British left, setting himself up as a devil's advocate, and adamantly refusing to follow party lines. This was particularly the case where the Soviet Union, of whom he had a lifelong distrust, was concerned. His antipathy to the U.S.S.R. was perhaps the only fixed point in his political beliefs. This paper examines Orwell's highly personal version of socialism, tracing its adaptations over time, and placing it within its context by contrasting it with other movements in the British left during the two decades bookending the Second World War.

Signaling Response of Neuronal Cells to 3D Tissue Scaffolds

Dalton N. Hughes*, Andreia Ribeiro*
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Neurons naturally grow and develop in a three-dimensional (3D) environment. Previous work from our group showed that 3D matrices more closely resemble *in vivo* systems than traditional 2D culture. Cells interact with their extracellular matrix and sense the dimensionality of their surroundings by the use of integrin receptors on the cell surface. We hypothesized that 3D environments impose changes in matrix-ligand organization and alter neuronal behavior by modulating β1-integrin cytoskeleton signaling. For this study we cultured PC12 cells, a neuronal cell model, on 2D and within 3D collagen substrates. We then treated the cultures with a function-blocking antibody to β1-integrin to analyze the effect of β1-integrin inhibition in neuronal behavior. We used fluorescent and confocal microscopy and western blotting techniques to examine and quantify changes in integrin expression, viability, outgrowth and cytoskeletal organization. We observed that, as β1-integrin activity is decreased, cell density decreases but the number of cells extending neurites and their length are increased. At the cytoskeleton level, there is an increase in β1-integrin clustering followed by an increase in actin stress fibers throughout the cell. The results of this experiment will improve the success of biomaterial-based therapeutics and allow for advanced *in vitro* test beds.

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NATO: Identity, Role, and Function in the Post-Cold War Period

Joshua C. Hunter
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Since the end of the Cold War, the North Atlantic Treaty Organization (NATO) has tried to adapt to a changing international security environment. This project examined several aspects of NATO's changing role, function, and identity in this fluid international system. Specific questions involve (1) the role and functions that NATO performs in addressing major security concerns for its member states and (2) the extent to which NATO's institutional scope has evolved in the post-Cold War period. Notions of identity are based on scholarly work concerning the collective construction of communities. Relative adherence to such a collective identity is traced through public opinion data in NATO member states. The research finds that although an alliance-based identity does exist, the strength of it has been challenged by diverging security interests and capabilities. Structural realities have created an environment in which unequal burden-sharing and the absence of an existential threat has allowed non-U.S. member states to enjoy the benefits of NATO membership at no great cost. Additionally, the United States has demonstrated leadership inconsistencies that have called NATO's relevance into question. However, despite the pains of transformation, NATO is still a viable institution in the new century.

Smoking and Perceived Health Status among Adults with Sickle Cell Disease

Donna Huynh
Shawn M. Bediako, Assistant Professor, Department of Psychology

Data from the *Cooperative Study of Sickle Cell Disease* were used to assess the association between smoking and self-rated perceptions of health status among 323 adults with sickle cell disease, a genetic blood disorder. Participants were categorized as "ever" smokers if they reported ever having smoked a cigarette, pipe, or cigar in their lifetime and as "current" smokers if they currently smoked at the time of the survey administration. Those who indicated that they had ever smoked but were not currently smoking were classified as "former" smokers. A one-way analysis of variance indicated that "ever" smokers rated their health as being worse than that of others their age ($\underline{M}$ = 3.04 vs. 2.74). Interestingly, there were no significant differences in perceived health status between current smokers (n=61) and former smokers (n=100). However, current smokers tended to have better ratings of their health status than former smokers. These findings suggest that it may be important for future research to explore psychological aspects of smoking and its impact on self-perceptions and health behaviors.

The Role of Coloration in Intersexual Selection in *Etheostoma barrenense*

Chioma E. Ihekweazu*, Jennifer Gumm, Tamra Mendelson*
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Intersexual selection often involves female mate choice of conspicuous male traits, such as elaborate coloration. Many red, orange and yellow colors in animals are derived from organic pigments called carotenoids. Carotenoid pigmentation may indicate foraging success or genetic quality since carotenoids are often acquired through diet. Additionally, carotenoids are used as immunostimulants and antioxidants, indicating overall health via performance or activity levels. Darters (genus *Etheostoma*) are freshwater fish indigenous to North America. Breeding males, *Etheostoma barrenense*, display orange-red pigments obtained through carotenoid consumption, and females prefer conspecific to heterospecific males based on coloration. Sexual selection therefore may influence reproductive isolation and potentially lead to speciation in darters. However, sexual selection on coloration within a species remains unclear. Urethane models of *E. barrenense* were painted to mimic natural color spectra from live males. Females had visual access to two models that differ in hue. Models were presented on either end of the female's tank; a female associated with a model by approaching within five cm. Time spent associating with each model was observed for 15 minutes and indicated mate choice based on color. A paired t test was used to analyze results, which will help elucidate the role that coloration has in mate choice in this group.

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Perceived Mortality and Alcohol Use among Individuals with Sickle Cell Disease

Lisa O. Jackson
Shawn M. Bediako, Assistant Professor, Department of Psychology

Sickle cell disease (SCD) is a genetic blood disorder that causes red blood cells to form into a crescent shape and block blood vessels, causing severe pain. SCD also impacts social relationships and may contribute to low self-esteem. Prior research indicates that self-esteem is significantly related to a host of health behaviors and, in this study, we explored how one index of self-esteem – perceived mortality – was related to frequency of alcohol use. Data were used from the Cooperative Study of Sickle Cell Disease, a national study aimed at understanding the natural history of sickle cell across the lifespan. Adult participants completed a survey that asked them to indicate the kind of effect that having sickle cell disease would have on how long they lived. In addition, participants also completed measures of alcohol consumption. It was hypothesized that participants who felt that they would not live long would also report increased alcohol consumption compared to those who felt they would live longer. Results indicated that there were no statistically significant differences between these two groups. Implications of these findings for further research are discussed.

The Incorporation of Music Therapy into Physical Therapy Sessions for Physically Disabled Individuals

Megha Jacob
Airi Yoshioka, Associate Professor, Department of Music

Since both physical and music therapy are successful fields that are known to have significant results when used alone, will a "physio-music" therapy (PMT) treatment be more beneficial for physically disabled individuals? An individual may suffer from a physical disability due to genetic, developmental, medical and/or environmental reasons. Physical therapy (PT) provides rehabilitative exercises for individuals with physical impairment to help them improve or restore their physical health. Music therapy (MT) promotes wellness in individuals by offering therapeutic techniques to help patients with any type of illness to improve emotionally and mentally. This study was designed to create exercises to implement musical activities into pre-prescribed physical therapy exercises based on each individual's physical ability. The individual's progress in the first eight weeks of their PT treatment was recorded as well as their progress in PMT for eight weeks. Following the sessions, a biweekly evaluation was conducted to assess if the patients had improvements or significant benefits from the PMT sessions. This study uses an inter-disciplinary approach in each session by using PT, MT, music education, and yoga to challenge the person's cognitive functioning such as memory and creativity as well as physical (motor movement and breathing) functioning. The results of the research will be presented at URCAD. The main objective of this research was to maximize therapeutic benefits for people by offering a safe learning environment in which the patients may work while they play.

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

Detection of Lateral Gene Transfer with Codon Usage Bias in Mutationally Biased Genomes

Isaac M. Jensen
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Indices measuring codon usage bias (CUB) are an important tool in genome analysis. CUB indices measure either the deviation from uniform codon usage distribution or the distance in CUB from a given reference set representing the major codon bias. Both approaches can provide dubious results when analyzing CUB in genomes with other significant underlying patterns, such as GC bias or GC skew. Here we analyzed the behavior of six CUB indices with and without correction for mutational bias, and we benchmarked their efficiency at predicting gene expression values from microarray expression data. Our results showed that the Relative Codon Adaptation (RCA) and the Relative Codon Bias (RCBS) perform particularly well at predicting gene expression on genomes with high mutational bias. We further demonstrated that the ratio of RCBS over RCA, when combined with statistical techniques over the length of a genome, can be used to detect possible instances of lateral gene transfer in genomes with a strong mutational bias.

This work was funded by the UMBC Department of Biological Sciences.

X-Ray Study of Nano-Scale Superlattice Materials

Natée D. Johnson
Fow-Sen Choa, Professor, Department of Computer Science and Electrical Engineering

This project used X-ray diffraction techniques and Fourier analysis as tools to study and compare grown supperlattice (SL) wafer quality. The objective was to provide immediate feedback to quantum cascade laser (QCL) growers as a means of improving their successive growth runs without waiting three to four weeks for device processing and testing. Poor wafers would be immediately eliminated, and performance for all other wafers could be anticipated prior to fabrication. Nano-scale SL-based devices, such as QCLs, have recently become very important due to their capability to identify toxic and explosive chemicals. Currently, the best candidate for room-temperature mid-infrared detectors are type-II InAs/GaSb strained layer SLs, composed of alternating compressive and tensile strained layers. Thicker layers are sometimes over-strained and lattice relaxation occurs: chemical bonds between atoms break and lead to serious degradation of periodicity. A very small percentage of relaxation can lead to serious decrease in laser performance. Through simulations, relaxations in InAs and GaSb layers were found to show distinct patterns, which helps in determining which exact materials cause problems in a SL. By extracting special features and key parameters in x-ray diffraction patterns, the epitaxial quality of QCL SLs were evaluated and correlated to the performance of fabricated QCL devices.

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

Design and Synthesis of Unnatural DNA Base Pairs Containing Expanded Purine Analogues

Cameron D. Johnson*, Orrette Wauchope, Katherine Seley-Radtke*
Katherine Seley-Radtke, Associate Professor, Department of Chemistry and Biochemistry

As an extension of Nelson Leonard's work on benzene-expanded purine nucleosides, one focus for our research has been utilizing a series of heteroaromatic expanded purine nucleosides to investigate nucleic acid structure and function. Strategically altering the structure of the natural nucleobases will allow for greater diversity in their biological interactions. Insertion of a five-membered heterocyclic spacer ring into the purine scaffold results in an expanded nucleoside that increases base-stacking capabilities. Additionally, this expanded nucleoside has an additional hydrogen bonding functionality due to the heteroaromatic spacer ring. These analogues will allow us to examine the role of electrostatics, base-stacking and stability within the DNA helix as well as enzyme recognition. The structure and purity of the target nucleoside analogues will be confirmed by NMR, HRMS and elemental analysis. Preliminary synthetic results are described hereiin.

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Spectrogram Analysis and Evaluation and Brainwave Appreciation of Music

Sheriff O. Jolaoso
Fow-Sen Choa, Professor, Department of Computer Science and Electrical Engineering

Fourier-analysis-based spectrogram measurements assist in quantitatively evaluating the quality of a music performance. To further develop tools helping to quantify the analysis of music performance, we focused our study on using electroencephalographic (EEG) brainwave signals to evaluate a person's appreciation of a music performance. We acquired EEG signals from subjects while playing music snippets and other synthesized sounds. The testing started with an auditory input composed of single tone signal at a fixed acoustic frequency. The next test we conducted gradually added harmonics to a single tone. We then measured the EEG brainwave signals when the subject was exposed to a single sound input containing all harmonics of a single frequency acoustic signal. Finally a music piece is used as the auditory input and we repeat playing the music piece several times and synchronously record each of the corresponding EEG brainwave signals. The neurological activity over the cortex can be transformed and presented as five different bands of frequency, delta (0.5-3 Hz), theta (4-7 Hz), alpha (8-14 Hz), beta (15-38 Hz), and gamma (39-100 Hz). Through comparisons of brainwave activities we observed that both the acoustic amplitude and tone variations affect neurological activity at different frequency bands and different brain areas.

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

An Analysis of the Peace-building Strategies in Ker Kwaro Acholi's Strategic Plan 2009-2014

Achsah A. Joseph
Devin Hagerty, Professor, Department of Political Science

After decades of war, Northern Uganda has achieved relative peace. Athough many national and international organizations have developed peace-building plans, the only plan created by the Acholi chiefs was Ker Kwaro Acholi's Strategic Plan. This study sought to examine: (1) how the objectives in the Strategic Plan relate to peace-building, (2) if Ker Kwaro Acholi has the resources to fulfill the plan, (3) how it is viewed by Gulu citizens, and (4) the effectiveness of the completed programs. This study was conducted in Gulu, Northern Uganda, and included one focus group and six one-on-one interviews. The interviews were conducted with Gulu citizens, Acholi chiefs, and Ker Kwaro Acholi employees. Dependence on outside funding, low staff retention rates, and inadequate equipment make it unlikely that the Strategic Plan will be completed within the 2009-2014 time frame. However, the organization has well trained staff, which makes the implementation of the plan feasible. Interviews with Gulu citizens informed me of the plans' trustworthiness. Ker Kwaro Acholi employees, chiefs and project reports discussed the programs' effectiveness. I found that the Strategic Plan's success is based on traditional Acholi culture. However, modifications should be made in order to address the needs of the younger Acholi population.

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

Characterization of the Monomer/Dimer Equilibrium within the 5´-Untranslated Region of HIV-1 RNA

***Amar Kaneria**, Sarah Monti, Lianko Garyu, and Kun Lu*
Michael F. Summers, Professor, Department of Chemistry and Biochemistry and Investigator, Howard Hughes Medical Institute

Human Immunodeficiency Virus type 1 (HIV-1) is a retrovirus that primarily attacks T cells within the immune system. These host cells develop an increased rate of apoptosis, resulting in a continuous decline of the body's immune system responses. This ultimately leads to death due to secondary infections. During the viral life cycle, HIV-1 packages two copies of genomic RNA into viral particles. The structural elements that control dimerization and RNA packaging are located within the 5'- untranslated region (5'-UTR) of HIV-1 RNA. The 5'-UTR consists of multiple hairpin structures which are separated by linker regions. The dimerization initiation signal (DIS) and unique- 5' region (U5) are hypothesized to stabilize the monomeric form of RNA. However, when the AUG hairpin interacts with U5, it disrupts the monomeric interaction between DIS and U5, allowing the DIS to be exposed and promote dimerization. In order to test this hypothesis, the DIS and U5 regions of the RNA were mutated such that a signature peak would indicate binding when the molecules were studied using nuclear magnetic resonance (NMR). By understanding the monomer/dimer equilibrium, we may one day be able to control the HIV-1 life cycle.

This work is supported by NIH Grant: NIH-ARRA 3R37A1030917-19S1.

Stroke Rehabilitation in Senior Center Environments: A Qualitative Study

Alpana Kaushiva
Sarah Chard, Assistant Professor, Department of Sociology and Anthropology

The prevalence of stroke in the United States is approximately 1 in 59 people, with 4.6 million people in the United States living with the aftereffects of stroke. Each year 600,000 people in the U.S. have a stroke, including 500,000 new cases and 100,000 recurrences (CDC). Trying to keep older adults who have suffered from stroke active is a critical challenge. Exercise can reduce the physical decline that is associated with stroke. Through participant observation this study evaluated how senior centers create an environment that supports self-efficacy in exercise for people who have suffered from chronic stroke. The findings suggest that senior centers influence adherence and participation in exercise programs and help program participants to actualize long-term goals. This study analyzed variation across different senior centers and the differences between traditional and new models of senior centers. In addition, outcomes from the Adaptive Physical Activity (APA) and Sittercize Exercise Programs were compared. The latter program does not involve any walking. Across the settings, it was found that the senior centers provide moral and social support. The results of this study can inform the creation of senior center settings and programs that facilitate exercise participation among stroke survivors.

The Applied Physical Activity for Chronic Stroke study, of which this study is part, is funded by a grant from the Department of Veterans Affairs Research and Development Program.

Characterization of the Homophilic Adhesion Molecule Cadherin 74A in Cell Migration during Drosophila Oogenesis

Alvin E. Kennedy*, Lathiena A. Manning*
Michelle Starz-Gaiano, Assistant Professor, Department of Biological Sciences

Cell migration is an important process during animal development and in disease progression. The molecular controls governing cellular movement are extremely complex. To elucidate these controls, we chose to study a simple example during fruit fly egg development. We studied a small population of migratory cells, the border cells, which detach from a simple epithelium and migrate while remaining in a cluster. For border cells to cluster and detach, there must be changes in the adhesive interactions among the neighboring cells. We examined members of a family of cell surface molecules, known as Cadherins, which may mediate cell adhesion in this context. Cadherin 74A (Cad74A) is expressed in the border cell cluster and thought to play a role in the border cell interactions during migration. The overall goal of our research was to investigate how cells mediate migration while remaining in a cohesive group, and the putative role of Cad74A in this process. To study Cad74A, we used a combination of approaches including mutant analysis, immunofluorescent labeling, and live-imaging to define the changes in adhesive properties. Our work clarified the role of Cad74A in cell migration, and examined its contribution to known border cell adhesion regulatory pathways.

This research was funded, in part, by a UMBC SRAIS grant.

Genetic Pathways Involved in Retinal Degeneration

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Retinal degeneration affects over 1.5 million people each year worldwide. Although we have mapped the genetic causes of the condition, the underlying cellular mechanisms behind photoreceptor cell death are not well understood. Homologous genes that trigger retinal degeneration have been identified in mice, allowing us to examine the biological changes that occur in a non-human species. We studied and grouped all the mutants according to rate and severity of photoreceptor function loss. This project analyzed tissue loss through cell morphology and histology, localization of phototransduction proteins by immunohistochemistry, and altered photoreceptor function by electroretinography. Our results indicate that mutants associated with rapid degeneration (*rd1, rd4, rd10, rd16*) control phototransduction and ciliogenesis. They generate missense mutations without terminating DNA translation and are linked to autosomal dominant retinitis pigmentosa in humans. On the contrary, mutants tied to intermediate (*rd2, rd3, rd5, rd8*) and slow (*rd6, rd7, rd9, rd12*) degeneration monitor general cell growth and development. They create base-pair deletions and substitutions that do cause premature termination of the polypeptide chain and result in autosomal recessive retinitis pigmentosa in humans. The goal is to identify mechanisms that we can apply to treat human retinal degeneration.

This research was funded by the Intramural Research and Training Award Fellowship program at the National Institutes of Health.

Carbocyclic Nucleoside Aromatic Fleximers as Antiviral Targets for Inhibiting *S*-Adenosyl-L-homocysteine Hydrolase

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Nucleosides are omnipresent molecules that perform numerous functions in biological systems. They have become a primary target for medicinal chemists in discovering new therapeutics. However, one problem facing researchers is the development of resistance to currently used antiviral drugs. To combat this increasingly pervasive problem, previous studies in our lab focused the design and synthesis of a number of flexible nucleoside carbocyclic enzyme inhibitors. The "reverse fleximers" consist of a split nucleobase that imparts a degree of flexibility while maintaining the elements needed for enzyme recognition. These analogues also utilize the Aristeromycin (Ari) "sugar" moiety rather than the traditional ribose. Ari is a potent inhibitor of *S*-Adenosyl-L-homocysteine Hydrolase (SAHase) an important enzyme involved in viral and parasite replication. The carbocyclic reverse fleximers should result in novel drug targets with improved activity and increased enzyme inhibition. The activities of these lead compounds will be tested by inhibition of SAHase, which exhibits broad-spectrum antiviral activity, and adenosine deaminase which is an anti-cancer and auto-immune target. The strategic structural modification inherent in the fleximers can be viewed as a powerful tool to combat the problem of increasing drug resistance to currently used antiviral agents.

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Moving to Water

Emily Kimak
Carol Hess, Professor, Department of Dance

A deeper understanding of the interrelationship between humans and nature has grown from scientists and artists alike. *Moving to Water* attempts to heighten awareness of this relationship through the lens of dance by revealing what lies between the human body and water in modern western culture. This project uses the perspective that awareness of water use can be acquired through increased consciousness of bodily actions used to access water on a daily basis. I expanded my knowledge of body awareness and ecology at the conference Somatic Experiments in Earth, Dance and Science, curated by Olive Bieringa of *BodyCartography*, in workshops on Body-Mind Centering, improvisation, and ecology. Additionally, I completed a literature review of performance and visual art centered on environmental topics. This research culminates in my original choreography of the dance piece *Moving to Water*, which explores movement including twisting of knobs, washing, and drinking. These seemingly mundane movements contribute significantly to our consumption of water and provide a wealth of possibility for dance composition. The piece was composed using improvisation, phrase work, a visual score, and the concept that all actions can be considered performance. The performance takes place in a public space on UMBC's campus, using the familiar landscape as sound and set.

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

The Effects of Extrinsic Rewards for Secondary Students in a Mathematics Classroom

Victoria L. Kohl
Linda Oliva, Assistant Professor, Department of Education

Much research has been completed on the difference between intrinsic and extrinsic motivation. Students need to be motivated in general in order to complete tasks at school. It has been shown that there is a correlation between extrinsic motivators and hindered student motivation when they are implemented improperly. This study analyzed how certain implementations of extrinsic motivators combined with intrinsic motivators affect student motivation in a ninth grade Algebra I classroom. A sub-question was: Are extrinsic motivators correlated with students becoming self-determined to achieve in school or is there a correlation between extrinsic motivators and hindered intrinsic motivation when motivators are implemented according to specific situations? For instance, students were given homework passes (extrinsic motivator) for completing a certain number of homework assignments on time as well as helpful feedback (intrinsic motivator) on each assignment that was returned to them. Ultimately, if a proper combination of extrinsic and intrinsic motivation helps students become more self-determined, teachers will be able to implement those tactics in a mathematics classroom and quite possibly in other subjects.

The Guido and the Mobster: Responses to Italian-American Stereotypes in Italy and the United States

Dora O. Korewa
Duncan Campbell, Part-Time Faculty in American Studies and Jason Loviglio, Associate Professor in American Studies and Director of Media Communication Studies

How are stereotypes of Italian Americans formed and received in the U.S. and in Italy? Pop culture is one of America's largest exports. Our television and films are released, subtitled or dubbed, and consumed worldwide -- along with the stereotypes and archetypes they feature prominently. This research focuses on two prominent Italian-American stereotypes: the Guido (a fake-tanned, image-obsessed party animal) and the mobster. This paper analyzes these two stereotypes through a media history, a content analysis of *Jersey Shore* and *The Sopranos*, and focus groups with Italian Americans and Italians. These various approaches allow for an analysis of the stereotype's roots, manifestation, and reception by the groups they claim to represent. The study examines the legitimacy afforded the mobster stereotype, academically and in the popular imagination, and offers an analysis of the continued perpetuation of this stereotype by the Italian-American community itself. As for the Guido stereotype, this study, through an analysis of the themes which emerged in focus group responses, offers explanations of how the stereotype can be seen both as wildly offensive and frivolously irrelevant by a community which seems to question the stereotype's genuineness and the tenuousness of the actual and perceived ties of Guido culture to the Italian-American community.

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

A Market Timing Strategy to Achieve Excess Returns

Leonid Kritz
Douglas Lamdin, Professor, Department of Economics

Market timing offers investors an opportunity to earn excess returns over market average returns. Market timing involves moving in and out of the stock market rather than a passive "buy and hold" strategy. My research focused on looking for an indicator to implement a successful market timing strategy. Using daily stock market data from January 2002 through November 2010 for the S&P 500 Index I found that the change in yields on long-term corporate bonds rated "AAA" can serve as a successful market timing indicator. On average, if the change in yields is negative then tomorrow the index declines, and vice versa. Using this timing strategy an investor beginning with one dollar in 2002 would have accumulated $10.73 by the end of the sample period, or a 34.5 percent annual return. This compares to a buy and hold investor who would have accumulated only one dollar and one cent. An analysis of the data using regression analysis confirmed the findings of the simulated trading strategy. Theoretical explanations for the empirical results are offered.

Incorporation of Tagged and Untagged L4 Ribosomal Protein into Ribosomes

Anthony P. Kronfli, *Lasse Lindahl, Janice M. Zengel*
Lasse Lindahl, Professor, Department of Biological Sciences

Ribosomes are responsible for the synthesis of protein in every living organism. They contain a large number of protein subunits (50-75 depending on the organism), but the functions of these proteins are not clear. Ribosomal protein L4 (RPL4) is an evolutionarily conserved protein present in ribosomes from bacteria to humans. Our lab uses a "tag" in mutated versions of the RPL4 to observe the role of its various features in yeast ribosomes. This tag consists of six histidine amino acids added onto the N-terminal end of the RPL4 amino acid chain, which makes it possible to observe the relative amounts of mutant and wild type RPL4 protein accumulating in the cell. This in turn, should make it possible to determine the function of mutant versions of RPL4 in ribosome assembly. However, the histidine tag may affect the overall structure of RPL4 and result in the tagged protein being less compatible with the ribosome than the un-tagged protein. This project is to determine if the tagged version is as effectively incorporated into the ribosome as the wildtype protein. The results of this project will be used to better plan and conduct other projects involving the N-terminal histidine tag on the L4 protein.

This project was supported by NSF grant MCB0920578.

Measles in a Modern World: Comparing the 2008 Outbreaks in Austria and the United States

Julianna M. Kuhn
Dawn Biehler, Assistant Professor, Department of Geography

In developed countries, like Austria and the United States, measles is often regarded as a disease of the past. However, in 2008 measles outbreaks occurred in both countries affecting several hundred individuals, securing measles a place as a modern-day problem. This research examines each country's outbreak by first evaluating the mechanics of the disease spread. The second portion asks for a more complex analysis of the episode: How have the media and popular discourse represented a) the measles outbreaks, b) the people who were infected, and c) the responsibility of the individuals and the state for controlling disease? The answers to these questions were sought through a qualitative discourse analysis of Austrian and American popular media documents, government reports and supplemental interviews. Each culture is navigating infectious disease in a global community where matters of personal freedom versus public safety are intensified by the fast-paced exchange of germs. Perceptions of parental versus government responsibility and the validity of the choices made by each show more individualistic trends in the United States compared to Austria. Despite these differences on the macro level, a government official, parent or doctor in Austria often experiences the same conflicts as their counterpart in the United States opening the possibility for an exchange of methods and logic.

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

Facebook as a Tool for Communicating Homework

Leanne M. Lenhart
Linda Oliva, Assistant Professor, Department of Education

The homework completion in my Social Studies class was low. Personal choice, forgetting, or not recording their assignment in class are all possible causes for students not completing their homework. A tool that would allow students to view their homework assignment outside of class is the popular social network site Facebook. Most of my students already have a Facebook account and check it daily. My study examined whether posting the students' homework assignments on a class Facebook group increases the homework completion rate. Posting on the "Poly American Government" Facebook group wall sends a notification to each group member. When they log into Facebook and check their notifications, they can instantly and conveniently see their homework assignment for the evening. If the students have any questions about their homework assignment or about what is being taught in class they can easily post on the group wall and their fellow students or I can reply. Homework completion rates were recorded before and after the establishment of the Facebook page and student perspectives of the Facebook page were examined.

Association between Parenting Goals and Parenting Practices among Chinese Immigrants

Kevin C. Lin
Charissa S.L. Cheah, Associate Professor, Department of Psychology
Christy Y.Y. Leung, Doctoral Candidate, Department of Psychology

According to the Census 2000, Chinese was the largest Asian-American group. Approximately six percent of the Chinese-American population was under the age of five. Despite the growing number of Chinese-American families with young children, research on the long-term parenting goals and indigenous parenting practices of immigrant Chinese mothers is limited. Culture plays a significant role in shaping parenting. Immigrant Chinese mothers are influenced by both the traditional Chinese culture and the mainstream Western culture. This study included 70 immigrant Chinese mothers of preschoolers in Maryland. Specifically, (1) the major themes of mothers' long-term socialization goals for their children's development, and (2) their endorsement of indigenous Chinese parenting practices were examined using interviews and questionnaires. Preliminary analyses revealed that these mothers emphasized their children's spiritual growth and proper education in their long-term socialization goals, and endorsed maternal involvement in their indigenous practices. Findings from this study enhance our understanding of how immigrant Chinese mothers achieve their long-term socialization goals for their children through their parenting practices in the American context. These findings can also help inform educators, social workers, or community service providers to better understand this cultural group and promote their successful development.

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education, and the NICHD grant (5R03HD52827-2).

English Standards in the UMBC Classroom

Elizabeth A. Lynch
Thomas Field, Professor, Department of Modern Languages, Linguistics, and Intercultural Communication

While the needs and challenges of students with limited English proficiency who come to countries like the United States are well documented, the difficulties faced by students who grew up speaking a standard, but non-United States form of English as their native language in their home country are rarely considered despite their growing presence in the U.S. educational system. I examined the ideological norms of "standard" English as applied in the English and History departments of UMBC using a questionnaire that ascertains how faculty in the History and English departments judge non-US English forms in written work. Some of these faculty members were interviewed to elaborate on their responses. The results reveal how standard English norms, as they are understood by a particular U.S. institution, may affect students. An understanding of the situation can help universities and schools to mindfully assist their students from World English backgrounds.

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

Finding Communities through Social Media

Morgan A. Madeira, Rachel Sweeton
Anupam Joshi, Professor, Department of Computer Science and Electrical Engineering

Social media sites have rapidly increased in popularity over the past few years. We have investigated the potential value of collecting and analyzing data from these sites. We identified communities based on similarities in the data. One application of this procedure is determining areas affected by natural disasters based on data collected from networking sites. Our research focuses on identifying these communities automatically. To better understand how to approach the bigger problem, we started by collecting data from Twitter and analyzing it based on political sentiment. We examined Tweets to infer an individual's political party and used the sorted data to create our gold standard. The standard is used to train the computer to classify novel data sets. We have been working toward having the computer recognize communities and predict whether a person is associated with certain groups.

This work was funded, in part, by Lockheed Martin and the Office of Naval Research.

Understanding How *cdc42* Impacts Growth and Branching in the Model Fungus *Aspergillus nidulans*

Richard Maduka
Mark Marten, Professor, Department of Chemical and Biochemical Engineering

We are interested in understanding how morphogenesis, and in particular hyphal branching, is regulated in filamentous fungi. We are studying mutant strains of the model fungus *Aspergillus nidulans* that have particular gene deletions we expect to play an important role in branching regulation. In this project, we are studying a mutant strain with a deletion of the *cdc42* gene. Spores from the fungi are grown on microscope coverslips in a nutrient broth. Resultant mycelia are analyzed as a function of time to determine the specific growth rate and the specific branching rate. These are compared with wild type controls to determine if the *cdc42* gene product plays a role in branching regulation.

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Spatial Learning Deficits on a Virtual Radial Arm Task in Schizophrenia

Anastasia S. Mallillin
Laura M. Rowland, Assistant Professor, Department of Psychiatry, University of Maryland School of Medicine

Past research suggests that impairments in spatial learning and memory are present among individuals with schizophrenia throughout the course of their illness. The objective of this study was to use a virtual eight-arm radial maze to evaluate spatial memory, particularly working and reference memory, in subjects with schizophrenia. This task was derived from the radial maze commonly used in rodents. Thirty-three chronic, clinically stable subjects with schizophrenia and thirty-nine healthy controls participated in this study. Subjects performed ten trials of a virtual eight-arm maze task. The goal of the task was to learn to retrieve four rewards that were each located in separate arms. As expected, subjects with schizophrenia were significantly impaired in learning the maze task compared to healthy controls. Subjects with schizophrenia made more reference and working memory errors, retrieved fewer rewards, and used more time and distance to retrieve rewards than controls. These results suggest that frontal and hippocampal function underlying spatial memory is compromised in schizophrenia. Results encourage future research to further understanding spatial memory deficits in schizophrenia. Results also encourage future research in the development of cognitive intervention strategies focused on learning and memory in schizophrenia.

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Graffito: A Graffiti Museum

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Preminda S. Jacob, Associate Professor, Department of Visual Arts
May Chang, Head of IT Services, Albin O. Kuhn Library

The goal of this project was to curate a virtual museum in the program *Active Worlds.* The virtual space allowed my group to curate a museum without being limited by actual curating issues, such as, space, budget, and material. This virtual space surveys three methods of street art: murals, stencils, and tagging. Visitors will not only experience a varied mix of street art, but they will also be immersed in the contextual locations typically associated with graffiti. Walking around the museum building viewers will encounter three horizontally staggered floors, and a gift shop and cafeteria in the negative space of the second and third floor. The first floor "Hip Hop and Tagging" showcases spray paint and painted tagging areas in Europe while photographs and videos inform visitors about the cultural connection between tagging and hip hop. The second floor "Stencil Making" focuses on street art utilizing a stencil over which spray paint or paint is used to create an image. Stenciled imagery is ubiquitous in the urban environment – popping up on walls, sidewalks and even on the street. The third floor, "Murals," features street art consisting of painted or spray-painted murals, or scenes. Mural graffiti can be found all over the world and can be broken up into numerous categories including: religion, war, political, propaganda, advertising, and even self-expression. The third floor gallery displays examples of each of these genres.

Retroviral RNA Packaging Elements Promote GAG Assembly

Trevor Mathias, Patrice Starck, Sabrina Ngo, Yasuyuki Miyazaki
Michael F. Summers, Professor, Department of Chemistry and Biochemistry and Investigator, Howard Hughes Medical Institute

There are a wide range of retroviruses, including HIV, that infect many species. All retroviruses package two unspliced copies of genomic RNA into their viron as a dimer. The selection of genomic material for packaging is mediated by RNA elements, known as the Ψ-site, which are generally located in the 5′ Untranslated Region (UTR). Genomic RNA is thought to be transported to the plasma membrane by Gag-polyprotein. The minimum region required for packaging in Moloney Murine Leukemia virus is called the core-encapsidation signal (Ψ^{ces}). This region contains stem loops SL-C and D which harbor GACG tetraloops at the top of each structure. The structure determined for the SL-CD dimer suggested that this serves as scaffold for the NC domain of Gag binding. We have hypothesized that the SL-CD dimer promotes this by resulting in the close proximity of NC binding sites. Genomic RNA of retroviruses promotes assembly *in vivo* and *in vitro*, but this mechanism is unclear. Since the Capsid (CA) domain of Gag is primarily responsible for assembly, we have synthesized CA-NC proteins in *E. coli*. CA-NC binds to the Ψ^{ces} RNA in a cooperative manner. These results suggest that the NC domain of Gag bound to Ψ^{ces} RNA promotes the interaction of CA domains for the assembly of Gag.

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Acute Tolerance to Etorphine for Wild Type C57B1/6 Mice

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Etorphine is an opioid receptor agonist that possesses an analgesic potency approximately a thousand times that of morphine. Its use is limited to veterinary medicine because it is fatal to humans. However, it is also a research tool to study opioid actions. For our studies, we used wild-type C57Bl/6 male mice to observe the development of acute tolerance to the analgesic effect of etorphine. The analgesia was measured using a hot plate test set at 55°C by the latency responses to pain, that manifest as hindpaw or forepaw lick, hindpaw flick, or jump. First, we tested the dose response to determine the EC 50 value, which is the concentration of the drug that produces 50 percent of the maximum effect. Then, a time course was performed to identify the duration of the effect of etorphine at a dose of six µg/kg. Acute tolerance to etorphine was assessed as the analgesia decreased after two administrations. These findings show that our methodology can be used for further study on opioid tolerance in mice.

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.

De Novo Mapping of Regulatory Networks by Comparative Genomics

Fialelei D.A. Matthews
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Comparative genomics approaches to regulatory network analysis must either rely on the assumption that the network of regulated genes is preserved or be provided with a description of the transcription factor-binding motif. Hence, these strategies require all the available previous experimental knowledge on a model organism, which can be relatively distant from the clade of interest. Here we analyze the feasibility of applying a simple hypothesis (repressor self-regulation) to exploit the abundance of genomic data in order to generate a robust candidate motif to conduct site search-based analysis of a transcriptional network. Taking advantage of the recent availability of data on the SOS transcriptional repressor LexA in Gram-positive bacteria, we benchmark this approach against the conventional method based on extension from a single experimental model organism. Our results reveal that this approach is powerful enough to generate de novo transcriptional network maps, which can be used for functional annotation. Furthermore, the use of a broad sampling base for motif discovery leads to more reliable and generic results than conventional methodology. We use this approach to generate a systematic map of the LexA regulon. This map suggests patterns of convergent evolution in cell-division inhibitors and their regulation by the SOS response.

This work was funded by the UMBC Department of Biological Sciences.

Pop-Tarts: A World unto Themselves

Samantha Medema
Warren Belasco, Professor, Department of American Studies

The Kellogg's Pop-Tart has been a snack-food icon for decades, but attempting to deconstruct and trace its ingredients, its manufacturing, and its place in American culture proved to be far more complex than one would expect from a toaster pastry. Drawing on and consulting the food research of Michael Pollan and Steve Ettlinger, as well as numerous other sources in the food and nutrition community, this research attempted to trace the Pop-Tart "from field to fork." My research took me through dozens of ingredients, the beginnings of the Kellogg company, marketing strategies, agricultural guidelines, processing woes, cultural references, and, perhaps most unsettling, the routine omission or refusal of Pop-Tart-related information and practices from Kellogg's. What this research made most apparent, however, was that the iconic status of a food product, even one as nutritionally-unsound as a Pop-Tart, can greatly impact our lives without our even needing to eat one.

RNA *in Situ* Hybridization Analysis of G-Protein β and γ Subunits in the Main Olfactory Epithilium of Mice

***Saloni T. Mehta**, Aaron Sathyanesan, Weihong Lin*
Weihong Lin, Assistant Professor, Department of Biological Sciences

Odorant receptors (ORs) are G-protein coupled receptors (GPCRs) of the olfactory sensory neurons of mice. It has been established that the ORs mediate olfactory signal transduction through the α subunit of the olfactory G-protein, $Ga_{olf;}$ however, little is known about its β and γ subunits. In other cellular systems, it has been shown that the Gβ-γ dimer plays important roles in signal transduction. In order to increase our understanding in regard to the peripheral olfactory system of mice, we performed RNA *in situ* hybridization (RISH) on coronal sections of the main olfactory epithelium (MOE) to test for the presence of Gβ and Gγ subunits previously identified in the MOE through an RT-PCR screen. We detected the presence of $G\beta_1$, $G\gamma_2$ and $G\gamma_{13}$ subunits through RISH. All other subunits tested did not show significant positive labeling distinguishable from background. Our results suggest the presence of multiple Gβ and Gγ subunits in the different cells of the main olfactory epithelium.

This work was funded, in part, by NIH/NIDC grant DC009269 and UMBC Startup fund to WL.

The Effects of Sexual Harassment on Ambulatory Blood Pressure in African American and Hispanic Women

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Cardiovascular disease (CVD) is the leading cause of death among all women in the United States, and is particularly deleterious to the health of women of color such as African American women. Exposure to chronic stress associated with perceived racism has been shown to be predictive of CVD among women. The influence of gender-salient sources of chronic stress such as sexual harassment, albeit pervasive with as many as one-third of women facing these experiences, remains unclear. In the proposed study, the relationship between negative social interactions perceived to be associated with gender and ambulatory blood pressure (ABP), will have been assessed. A sample of 294 African American (n = 153) and Hispanic (n = 141) women between the ages of 24 and 65 habituating the New York City area completed daily mood diaries about their social interactions while wearing an ABP monitor that assessed blood pressure over a 24-hour period. The data will also be examined to determine whether other factors, including perceived racism and trait negative emotions, are related to associations between daily negative social interactions, which is perceived to be associated with gender and ABP. The goal of this research project is to understand the implications of exposure to sexual harassment for CVD risk in women of color.

The Presentation of *Plasmodium* Antigen by Splenic Dendritic Cells

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Malaria is caused by a protozoan parasite from the genus *Plasmodium*, which is transmitted to humans through the bite of a female *Anopheles* mosquito. Previous research in our laboratory has shown that $CD8^+$ T cells are essential for protective immune response against malaria. Dendritic cells (DCs) are required to present antigen to $CD8^+$ T cells. A thorough understanding of DC-$CD8^+$ T-cell interactions is critical for the development of a successful vaccine. The primary objective of our research was to determine whether or not DCs present *Plasmodium* antigen to $CD8^+$ T cells. To address this question we immunized C57BL/6 mice intravenously with 100,000 sporozoites per mouse. Splenic DCs were purified from the animals 48 hours post-immunization and incubated with carboxylfluorescein succinimidyl ester (CFSE) labeled $CD8^+$ T cells. CFSE dilution was used as a marker for $CD8^+$ T-cell proliferation. In our experiments, 20.1percent of $CD8^+$ T cells proliferated when incubated with sporozoite activated DCs. Based on these results, we conclude that *Plasmodium berghei* CS^{5M} sporozoite activated DCs can prime $CD8^+$ T cells. An understanding of how a protective immune response against malaria is generated will provide insight into the development of a malaria vaccine.

This work was funded by Johns Hopkins Malaria Research Institute Summer Undergraduate Program.

The Role of Economic Disparity in Human Rights Abuses: Case Study on Rwanda and Sierra Leone

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Approximately one million people have died in the Rwanda and Sierra Leone genocides. Mass killing and genocide have been a too common phenomenon in sub-Saharan African countries. The social tension that erupts into such horrific human rights abuses has been mostly classified as the result of ethnic diversity or flawed government, or both. This research develops case studies of Rwanda and Sierra Leone in order to illustrate how another factor, economic disparity can lead to human rights abuses. This study addresses the role of economic disparity in the existence of human rights abuses in Rwanda and Sierra Leone despite the absence of such abuses in other states with similar economic disparity.

Apontic, a Novel Regulator of Janus Kinase/Signal Transducer and Activator of Transcription (JAK/STAT) Pathway in Drosophila Testis

Archana Murali
Michelle Starz-Gaiano, Assistant Professor, Department of Biological Sciences

Stem cells maintain their undifferentiated state through signaling networks present in their local environment. Understanding these complex regulatory mechanisms will advance the field of stem cell research, which is relevant to developmental biology and regenerative medicine. The Drosophila testis provides a simple, tractable system that we can exploit to identify regulatory mechanisms that may be well-conserved. Fly testis supports two stem cell populations, the germline stem cells (GSCs) and the cyst progenitor cells (CPCs). The GSCs and CPCs surround a cluster of somatic cells called the hub, which acts as a signaling center. The hub secretes a ligand that activates the JAK/STAT pathway, which maintains both stem cell populations until they move away from the hub and begin differentiation. We previously identified a novel negative regulator of the STAT pathway, Apontic *(*Apt) in Drosophila ovaries. In this study, we tested the role of Apt in testis. Apt was highly expressed in the stem cell populations and in the hub. We up-regulated *apt* in CPCs and showed that this results in fewer stem cells. Furthermore, we observed that mutations in *apt* results in more stem cells in a distinct pattern. We concluded that Apt acts as a novel regulator of the stem cell maintenance pathway.

This work was funded, in part, by UMBC SRAIS grant.

Translational Misreading in *rbfA* Compensatory Mutants

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The process of protein synthesis occurs when the ribosomes translate the mRNA of a cell into a string of amino acids, which forms the protein. The prokaryotic ribosome 70S is comprised of a large (50S) and a small subunit (30S). Ribosomes are comprised of many ribosomal RNAs and proteins. Ribosomal binding factor A (*rbfA*) helps the proteins assemble onto the rRNA. Cells without this binding factor exhibit a slow growing phenotype as well as cold sensitivity. *rbfA* mutants grown at low temperatures revert to cold insensitivity due to mutations in the *rpsE* gene. *rpsE* mutations can cause increased inaccuracy in translation. We are interested in determining whether these *rbfA* and *rpsE* mutations cause inaccuracy. Translational misreading results from incorrect base pairing between the mRNA codon and the tRNA anti-codon, which creates incorrect proteins. We will quantify the misreading using a dual luciferase assay. Comparisons will be made between *rpsE* mutants with and without the *rbfA*. If misreading causes the cold sensitivity, we expect that the strains lacking *rbfA* will have higher misreading rate than the wild type strains.

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Analysis of HIV Specific Shark Single Domain Antibodies by Phage Display

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The nurse shark is one of the oldest vertebrates that have an immunolglobulin-based immune system similar to humans. They express an immunoglobulin called the New Antigen Receptor immunoglobulin, or IgNAR. The Variable (V) region of the IgNAR molecule is stable and can bind antigens independently of light chain V regions, making it an ideal system for phage display assays. We used the HIV surface glycoprotein, gp120, to initiate immune response in the shark. Viral gp120 forms the trimeric spikes on HIV necessary for entry into host cells. When gp120 contacts the receptor CD4, a conformational change occurs, exposing the chemokine receptor binding site. The virus then binds chemokine receptors and enters host cells. We hope to find IgNAR V clones that bind near the CD4 binding site on gp120 to induce the conformational change by mimicking the virus-CD4 interaction, which would be beneficial for vaccine development. NARV regions from a gp120-immunized nurse shark were cloned into a phagemid and panned with increasing stringency to obtain gp120-specific clones. One NARV clone has shown specificity towards the CD4 binding site, but does not induce the conformational change. We are currently building a library of higher complexity to obtain more antigen-specific clones.

This research was funded by the National Institute of Health Grant RR006603.

Characterization of AC1-EXR and AC1-LetR Breast Cancer Cell Lines

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Some of the most effective therapies for estrogen receptor positive (ER+) breast cancer in post-menopausal women are aromatase inhibitors (AIs) i.e., letrozole, exemestane, and anastrazole. AIs block the conversion of androgen into estrogen resulting in less stimulation of ER-mediated pathways, which ER+ breast cancer cells depend on for growth. A significant percentage of patients, however, either do not respond to AIs or become resistant to them. We are interested in understanding the resistance mechanisms of breast cancer cells to identify potential therapeutic targets in order to prevent or treat this resistance. To study this, hormone-independent, AI-resistant cell lines were developed from AC1 (ERα+/HER2- MCF-7 cells transfected with the aromatase gene) cells that were made resistant to AIs (exemestane or letrozole) *in vivo* in xenograft tumors cells by long-term AI treatment. The resulting cell lines were exemestane-resistant (AC1-EXR) and letrozole-resistant (AC1-LetR). Preliminary cell viability assay results indicate that compared to parental AC1 cells, AC1-EXR and AC1-LetR cells were significantly more resistant to growth inhibitory effects of exemestane and letrozole, respectively. Additional studies to better understand the underlying mechanisms of AI resistance will include investigation of the aromatase activity and of the expression of growth factor receptors and other signaling pathway proteins.

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Evaluating the Mid-Atlantic Wind Energy Resource: A Multi-Platform Data Analysis Study

Eliana NessAiver, Soutry De
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It is becoming widely recognized that the use of traditional forms of energy such as fossil fuels is not sustainable and has gradually led to significant climate change. As a result, research into alternative sources of energy has become an increasingly important endeavor. Currently, the scientific community does not have much detailed knowledge about winds near the mid-Atlantic coast, a necessity for establishing the feasibility of building wind turbines in coastal or offshore regions. Business investments in particular depend upon whether available weather data are sufficient to determine wind patterns in a specific area. Such data often spans only a short length of time, necessitating accurate extrapolation from these short-term measurements to long-term patterns. This study addressed the collection and analysis of wind data to determine predictability and strength of mid-Atlantic winds and to identify inter-annual, seasonal and diurnal patterns in wind speed and direction using wind measurements gathered from multiple sources. These sources included buoys, weather balloons, and anemometers on high towers from a number of locations along the coast. Our results indicated that the mid-Atlantic winds offer a promising wind resource for megawatt wind turbines.

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

The Effects of Patriarchy and Migration on Nigerian-Igbo Culture Sibling Sets within the United States

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This study focused on immigrant familial relations within sibling sets of Nigerian-American families of the Igbo tribe living in the United States. Traditionally Igbo culture is patriarchal, granting males greater respect than females within the family. As a second generation Nigerian-American, I have been afforded the opportunity to negotiate between that traditional system and a range of family styles practiced in the United States in constructing my family relationships. In this study I examined how four sets of siblings from immigrant families negotiated the tension between Nigerian and American practices to create distinctive family structures and practices. The extent to which families retained or modified tradition depended on the values held within the families. I conducted and analyzed interviews with key members of each sibling set to examine the effects of migration and patriarchy on their families. The dynamics between each of the sets as well as the structure within them varied. All families have retained the sibling-centric structure, but some now allow sisters to function as the head of the family. Where one lived, where one grew up, how many siblings one had and what gender grouping one belonged to all worked together to affect how they interacted.

Analysis of Brca1 DNA and RNA Expression in a Transgenic Mouse Model

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Breast cancer is the most prominent form of cancer in women worldwide. We are using a mouse model of human BRCA1-associated breast cancer to identify key biomarkers for the early detection of breast cancer. While transgenic mouse models are critical for understanding progression of breast cancer, a thorough phenotypic analysis of the model is required to fully understand and interpret results. Previous studies in the Brca1 mutant model have shown that loss of the full-length Brca1 gene leads to a higher occurrence of cancer. Although the deletion of Brca1 was specifically targeted to occur in the mammary epithelial cells, preliminary results from our lab suggest that Brca1 is also deleted in adipose tissue. This finding is significant because adipose tissue may also play a role to breast cancer development and we have observed physiological changes in the mammary adipose of Brca1 mutant mice. This study seeks to determine which cell types within the mammary gland have targeted deletion of Brca1 by analyzing DNA by PCR and RNA by real time PCR. We anticipate that these results will provide insight into which cell types are important in the development of BRCA1 associated breast cancer.

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Searching for Proteins that Recognize Signals that Determine the Sorting of Endosomal Cargo Proteins

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Clathrin-Independent Endocytosis (CIE) internalizes a unique set of cargo proteins such as MHCI, CD44, CD147, CD98, Tac and Glut1. Once inside the cell, some cargo (e.g., Tac, Glut1 and MHCI) are directed for lysosomal degradation while others (e.g., CD44, CD98 and CD147) are recycled to the plasma membrane implying that an endosomal sorting event occurs. This event was found to occur in a Rab5-containing compartment, and cargo proteins that go straight to the recycling compartment had a sorting determinant in the form of acidic clusters, which were conserved in the sequence of their cytoplasmic tails. We hypothesize that certain proteins also play a role in this process by recognizing this sequence. To examine the sorting mechanism by looking for protein-protein interactions, we used a yeast-two hybrid screen with the cytoplasmic tail of CD147 as bait and a human universal cDNA library as the prey; positive interactions gave yield to expression of reporter genes. After running a colony PCR, we sequenced our products and ran a BLAST search, and got proteins including HOOK 1, ATP1B3 and ARHGIB, a RhoGDI protein. These results will help us to better understand the sorting mechanism that selectively recycles cargo protein in the CIE pathway.

This work was funded by the Summer Enrichment Program of National Institute of Health.

Reverse Carbocyclic Fleximers as a Means of Overcoming Drug Resistance

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Drug resistance is a common problem occurring in monotherapies for many diseases, often caused by mutations in the active sites of target enzymes. This resistance has become a major focal point for pharmaceutical research. Our lab has designed and synthesized a series of carbocyclic flexible inhibitors, termed “fleximers”, by splitting a nucleoside’s purine ring into its imidazole and pyrimidine components. Previous studies have shown that this flexibility allows the nucleoside analogue to interact with residual amino acids in the enzyme’s active site. The primary goal of this project is to investigate the role flexibility plays in avoiding resistance mutations. A second goal is to explore a "reverse" connectivity for the fleximer scaffold, where the carbocyclic sugar moiety is connected to the N1 position of uracil, with the C5 position being substituted with a series of five-membered ring heterocycles. Initial analogues of these compounds have shown unexpected inhibitory activity against adenosine deaminase (ADA). ADA is a critical enzyme in purine metabolism, and is overproduced in certain cancers and autoimmune diseases, thus the results of this study could provide new leads for therapeutic uses. The synthesis, characterization, and biological data of this new class of fleximers will be presented herein.

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Toward an Automatic Method for Drug-Related Mutational Extraction from Text

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Generalized dosage administration guidelines for drugs do not always allow patients to receive the full effects of the drug and do not account for genomic-related toxicity. Ideally one would like physicians to prescribe drug dosage for each patient’s individual genome. Pharmacogenomics aims at finding relationships between drugs and genomic variation in order to move towards this personalized medicine. An example of a drug for which dosage is affected by specific mutations is warfarin. Incorrect dosage of warfarin could be lethal to a patient who has sensitivity to this drug due to their genomic background. Thus, warfarin’s sensitivity is well-documented making it an ideal candidate for benchmarking applications for pharmacogenomics analyses. We have developed a tool called Extractor of MUtations (EMU) and used it to extract mutation and gene information on diseases from PubMed abstracts; specifically in breast and prostate cancers. Here, EMU was used to extract mutational information related to warfarin. We benchmarked EMU against a manually curated set of warfarin-related abstracts and measure the precision with which we extract the correct mutation and drug-relationships. This analysis yielded a 0.77 precision in the retrieval of drug-related mutations, showing EMU can be applied to extract pharmacogenomics data.

Automatic Detection of the Major Codon Bias in Mutationally Biased Genomes

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The detection of Codon Usage Bias (CUB) patterns is a fundamental tool for genome analysis, as it can provide relevant information on gene expression, lateral gene transfer and other genomic features. CUB indices have been developed, but they rely on an arbitrarily defined reference set or implicit integration of several underlying patterns. Recent attempts at automatically isolating a reference set using algorithmic techniques have floundered when confronted with genomes harboring conflicting biases, such as mutational bias. Here we show that, due to its implicit sampling of genomic base composition, the Relative Codon Adaptation index (RCA) can be successfully applied to automatic methods for reference set isolation, even in heavily GC-biased genomes, offering improved correlation with expression data. We have also examined different aspects of the underlying algorithmic technique. Our analysis shows that a final reference set size of approximately one percent of the total genome is optimal for both genomes showing strong and weak translational and mutational biases. Deterministic sampling of different subsets of the genome as starting points for the algorithm iteration also demonstrate that the algorithm systematically converges onto the major codon bias in both weakly and strongly biased genomes.

This work was funded by UMBC Department of Biological Sciences.

Struggle to Collaborate with Strangers

Mallorie B. Ortega
Frederic Worden, Associate Professor, Department of Visual Arts

Finding the right people to collaborate with can be very difficult; especially if the potential collaborators are complete strangers. Very often, we encounter people who, although we do not know them personally, we can see have talent, drive and strong personalities. There is a natural desire to want to reach out to these people and forge a relationship based on common interests or activities. In spring 2010, I conducted an experiment and asked over 20 strangers to sing a song with me on camera. Of the 20, only two were willing to sing a song. It seemed clear that some form of social inhibition or shyness was standing in the way of developing a productive relationship. This shyness or inhibition may be very wide spread in contemporary society and not only stifles creative collaborations, but also creates barriers between people. This year, I extended my project by setting up a collaboration with people I hardly knew, but who I recognized as being exceptionally talented individuals. I created a music video in which these six people worked together to complete the video. Turning this group of strangers into a cohesive and productive team was a difficult challenge, but did provide valuable insights into the creative process as it develops among a group of individuals with no prior association. Though there were some social barriers between us, there was a common artistic goal that we all wanted to produce. Setting yourself apart from other talented artists, with the Internet at everyone's disposal, is very difficult. By collaborating, we were able to make a name of ourselves amongst our peers.

Always Wanting More: Access, Entitlement, and Expectations of Popular Music Bands in the Age of Social Media

Christine N. Osazuwa
Frederic Worden, Associate Professor, Department of Visual Arts

Always Wanting More is a documentary film investigating the culture of pop rock bands and the fanatic behavior exhibited by their fans. The purpose of the documentary is to understand the impact of music, marketing, and social media on culture, adolescent identity, and the music industry. This musical genre consists of young artists, signed to independent record labels (or unsigned) that play a radio-friendly style of rock music. The bands in this genre are much more accessible to their fans than the pop idols of the past due primarily to internet sites such as Facebook, MySpace and Twitter. Lack of media coverage of this genre and its impact on youth culture fueled my decision to use film to capture the dynamic nature of the concerts, including the sounds, the fans, and the overall intensity of these events. The documentary was filmed between May 2010 and February 2011 and covered both large festivals and smaller concerts. Through interviews with bands, fans, parents, industry insiders and experts in relevant academic disciplines, I uncovered a wide range of opinions as to the value and importance of the increased levels of intimacy between music celebrities and their fans made possible by the new social media technologies. The documentary investigates this musical world as an interesting and suggestive example of wider cultural currents and as a barometer of the current youth culture zeitgeist. The intertwined and synergetic impacts of social media and charismatic pop music bands are doubtlessly having powerful influences on impressionable young people and our hope is that *Always Wanting More* can shed some meaningful light on this phenomenon.

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

Utilizing Artificial MicroRNAs to Analyze Gene Function in the Green Alga *Volvox carteri*

Stephanie A. Owusu, *Akelia D. Wauchope*
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The green alga *Volvox carteri* is an ideal organism for investigating cell differentiation because it has just two cell types, somatic and gonidial (reproductive) cells. To better understand how cell differentiation works in *Volvox* we are developing RNAi tools that can be used to repress expression of candidate genes that might be developmentally important. Specifically, we are developing a system for expressing artificial microRNAs (amiRNAs). amiRNAs are modified miRNAs engineered to knockdown expression of target genes. In this investigation we replaced the constitutive promoter of previously tested amiRNA constructs with the inducible *nitA* gene promoter and targeted the *morA* and *myoF* genes, both of which are hypothesized to be important for *V. carteri* cell differentiation. We introduced the constructs into a *V. carteri* recipient strain and are analyzing the transformants to determine whether they express the amiRNA genes and exhibit the expected cell differentiation phenotypes. We report the results of these experiments here. If successful, these experiments should lead to a better understanding of *V. carteri* cell differentiation and cell differentiation in animals and higher plants.

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Immune Tolerance and CD20-Specific Lentiviruses

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Autoimmune disease often results from immune cells recognizing host peptides as foreign, leading to immunogenic responses such as the destruction of peptide-expressing host cells. Tolerance to these self-peptides may be induced by retrovirally infecting naïve B cells *in vitro* with the peptide coupled to an immunoglobulin heavy chain (IgG), allowing the B cells to present the peptide via MHC class II molecules, and infusion of peptide-presenting B cells prior to disease onset. An alternative method involves infecting B cells *in vivo* with CD20-specific lentiviruses that express the peptide-IgG. Since CD20 is expressed predominantly on B cells, the virus will almost exclusively infect B cells when injected into the body. This study involves the use of lentiviruses for induction of tolerance by this means. Lentivirus plasmids coding for two different peptide-IgG have been constructed. The lentiviruses infect CD20-expressing Raji cells but not two other CD20-deficient cell lines; the quantity of peptide-IgG produced in these cells is currently being measured. These peptide-IgG lentiviruses will then be used to induce tolerance in mouse models of human autoimmune conditions with mice expression human CD20.

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Study of Morphine Tolerance and Dependence

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Morphine is an opiate that binds to the mu-opioid receptor and is used to treat severe pain. Development of tolerance and dependence is a side effect to chronic morphine treatment that hinders its use as a long-term analgesic drug. Male mice, C57BL WT, were used to evaluate the tolerance and dependence to morphine. Tolerance to the analgesic effect of morphine was assessed using the hot plate test at 55 degrees Celsius (+/- 0.5) with a 30-second cut-off time. Latency to respond with a paw lick, hind-paw flick, or jump was monitored. Tolerance was induced by subcutaneous injections of morphine (15mg/kg) for eight days and was measured by a decrease in the response. The eighth day, naloxone (1mg/kg), a mu-opiod receptor antagonist, was used to precipitate morphine withdrawal and assess morphine dependence in chronically treated mice. Results indicate that mice treated with chronic morphine tolerance developed after two days along with significant weight loss compared to control mice treated with saline. Naloxone treatment induced withdrawal symptoms such as jumps and diarrhea, which indicate dependence in the mice treated with morphine. This experiment can be used to test the tolerance and dependence of different strains and mutated mice.

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Measuring the Release of ATP from the Mouse Carotid Body

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Adenosine triphosphate (ATP) is considered to be an essential excitatory neurotransmitter in the cat and rat carotid body (CB). However, the role of ATP in the mouse CB has yet to be determined. Therefore, we have developed a system to measure *in vitro* release of ATP from the mouse CB using bioluminescence techniques. The initial focus was to determine an optimal *in vitro* environment. We tried various chamber systems and methods of integrating the CB within these systems. These attempts have elevated our understanding of the sensitivity of the measurement, the sample collection procedures, and the quantification of sample concentration. We have found that the methods that have been previously used to measure the ATP release from the cat and rat CB cannot be directly applied to the mouse CB due to the small tissue volume. Further, due to the small amount of the ATP release, possible bacterial contamination has impeded upon accurate measurements. Thus, experiments were performed aseptically. The incubation chamber was made of Spin-X® Centrifuge Tube Filter. The filter was coated with two percent low melting temperature agarose to hold four CBs. Krebs (120 µL) was added and CBs were incubated for seven minutes at 37 ˚C. By using trichloroacetic acid, we estimated the maximum release of ATP from the CB of DBA/2J mice was 289 pmoles/minute. In hyperoxic/normocapnic conditions, the release was 7.88 pmoles/minute.

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Investigation of the Binding Affinity of GP32, an SSB Protein, for dsDNA

Divya Patel, Ajay Vaghasia
Richard Karpel, Professor, Department of Biochemistry

Bacteriophage T4 gene32 protein (gp32) is a classical single stranded DNA binding protein (SSB) that plays a crucial part in DNA replication, recombination, and repair. Although its primary function is to bind to single stranded DNA (ssDNA), it has been previously demonstrated that gp32 weakly binds double stranded DNA (dsDNA). In order for gp32 to effectively bind ssDNA patches which exist during DNA repair, replication, or recombination, gp32 cannot rely upon three-dimensional diffusion. Putatively, gp32 is capable of one-dimensional diffusion along dsDNA until it encounters ssDNA. This research focuses on finding the binding affinity of gp32 for dsDNA. In order to determine this affinity, we have made use of the dye azure A. Upon binding to dsDNA, the visible absorbance spectrum of azure A changes. In the presence of gp32, however, gp32 competes with azure A to form a complex with dsDNA. The difference in the absorbance of Azure A in the presence and absence of gp32 can be used to determine the concentration of unbound dsDNA and to calculate the affinity. Our data indicates a weak binding affinity of gp32 for dsDNA; however, further spectrophotometry and structural studies still need to be conducted in order to determine the actual affinity and dsDNA binding site size on gp32.

A Plausible Mechanism for Vomeronasal Organ Protection

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Semiochemicals detected by sensory neurons in the vomeronasal organ (VNO) mediate sexual, social, and interspecies defensive behaviors. The mechanisms that regulate chemical access to the VNO are unknown. We recently have found that solitary chemosensory cells (SCCs) in the VNO entry duct detect bitter compounds (Ogura et al., 2010). We hypothesize that SCCs play a role in protection of the VNO from harmful/bitter substances by monitoring the chemicals at the VNO entry duct. We examined whether long term exposure to a bitter substance, strychnine, would have an effect on the semiochemical-mediated behaviors. To test the role of SCCs on VNO protection and proper function, we individually housed five TRPM5 wild-type (WT) and TRPM5 knock-out (KO) mice. We then exposed them to strychnine for ten days. After the exposure we ran mating, fear, and aggression tests. The results for WT mice show that two of five displayed fear behavior; one of four mounted females and displayed aggressive behavior. For the KO mice two of five displayed fear behavior; three of five mounted females and displayed aggressive behavior. The data suggest that strychnine reduced typical behavioral responses of WT and KO mice, both groups showing reduced mating, aggression, and fear responses when compared to control mice.

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The Effects of Students' Surnames on their Academic Success

Catherine E. Perry
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All students should have an equal opportunity to succeed. There is a possibility that students' surnames may affect the assistance they receive from instructors and their placement in higher or lower performing classes. Class lists were collected from classes split by performance with attention focused on the first letter of the last name. The goal was to see if the difference in the proportion of students with last names at the beginning of the alphabet to those at the end was statistically significant. Applying a chi-squared test to a small sample of middle school students yielded some interesting results suggesting such a bias. Classroom procedures, including assistance students received from instructors, were investigated to explore possible causes of such a trend.

DMDM: Domain Mapping of Disease Mutations

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Domain mapping of disease mutations (DMDM) is a database in which each disease mutation can be displayed by its gene, protein or domain location. DMDM provides a unique domain-level view where all human coding mutations are mapped on the protein domain. To build DMDM, we aligned all human proteins to a database of conserved protein domains using a Hidden Markov Model-based sequence alignment tool (HMMer). We used the resulting protein-domain alignments to provide a domain location for all available human disease mutations and polymorphisms. The number of disease mutations and polymorphisms in each domain position are displayed alongside other relevant functional information (e.g., the binding and catalytic activity of the site and the conservation of that domain location). DMDM's protein domain view highlights molecular relationships among mutations from different diseases that might not be clearly observed with traditional gene-centric visualization tools. These unique graphical interfaces can provide new insight into proteins related by their domains and disease mutations, revealing commonalities between diseases.

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Prostate-Specific Expression of *MYC* in a New Model of Prostate Cancer

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Prostate cancer is the most prevalent type of cancer in men in the United States, second only to melanoma. To better understand this disease, there is a pressing need for mouse models that recapitulate key elements of the human disease. One major caveat of current models is they do not target oncogene expression strictly to epithelial cells. We have chosen to focus on the oncogene *MYC* that is overexpressed in a variety of human cancers, including prostate cancer. Existing mice in which human *MYC* is driven by a rat *probasin* promoter *MYC* mice show phenotypic features of prostatic intraepithelial neoplasia (PIN) and carcinoma that are quite similar to that seen in humans. To address this caveat we will use the Nkx3.1 promoter to drive expression of the *MYC* oncogene exclusively to the prostate epithelium. Thirteen independent transgenic strains carrying a *MYC* transgene driven by a 70kb Nkx3.1 regulatory region have been generated. Several of these lines exhibit PIN lesions in all four lobes of the mouse prostate which phenotypically mimics human disease. Immunohistochemical and quantitative analyses will provide more definitive studies into the multi-step process of prostate carcinogenesis.

This work was supported by a grant from the Patrick C. Walsh Prostate Cancer Research Fund to C.J.B.

TweetCollector: a Framework for Retrieving, Processing, and Storing Live Data from Twitter

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Social media systems like Twitter and Facebook provide an important new source of information about emerging events, interests, opinions, and trends. While these posts are brief, they are rich in meta data and connected to complex social networks. Twitter is an especially interesting source due to its openness and high volume of over 100 million posts a day. Collecting, filtering, analyzing and storing information from a dynamic Twitter stream is an essential component for any system that derives information from it. I designed and implemented TweetCollector as a scalable system to automatically collect Twitter status updates matching a user-specified query. The received tweets are run through an extensible workflow, to which new components can be added as needed. After processing, the status updates, along with the data generated during the processing phase, are stored in a relational database for human inspection and further analysis. Scalability is achieved in a multicore environment through the use of multi-threading and resource pooling. TweetCollector ensures reliable collection of statuses with on-the-fly processing in order to allow social media researchers to rapidly discover and react to new information from a promising new data source.

This work was funded, in part, by the Office of Naval Research through a subcontract from Lockheed Martin.

Gender Differences in Coping and Self-Esteem among Adults with Sickle Cell Disease

Evan Raines, Mahnoor Siddiqui
Shawn M. Bediako, Assistant Professor, Department of Psychology

We examined the influence of gender on coping and self-esteem among adults with sickle cell disease, a common genetic blood disorder. Eighty-eight individuals (41 females and 47 males) completed the Coping Health Inventory, the Rosenberg Self-Esteem Scale, and a pain episode survey as part of the Cooperative Study of Sickle Cell Disease, a large multi-site study funded by the National Heart Lung and Blood Institute. Pearson product-moment correlations were computed separately for females and males in the sample, adjusting for the number of sickle cell pain episodes. We observed gender differences in the relation between self-esteem and coping, such that higher self-esteem was significantly associated with better coping for females, but not for males. These findings suggest that men and women might differ with respect to their coping habits and that these differences might explain variations in some health-related outcomes.

The Effectiveness of Estates as Legacies

Ryan A. Ramos
W. Edward Orser, Professor Emeritus, Department of American Studies

Each year thousands of tourists in the United States visit estates that the wealthy have bequeathed to the public. This research specifically examines two residences of the Country Place Era of America's nineteenth and early twentieth centuries that have been left as institutions of education and enjoyment for the public, to determine whether their current functions properly reflect the founders' intent. The exemplars used are Pierre S. du Pont's Longwood Gardens in Pennsylvania and Henry Francis du Pont's Winterthur Museum in Delaware. A selection of official and legal documents pertaining to the estates have been analyzed to examine how the current functions of the estates are in keeping with the uses expected by the benefactors. In Longwood's case its primary function as a memorial to the horticultural vision of P.S. du Pont is investigated, while in Winterthur's case its primary function as an exhibition of seventeenth to nineteenth century Americana that H.F. du Pont envisioned is explored. These estates represent distinctive endeavors to project and sustain a private legacy in the public sphere.

The Expression, Purification, and Crystallization of the H-NOX Regulatory Domain of Bovine Soluble Guanylate Cyclase

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Soluble guanylate cyclase (sGC) is a 150 kDa heterodimeric enzyme (α and β subunits), which converts GTP to cyclic GMP to promote vasodilation. The β subunit contains a heme nitric oxide/oxygen-binding (HNOX) regulatory domain, which selectively binds nitric oxide (NO), activating the catalytic domain. Understanding the mechanism of activation of sGC through structural studies would be a useful tool to treat cardiovascular disease. The HNOX domain of bovine sGC contains about 193 amino acids. Because the β193-sGC construct (residues 1-193) is poorly expressed in *E. coli*, site-directed mutagenesis was used to introduce stop codons at sequential positions (from 187 to 198) along the original template. Expression conditions were tested for all 11 mutants, but only the β197-, and β198-sGC proteins were expressed in a soluble form. After partial purification via ion exchange chromatography, both proteins display a UV/Vis spectrum characteristic of the NO-bound heme. NO was not added during expression or purification, suggesting that its origin is likely atmospheric. Crystals of β197-sGC grown using our Art Robbins Phoenix crystallization robot diffracted poorly at the synchrotron (7 Å), but to our knowledge, these are the first mammalian HNOX crystals. We are now working to improve the diffraction quality of our crystals.

This research was funded in part through an American Heart Association Scientist Development Grant (EG), UMBC DRIF (EG), and a UMBC Undergraduate Research Assistantship Support grant (EG).

Do Students Achieve the Mastering of a Foreign Language at a Faster Rate in a Same Sex Class?

Yira Rawlins-Prins
Linda Oliva, Assistant Professor, Department of Education

Learning differences based on gender may play a role in student performance in learning a foreign language. This study investigated how urban high school students learned Spanish in three class formats: one class of seventeen boys, one class of seventeen girls, and a heterogeneous class of eight boys and eight girls. Student learning was assessed in the following ways: homework, surveys, projects, quizzes, and tests. Student performance data was collected for six weeks and results from each class were compared. In addition, students from each of the classes were interviewed to obtain their perspectives about their single sexed or mixed class format.

Ornamentation in the Historical Context

Hannah J. Rider
Lisa M. Cella, Assistant Professor, Department of Music

A well-informed, musical interpretation of pieces composed within the Baroque Period (1600-1750) requires knowledge of the performance practice of the time, which, unlike the standard classical training of today, involves the addition of ornaments or embellishments by the performer to the composer's work. I set out to gain the necessary knowledge and confidence to put into practice this creative, improvisatory style. In order to achieve this, I explored the literature from the time and asked for the help and advice of experts in the field. Focusing my research on the composer Telemann and his 12 Fantasias for solo flute, I also analyzed the ornamentation in recordings that other musicians have made. I am now ready to share the knowledge I have gained about the performance practice relative to the types of ornaments and the proper implementation thereof, to offer a survey, with examples, of choices other performers have made for the presentation of these pieces, and to perform my own version of one of the 12 Fantasias.

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In-Situ Bioremediation of Explosive Residue for Reduction of Trace Signatures

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Background levels of explosive residues in areas of heavy warfare and/or frequent improvised explosive device (IED) attacks pose long-term health risks to civilians and hamper detection of buried explosive threats by methods detecting explosives-specific signatures. Current methods of bioremediation include collecting contaminated soils into composting windrows or treatment of soil slurries in a reactor augmented with microbial or fungal inoculants, which are limited by the need to move large amounts of soil while requiring large areas for processing. In this study we investigate approaches to stimulate natural microbial degradation of 2,4,6-trinitrotolulene, and other nitrogen containing explosives *in situ* through addition of microbial "fertilizers" with the goal of reducing trace signatures, increasing detection probability of buried explosives. These fertilizers are carbon and phosphate sources designed to support growth of microbes specifically capable of using explosive compounds as nitrogen sources. We have demonstrated that TNT-degrading microbes are common to uncontaminated soils, by isolating microbes from all sites analyzed to date. We have also developed/identified analytical methods for assessing TNT degradation. Future efforts focus on biochemical and genetic characterization of isolates, and application of analytical techniques to identify carbon and phosphate combinations that generate the highest level of degradation by indigenous microbes.

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Annotation of Highly Up-/Down-regulated *Aedes aegypti* Genes and Investigation of their Anti-Dengue Activity

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As many as 100 million cases of dengue infection occur annually. The continued challenges in vaccine development and mosquito eradication efforts show an urgent need to find new methods of control. The RNA virus is transmitted between human hosts by mosquitoes, primarily *Aedes aegypti*, as a bloodmeal is taken. Many *Aedes aegypti* genes that code for proteins of unknown function are currently not annotated. In this work, we used BLAST to search for homologues in other organisms of the most highly up-/down- regulated genes from several *Aedes aegypti* microarrays comparing gene expression in various mosquito body compartments. This annotation will aid in achieving the following aims: first, to learn which genes are specifically expressed in each compartment, and which genes are ubiquitously expressed throughout the mosquito; and second, to assess the effect of dengue virus (DENV) infection on gene expression. Our preliminary results show that many of these unannotated genes do not seem to be transcriptionally regulated during DENV infection, but these findings do not rule out their importance. Further analysis and a better understanding of genetic function could lead to the identification of novel strategies of dengue control.
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Intuitive Fluorescent Biosensor for Millimolar Glucose

***Sadella C. Santos**, Leah Tolosa, KarunaSri Mupparapu , Govind Rao*
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The purpose of this research is to create a more intuitive glucose biosensor. Sensors previously developed at CAST are structured by placing the fluorescent dye on the opposite side of the binding site. These sensors detect concentration levels in micromolar levels or lower, and show that an increase in glucose concentration corresponds to a decrease in fluorescence signal. These readings are not ideal because most clinically relevant concentrations are in the millimolar levels, the relationship between increased concentration and decreased signal is not intuitive, and the decrease in signal can be confused with various systematic errors. Research was done by changing the placement of the fluorescent dye so that it is situated next to the binding site by using the E149C GBP mutant and labeling this site with the dye IANBD. In addition, Ala-213 was replaced with Arginine to create the E149C/A213R GBP mutant. Based on previous research, the change in binding site and placement of dye is predicted to show an increase in fluorescence signal with an increase in glucose, and the detection of concentrations in the micromolar level. This research can be used to develop a noninvasive and cost efficient sensor for monitoring glucose levels in diabetics.

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Is America Really Singing? A Review of (Supposedly) Common Song Repertoire

Joey B. Schenning, Jr.
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This study examined the relationship between the National Association for Music Education (MENC) *Get America Singing … Again!* campaign and Anne Arundel County's elementary music curriculum. In 1995, MENC released a list incorporating 43 songs that “establish a common song repertoire that 'Americans, of all ages, know and can sing.'” This study investigated differences between the *GAS* common song repertoire, the county curriculum, and the songs my students were actually familiar with. I provided a form to my third, fourth, and fifth graders at a local elementary school where they could mark (based on sound clips) whether or not they were familiar with a song. Students were asked to fill in the title if they knew it. Additionally, I polled current music teachers from other regions to compare any songs from this list that may have been missing, perhaps for regional reasons. Afterward, I supplemented the students with the songs they were not familiar with, ensuring they receive a well-rounded and multicultural musical experience.

Using Musical Instruments to Support Student Learning

Alexander R. J. Scott
Linda Oliva, Assistant Professor, Department of Education

Educational research shows that overall, subject matter retention rates between primary grades, especially in cultural-arts subjects, are very low. While classroom teachers try their best to use educationally sound methods in order to foster a greater subject matter retention, students seem more likely to forget content knowledge in areas that "just don't matter" as much as the heavily emphasized tested subjects. This study explored the effect that incorporating musical instruments in the general music classroom had on students' learning of important music concepts, such as the make-up of a pentatonic scale. I devised a set of lessons that introduced the students to the glockenspiel and the correct way to play it. This unit included lessons which focused on the pentatonic scale and its construction. By the end of the unit, about 90 percent of the students were able to correctly identify that the pentatonic scale was made distinctive from other scales because of its usage of the interval of a skip. In classes that the students did not use the glockenspiel to learn the pentatonic scale, the retention rate was much lower.

The Socialization Goals and Parenting Behaviors of Korean Immigrant Mothers and their Children's Outcomes

Annah Seo
Charissa S. L. Cheah, Associate Professor, Department of Psychology

Culture influences many aspects of parenting, including parents' expectations of their child and which behaviors parents use to achieve their goals. In the case of Korean immigrants in the U.S., mothers incorporate Western parenting practices as well as more traditional Korean child-rearing practices. In our previous research, Korean American mothers' socialization goals predicted their children's conduct, peer relationship problems, and prosocial behaviors. However, the mechanisms through which parenting goals are related to child outcomes remains unaddressed by the limited literature on Korean-American parents and children. Moreover, no studies have conducted actual observations of Korean immigrant mothers' behaviors. This project examined the associations between seventy Korean immigrant mothers' (1) socialization goals and observed parenting behaviors and (2) observed parenting behaviors and their children's social, emotional, and behavioral outcomes. Korean immigrant mothers' behaviors with their three-to-six-year-old children were observed during a free-play session (warmth, control, sensitivity, positive and negative affect, and Korean-specific parenting behaviors). These findings will contribute to our understanding of intracultural variations, the belief-behavior relations, and methodology (parental report versus observations) in the study of parenting and family functioning. These findings will also provide needed information on factors that predict effective parenting and the healthy behavioral adaptation of Korean immigrant young children.

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Plantation Management in Post-Reconstruction South Carolina: White House Plantation and the Aimars

Sarah Elise Sexton
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Plantations in the South during and after Reconstruction suffered financially for a variety of reasons, including inability to adapt to Emancipation, inability to secure credit, low land values and lack of crop diversity. What then would cause two successful apothecaries to buy a plantation in 1871, when many plantations were struggling? In 1871 two brothers, Charles Pons and George Washington Aimar, who co-owned a successful apothecary in Charleston, South Carolina, bought White House Plantation on Toogoodoo Creak, thirty miles from Charleston. Hired managers sent regular updates to the brothers about the Plantation's doings, from 1871 until it was sold in 1898. These letters are a valuable source of information on post-Reconstruction Plantation management but must be contextualized. This work seeks to understand White House Plantation through these letters and in the context of the times, place, and lives of the brothers, as well as to understand their motivation for owning a plantation. In addition to the letters, other primary sources include the Plantation's ledger, legal papers, and personal documents belonging to the brothers. Many of these items, including the letters, are in the collections of the South Carolina Historical Society, others are in private collections of family members.

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B7H1 Expression in Lung Cancer: A Potential Therapeutic Biomarker

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The immune system has the ability to recognize and destroy tumors. Therefore, tumors have developed ways to evade the immune system. In the body, tumors protect themselves by inhibiting immune function by inducing T-cell tolerance via expression of coinhibitory ligands. PD1 receptor engagement on the surface of T-cells by one of its ligands, B7H1, inhibits their function and is useful for the prevention of autoimmune diseases. In tumors, however, PD1 engagement by B7H1-expressing tumors has been shown to create tumor-specific T-cell tolerance. In this study, we hypothesize that one medium by which lung cancer cells evade immune detection is by expressing B7H1. To test this hypothesis, we stained human lung cancer cells with B7H1 antibody and evaluated expression by Fluorescence Activated Cell Sorter (FACS) and immunohistochemistry (IHC). We found that the cancer cells which expressed high levels of B7H1 by FACS were also showing positive signs of staining through IHC and therefore, FACS staining correlated with IHC. Our findings suggest that it is feasible to determine B7H1 expression of biopsy samples from patients using IHC. We propose that biopsy samples from patients with high levels of B7H1 might indicate that they are good candidates for successful anti-PD-1 immunotherapy.

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Toward Tactile Authentication for Blind Users

Shiva Sharma
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An authentication mechanism has been adapted to enable individuals who are blind to access electronic data using their sense of touch. To enter the system, users must identify a set of pre-selected pin-based stimuli from a wider range presented via a tactile mouse. Findings from an empirical study conducted as part of the research, reveal that 16 participants were able to authenticate access to the system over the course of a one month period, with low levels of error. The approach was found to offer benefits over conventional authentication mechanisms. The tactile authentication system offers an inclusive experience enabling access to users regardless of level of sight. As information is presented underneath the user's fingertips, 'tactile passwords' are shielded from the view of observers. As the sense of touch is personal to each user, tactile stimuli are difficult to describe in concrete terms, and cannot easily be written down or disclosed to others, thereby enhancing security from third-party attacks.

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

The Politics of the Criminal Justice System: An Anthropological Perspective

Tomiko Shine
Sarah E. Chard, Assistant Professor, Department of Sociology and Anthropology

This ethnographic study examined the effects of imprisonment on the lives and families of three African-American men, aged over 50, who were imprisoned for over fifteen years in the 1960s to1980s. The incarceration rate in the United States has risen dramatically over the past thirty years and African-Americans are disproportionately represented within prison populations. Although thirteen percent of the overall population is African American, 40 percent of the prison population is African-American. Critics of the criminal justice system note that this high incarceration rate produces numerous challenges for African-American families and communities. Using open-ended interviews with participants and participation-observation of community events on community re-entry processes, I explored the men's perceptions of the cultural and social effects of their incarceration. The men described both their historical experience and the ways in which their previous incarceration has continued to shape their lives in the present. Taking this approach identified a broader social-political context of incarceration, narrating not an African American story, but in fact an extension of the American story.

Increasing Depth of Homework Assignments: Integration of Writing in Chemistry

Jonathan J. Shumway
Linda M. Oliva, Assistant Professor, Department of Education

It is important for educators in science, technology, engineering, and math classes to design meaningful and effective homework assignments that will increase their students' critical thinking skills and academic performance. Homework assignments can be structured to support active processing of important concepts reviewed in class. This study examined the effects of homework that was writing intensive in a local high school chemistry class. There were four groups of students that were under study. Two groups were labeled, "problem intensive," and the other two groups were labeled, "writing intensive." The problem intensive groups were assigned traditional chemistry problems to solve for homework. The writing intensive groups were asked to explain their homework answers and methodology in a systematic fashion and to elaborate on their thoughts and problem solving method each step of the way. Furthermore, the students in the writing intensive group were asked to write a double journal entry every night by writing their thoughts and notes in their own words and synthesizing and reinforcing the knowledge learned in class. Data from student performance, critical thinking, and their perspectives of each condition were compared.

Hippocampal Activity in the Neonatal Ventral Hippocampal Lesion Model of Schizophrenia

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Schizophrenia is a debilitating disorder affecting approximately one percent of the US population. The disease is characterized by symptom clusters including hallucinations and delusions, social withdrawal and anhedonia, and cognitive dysfunction. Previous research has shown disrupted morphology and function of the hippocampus, a brain region implicated in long-term memory and consolidation of multiple cortical inputs, in human schizophrenic patients. Multiple theories have proposed altered interneuron function and GABAergic signaling, suggesting cortical disinhibition. Interference with hippocampal maturation has been shown to cause deficits in inhibition through disrupted modulation of interneurons in prefrontal cortex by dopamine. A neonatal ventral hippocampal lesion model mimics symptoms and pathologies of the disease that emerge in late adolescence, similar to the disease. While abnormalities in cortex exist in this model, little is known about the electrophysiology of the remainder of the hippocampus. In this series of experiments, juxtacellular recordings are used to record basal firing and field potentials in the hippocampus in anesthetized rats. Furthermore, electrodes are implanted in the hippocampus to measure activity in the behaving animal. This work will determine whether the disinhibited state observed in prefrontal cortex in this animal model can be extended to other cortical regions and in the hippocampus.

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Patient Identification and Diagnosis Using Fourier Analysis and Beam Forming of Multi-electrode Brain Wave Signals

David Shyu
Fow-Sen Choa, Professor, Department of Computer Science and Electrical Engineering
Elliot Hong, Associate Professor, Department of Psychiatry, University of Maryland

Electroencephalography (EEG) measurement can record electrical activity produced by the neurons firing in the brain. The double-click-auditory-response of EEG signals was used to identify schizophrenic patients. In a normal brain, the gating effect (suppression of responses from repeated signals) is typically seen when the same stimulus is heard more than once. However, it is not a perfectly reliable method since occasionally the patient-group response also shows significant suppression. By comparing Fourier spectra of the first and second auditory EEG responses, our initial data have shown that the Fourier spectra of normal people brain waves overlap well even though their pulse energies are different. However, Fourier spectra of patients' first and second EEG responses are quite different. A MATLAB program is developed to evaluate the score of brain wave response by calculating the cross-correlation function of these Fourier spectra. Initial results show successful differentiation of scores among control and patient groups. More data is currently being analyzed to verify the effectiveness of the method. Furthermore, most seizures are usually caused by abnormal electrical discharges in the brain. To locate the problem area we also implemented beam-forming code to combine with multi-electrode signals and achieve position locating of specific brain signals.

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

Writers and Artists Together: Design Students Interpret the Words of *Bartleby 2011*

Kayla Smith, Lisa Nicholson
Sally Shivnan, Senior Lecturer, Director of Writing and Rhetoric, Department of English
Guenet Abraham, Associate Professor, Department of Visual Arts

This exhibit showcases the collaboration of UMBC's student poets, fiction writers, and essayists with its most talented graphic design students, by displaying the design students' visual interpretations of the written works in the 2011 issue of *Bartleby*, UMBC's creative arts journal. Each design student has produced an image for a single poem, story, or essay, incorporating some or all of the text into the image. To ensure that each image is the artist's own unique and independent interpretation, design students produced their work without the consultation of the authors. Authors were only permitted to see the visual interpretation of their work after it had been completed. The text of each written work appears beneath the poster-size image. This project celebrates the release of *Bartleby* 2011 and the work of its staff—an interdisciplinary effort involving students from across many majors, who bring together writing and art from students across the university community. At the exhibition, *Bartleby*'s editors will be on hand to talk about their work producing the new issue.

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

Limiting the Distractions of Cell-Phone Use in the Classroom

Christian F. Solliday
Linda Oliva, Assistant Professor, Department of Education

Despite the fact that there is a school-wide policy against having cell phones in the school building, students' use of cell phones during instruction is pervasive. Students' cell phone use was distracting them from their work and included sending and receiving text messages, sending and receiving emails, talking, listening to music, and surfing the Internet. This study investigated the effect of positive behavioral interventions on student cell-phone use in two high school social studies classes. Students were rewarded for keeping their cell phones out of sight at all times during class. Students who did use their phones caused the entire class to be excluded from the reward of receiving candy. The successful completion of eight consecutive weeks would result in a pizza party for the class. After four weeks without success students were then given rewards on an individual basis every five days, since most violations were continually commited by the same students. Eight students (four who received rewards and four who did not) were interviewed to explore the reasoning behind the use of cell phones and the effect of various reinforcements.

Hiccupping: Who Does it and When?

Skylar M. Spangler, *James Koehler, Marcello Cabrera, Jessica Nave-Blodgett, Schnaude Dorizan, Iman Kennedy*
Robert R. Provine, Professor, Department of Psychology

Hiccups have been a mystery since antiquity, but more effort has been made to stop than understand them. Hiccups are performed by all members of our species, but their function is unknown. Attempts to explain hiccups typically consider them as vestiges of an act useful in our evolutionary past, or before birth. Hiccups, or hiccup-like behaviors, are performed by many vertebrates, and hiccups are one of the most common behaviors before birth. Intractable hiccups are also a common consequence of thoracic surgery in older, mostly male, patients. Although hiccupping involves many interesting evolutionary, developmental, and medical issues, we focused on concrete facts about hiccups, not speculations about their function, history, or physiology. Our task was to describe the frequency of hiccupping from birth to old age, seeking possible age- and sex-related trends. We dealt with the infrequent and unpredictable occurrence of hiccupping by having males and females of varying ages describe the time since their most recent bout of hiccups then analyzing the frequencies. Age and sex differences suggest underlying maturational and hormonal processes that influence hiccupping. This study is the first detailed description of hiccupping during postnatal life and defines the motor act that subsequent neurobehavioral analyses must explain.

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Retinal Expression and Pressure-sensitive Modulation of CCR5, CCR3 and CCR1 in Glaucoma

Monét M. Stanford, *Nicholas Ward, Heather Cathcart*
Rebecca Sappington, Assistant Professor, Vanderbilt University School of Medicine

Glaucoma is characterized by loss of retinal ganglion cells (RGCs), whose axons form the optic nerve, and is often accompanied by elevated intraocular pressure (IOP). RGC sensitivity to IOP involves signals from astrocytes and microglia. We sought to identify cell types that could respond to CCL5 in the retina by determining the expression patterns of three chemokine receptors known to bind CCL5, which are CCR1, CCR3, and CCR5. Cell-type-specific expression was assessed by triple label fluorescent immunohistochemistry, where labeling for CCR1, CCR3 and CCR5 was compared to that of cell type specific markers in C57. We compared CCR3 and CCR5 localization with CCL5 localization in DBA/2 mice, as a function of age and IOP. In normal C57 retina, CCR1 was not present, but CCR3 and CCR5 localized to RGCs and astrocytes. Interestingly, CCR3 labeling was greater in astrocytes, while CCR5 labeling was greater in RGCs. In the DBA/2 mouse, comparison of CCL5 labeling with that of CCR3 and CCR5 indicated close proximity of CCL5. In RGCs, CCL5 was expressed along with both CCR3 and CCR5. These data suggest that CCL5 signaling is altered in the DBA/2 mouse model and that both astrocytes and RGCs are viable targets of this signaling. Furthermore, the expression of CCL5 and its receptors by RGCs, suggests a possible autocrine function.

This work was supported in part by a training grant (T32-EYO7135, P30-EY008126) which provides funds for research in eye and vision science. The Vanderbilt Vision Research Center provides a focus of activity and interaction that facilitates collaborations among investigators. This work was also supported by a Career Development Award from Research to Prevent Blindness, Inc.

NMR Analysis of the Conserved Bulge in the Core Encapsidation Signal of Type-C Gammaretroviruses

Patrice S. Starck*, Trevor Mathias, Sabrina Ngo, Yasuyuki Miyazaki, Michael F. Summers*
Michael F. Summers, Professor, Department of Chemistry and Biochemistry and Investigator, Howard Hughes Medical Institute

All known Type-C gammaretroviruses have two stemloops (SL-C and SL-D) harboring a GACG tetraloop and a uni-stemloop bulge in the 5′-untranslated region. SL-C is of particular interest because it is know to promote dimerization, which is necessary for genome packaging. The consistency with which the bulge occurs implicates its structural importance. The Moloney Murine Leukemia Virus (MMLV) and the Mouse Endogenous Virus (MEV) have different bulges on SL-C: a GGAA bulge, and GUA bulge respectively. Interestingly, the Gibbon Ape Leukemia Virus (GALV) does not have a significant bulge on SL-C. Instead, it has a GUA bulge on the 5’ side of SL-D. Previous nuclear magnetic resonance (NMR) analysis revealed that the second and third bases (G339 and A340) of the Moloney Murine Leukemia Virus’s bulge form a syn conformation. NMR analysis in this project also suggests a syn conformation for the bulges of GALV and MEV, which has a significant effect on structure, as well as the multiple conformations of the stemloops. Understanding more about these structural motifs may give insight into the function of these bulges.

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Human Capital Explanation of the Gender Wage Gap, 1875-1950

Marie Steele
William Lord, Professor, Department of Economics

The gender wage gap, 1-λ, has varied over time. I reviewed the literature on how λ changes and developed a novel model incorporating important determinants of λ, which have not been looked at all together before. I examined whether the change in λ can be explained by skill (i.e., human capital) differences and also considered discrimination. The equations below specify human capital by gender in terms of physical strength (important in the nineteenth century), formal schooling, and job experience.

$$h_{ft} = \left[h_{0ft} + \hat{h}\right] * E_{ft}$$
$$h_{mt} = \left[h_{0mt} + \hat{h}\right] * E_{mt}$$
$$\hat{h}_{(t+1)} = v * x_t^{\theta_1} * s_t^{\theta_2} * h_t^{\theta_3}$$

Here h_{ft} and h_{mt} are the human capital of females and males respectively at time t; h_{0ft} and h_{0mt} are the human capital from 'birth' (such as physical strength); $\hat{h}_{(t+1)}$ is the human capital acquired through schooling; while the E_{ft} and E_{mt} capture increases in human capital from on-the-job experience. The $\hat{h}_{(t+1)}$ term increases with the goods, *x*, and student time inputs, *s*; the θ_is reflect the productivity of those inputs in producing $\hat{h}_{(t+1)}$. λ is then determined by the ratio h_{ft}/h_{mt}. I found the data necessary to test this model of λ over the period 1875-1950. The model calibration accords well with the actual path of λ.

The Cool Kids Call Them C-Notes: The Effectiveness of Cornell Notes in a Social Studies Class

Hope Stone
Linda Oliva, Assistant Professor, Department of Education

The Advancement via Individual Determination (AVID) program incorporates Cornell Notes in which the students are asked to form questions, summarize, and reflect on the material given. Students are given a number of skills and tasks that must be completed for the average student to be successful in upper level classes. Study skills and note taking are absolutely crucial when these students enter higher institutions, but are they set for success with the practice of Cornell Notes? This study examined the effect of using Cornell Notes on student performance in a Social Studies Course. A survey was conducted to gather student perspectives about the use of Cornell Notes. Student performance data in classes that used Cornell Notes and classes that did not were compared.

Building a Mathematical Model to Understand the Molecular Interpretations of Spatial Gradients of Biological Activators

David P. Stonko, Xuan Ge
Bradford E. Peercy, Assistant Professor, Department of Mathematics and Statistics
Michelle Starz-Gaiano, Assistant Professor, Department of Biological Sciences

Small alterations in biochemical signaling can be transformed into major differences in cellular decisions. Our interdisciplinary project revolved around the conserved Signal Transduction and Activator of Transcription (STAT) signaling pathway and the regulation of cell decisions. The STAT pathway is essential in stem cells, immune function, and some cancer progression. We took advantage of a simple system in Drosophila ovaries to identify the mechanism that determines STAT activation and results in the transition of stationary cells to migratory ones. STAT activation is initiated by diffusible molecules radiating from a localized source, generating graded activation in neighboring cells. Cells closest to the source robustly activate downstream signaling, and become mobile cells; distant cells downregulate signaling and are stationary. A heuristic model of the molecular interactions can capture how graded signal is converted to activation of motile cells. We analyzed this model to determine the critical parameters and determined its underlying mathematical structure and relationship to the biology. We began to construct a biophysical model to inform new testable hypotheses. We will continue to polish this biophysical model and conduct genetic and cell biological experiments to understand how epithelial cells can convert analog information into the binary activation of a molecular pathway.

This work was funded by a grant from the National Science Foundation for the UBM Undergraduates in Biological and Mathematical Sciences program.

Effectiveness of Spin-on-Glass Films on Reducing Dielectric Breakdown in Poled Polymer Devices

David A. Sweigart
L. Michael Hayden, Professor, Department of Physics

We investigated the effect of Spin-on-Glass (SOG) layers as charge barriers which help to prevent dielectric breakdown in sandwiches of electro-optic (EO) polymers during high-field electric poling. Thin film samples of EO polymers were prepared consisting of mixtures of guest chromophores embedded within a polymer host. Application of an electric field, at a temperature above the polymer's glass transition temperature, results in a partial alignment of the guest chromophores. Higher poling fields give rise to better chromophore order which is directly related to the macroscopic optical nonlinearity. The poling efficiency is severely limited by the onset of dielectric breakdown. The poling field where breakdown occurred could be increased by insulating the polymer film with sub-micron thick SOG barrier layers, leading to enhanced poling field strengths and larger EO coefficients. These results show that our poling technique using SOG layers may be a promising method to create improved EO polymer devices for a broad range of applications including EO modulators and THz emitters and sensors.

This work was funded, in part, by a grant from the National Science Foundation No. DMR 0120967 and through the Undergraduate Research Assistantship Support program from the UMBC Office of the Vice President for Research.

Sinless

Diego Tapia
Frederic Worden, Associate Professor, Department of Visual Arts

Many films today focus solely on entertaining audiences and are reluctant to take on difficult or controversial subjects. My short film, *Sinless*, takes another approach. It is the story of an adult man who gets sexual satisfaction from molesting young children. The film attempts to work in a short-form fictional format to convey both the tragic consequences of child abuse for the young children involved and the conflicted feelings and motivations driving the adult abuser. The film does not offer a happy ending or other Hollywood-style explanations for the fact of child abuse, which is a pervasive and often hidden facet of contemporary society. The film was shot on location using a Canon T2i DSLR camera and a H4n Zoom recorder for capturing sound. It was edited using Final Cut Pro 7 editing software. *Sinless* investigates a very delicate subject that many prefer to not include in their movie-going experiences. I believe, however, that a film like *Sinless* can be both rewarding for audiences to view and can also raise important issues in our society that need more public awareness.

Characteristics of Kynurenine Pathway Metabolites and Enzymes in Human Blood Cells

Margarita A. Tararina, *Ana Pocivavsek, Robert Schwarcz*
Ana Pocivavsek, Postdoctoral Fellow, Maryland Psychiatric Research Center, Department of Psychiatry, University of Maryland School of Medicine
Robert Schwarcz, Professor, Maryland Psychiatric Research Center, Department of Psychiatry, University of Maryland School of Medicine

Studies in human tissues and body fluids, as well as animal models, implicate the pathophysiology of several immune and central nervous system diseases, including schizophrenia and Huntington's disease, in the impaired function of the kynurenine pathway (KP) of tryptophan degradation. However, only sporadic attempts have been made to examine peripheral KP metabolism in easily-accessible blood cells in humans and to use these measures as indicators of abnormal KP function in the brain. The present study was designed to develop new methodology to investigate the activity of several KP enzymes in peripheral blood mononuclear cells (PBMCs) obtained from healthy volunteers (N = 4). Blood was drawn by venipuncture, transferred into histopaque tubes, and immediately centrifuged (1000 x g, 10 min). The buffy coat was removed, washed with saline, and re-centrifuged to obtain the PBMC pellets, which were used to identify and characterize kynurenine 3-monooxygenase, kynureninase, and 3-hydroxyanthranilic acid dioxygenase activities. Many properties of these enzymes in PBMCs proved to be very similar to the brain. Thus, analysis of the KP pathway in PBMCs may provide a convenient means to monitor KP metabolism in the brain, allowing the study of this pathway under both physiological and pathological conditions.

This research was funded by NIH/NINDS Grant # RO1NS057715 to Robert Schwarcz.

Worthwhile or Wasteful? An Evaluation of Techniques for Measuring the Impact of Business Subsidies

Andrea P. Thomson
Roy T. Meyers, Professor, Department of Political Science

This research investigates (1) Maryland, Pennsylvania, and Virginia's methods of gathering information about the performance of their economic development programs and (2) the use of this information in policy formation and decision making. Most states employ an assortment of development programs to grow local economies. These incentives include business tax preferences, grants and loans. Unfortunately, actual incentive impacts are elusive, hindering state agencies' ability to distinguish between worthwhile and wasteful business subsidies. The product of this research is a set of practical recommendations aimed at addressing this information shortfall while guiding states in the formulation of more effective economic policies. The information in this presentation was gathered though interviews and a review of primary and secondary sources.

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

Investigation of Poly(N-Isopropylmethacrylamide) Hydrogels

Robby L. Tietz, *Steven Manning*
Lisa Kelly, Associate Professor, Department of Chemistry and Biochemistry

The development of molecular thermometers is important in applications such as microfluidics, thermal therapy, and smart packaging where traditional temperature measurement is impractical or impossible. Hydrogels possess the unique physical properties of being stimuli-responsive to numerous environmental variables including temperature and pH. Poly(N-Isopropylmethacrylamide) (PNIPMAm) nanogels have been synthesized via free radical polymerization yielding cross-linked spheres having uniform diameters of 155±1nm. UV-Vis spectroscopy and dynamic light scattering (DLS) have been used to establish a lower critical solution temperature (LCST) near 44°C, at which point the PNIPMAm hydrogels undergo a fully reversible coil to globule transition. DLS was used to determine that the PNIPMAm hydrogels collapse to 84±1nm upon heating through the LCST, and the transition was reversible upon cooling. Size control has been examined and has proven to be possible based upon surfactant concentration used during the polymerization. PNIPMAm is an excellent candidate for future research as a temperature specific molecular thermometer based upon its remarkable physical properties.

This research was supported, in part, by Rohm and Haas.

Opto-Mechanical System Design and Development

Hamilton K. Townsend
J. Vanderlei Martins, Associate Professor, Department of Physics
Anne Marie Spence, Assistant Professor, Department of Mechanical Engineering

The ability to measure and identify anthropogenic aerosols that characterize the formation and maturation of a cloud's microphysics is limited by the frequency and ability to amass data using conventional methods. The established methods used to elucidate the development and behaviors of clouds, such as radar and *in situ* aircraft observations, are inherently flawed in their ability to provide the accuracy and a continuous state of readiness essential to observe a continuous and changing climate. In light of the void for an adequate and cost-effective means to observe cloud formations, new methods of observation are being developed. The Cloud-CubeSat is currently being designed as a low-cost Pico-satellite to provide the remote sensing capabilities necessary in order to obtain an accurate understanding of cloud microphysics and thermodynamic properties. In the Laboratory of Aerosols, Clouds, and Optics (LACO) at UMBC we are currently working with an optical engineer to develop an opto-mechanical system able to encompass one thermal infrared camera, two short-wave infrared detectors, and a visual camera. In conjunction with this effort, we are performing software analysis to determine the stability of the proposed optical system with respect to static and dynamic loading.

This work was funded through a NASA Goddard Educational IRAD grant and other internal resources for FY 2010.

Investigating the Technique and Legacy of José Limón

Franki Trout
Douglas Hamby, Associate Professor, Department of Dance

The dance piece I developed, titled "Aftermath," explores the effects of the recent Haitian earthquake. It uses the principles of Limón technique to realize my own artistic vision. José Limón was a leading founder of American modern dance, and a major influence in the dance world during his lifetime. My research involved learning his specific technique from the dancers in the José Limón Dance Company, who maintain his legacy by continuing to perform his choreography and teach his technique to the next generation of dancers. The Limón technique principles of fall and recovery, breath, suspension and musicality are useful in preparing the dancer to perform any type of movement. My work explores the chaos, devastation, and loss of the Haitian earthquake that occurred in 2010. The Limón style lends itself to the content and focus of the piece which deals greatly with the human condition and emotional experiences. "Aftermath" demonstrates that the blending of dance ideas and practices from past artists is valuable to a dance world that is constantly changing and evolving.

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

Understanding the Interaction between Melanopsin and Arrestin Using FRET

Devyani T. Ujla*, Evan Cameron*
Phyllis Robinson, Professor, Department of Biological Sciences

A small subset of retinal ganglion cells known as the ipRGCs regulate non-visual processes including pupillary light reflex, circadian rhythmicity, and sleep. These processes are mediated by the photopigment, melanopsin, expressed in the ipRGCs. Upon illumination, melanopsin initiates a signaling transduction cascade within the cell. This signaling causes a depolarization resulting in action potentials that carry light information to higher order processing centers in the brain. Like most G-protein coupled receptors (GPCRs), melanopsin signaling is attenuated by GPCR kinase phosphorylation. This phosphorylation is a cue for arrestin binding which terminates the signal. However, it is unknown if arrestin deactivates melanopsin. In mammals, three types of arrestins are expressed: visual arrestin, βarrestin 1 and βarrestin 2. Studies have shown that βarrestin 1 and 2 are co-expressed with melanopsin, while visual arrestin localizes exclusively in the rods and cones. Therefore, we hypothesize that melanopsin is deactivated by either βarrestin 1 and/or 2. Using Forester Resonance Energy Transfer (FRET) we will determine the degree with which melanopsin and arrestin interact. To date, we have successfully constructed melanopsin–eCFP, βarrestin 1–eYFP, and βarrestin 2–eYFP expression vectors. Also, we have expressed these constructs in HEK-293 cells and verified their expression and localization using confocal microscopy.

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Innovations in Computer Game Development

UMBC Game Developers Club: Jonathan Moriarty, Joseph Breeden, Fernando Lynch, Gini Bailey, Ben Webber, Lauren Sparks, Kenneth Miner, Nathaniel Lam, Alex Dixon, Alex Grube, Gal Afik, Ryan Griffen, Kewn Marhey, Mark Jarzynski, Richard Lee, Eve Addison, Zoe Kilbourne, Kevin Somers, Cory Mewborn, David Kim, Colin taylor, Grg Aring, Nicolas McAvoy, Jonathan Hicks, Daniel Weber, Patrick Ly, Carrington Dennis, Josh Poole, AugustoBlomer, Katharine Jay
Neal McDonald, Assistant Professor, Department of Visual Arts

Every year the UMBC Game Developers Club works as a group to explore the field of game development in new ways. The GDC focuses on making fun games with innovative concepts and creative mechanics. This year our club will present four projects, in both 2D and 3D environments. Light is a 2D platformer focused on the concept of bending light to solve puzzles. City of Gears (COG) is a steam-punk tactics rpg infused with classic Multi User Dungeon (MUD) elements. Titan is a 3D physics-based shooter aiming to make use of gravity mechanics in new and interesting ways. Slug 3D is a frantic platformer experience leaving the player vulnerable but giving them options when moving around in the world.

Nigeria's Resource Curse: Conflict in the Niger Delta

Amond U. Uwadineke
Carolyn Forestiere, Associate Professor, Department of Political Science

The goal of this research was to gain a better understanding how the presence of oil in the Niger Delta has influenced conflict within this important region in Nigeria, and how this natural resource has hindered the development of the political institutions of the Nigerian State. Three important themes were addressed in this research: 1) the "resource curse" in Nigeria, 2) ethnic identity in the Niger Delta, and 3) the different types of conflicts found within the Niger Delta. The Niger Delta region produces enormous oil wealth for the Nigerian state, but there is a paradox in which the people of the Niger Delta have not benefited from the vast oil wealth. After many years of neglect, many of the ethnic groups that inhabit this region have been making their voices heard with both peaceful protest, and armed resistance in support of their demand for a greater share of Nigeria's oil revenue. The research questions were answered using data from local reports by non-governmental institutions, parastatals, multinational companies, and books on the Niger Delta. Finally, the importance of this research is that it sheds light on a struggle within a country that is the fifth largest source of imported oil for the United States.

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

Determining Student Engagement through Various Warm-Up Activities

Ashish M. Vadalia
Linda Oliva, Assistant Professor, Department of Education

Most research that has been done on the relationship between student engagement and content comprehension shows that there is a need for teachers to actively engage students from the onset of class; however, the best method to accomplish this task is not clearly stated. This study investigated how students responded to three different types of warm-up activities: recall activities, preview activities, and off-unit content-related activities. Both objective and subjective forms of assessment were conducted through three standard and honors high school chemistry classes. The objective assessment consisted of student grades on warm-up drills, while the subjective assessment was conducted through post examination surveys. The analysis of the data shows that students found the off-unit activities most enjoyable; however the recall activities were the ones that showed the fastest transition to full-class engagement.

Body Mechanics: Applying Suzuki, Viewpoints and Delsarte System of Expression to Stage Performance

Shaun Vain
Alan Kreizenbeck, Associate Professor, Department of Theatre

Every individual possesses a refined vocabulary for expression. As we dance, play basketball and stand on a subway train, we are transmitting and receiving countless signals relaying information about ourselves, other individuals and the space which surrounds us. We all possess the ability to decipher body language, a skill we use in our daily activities. I have devoted much of my research to testing and understanding this language, through observing daily habits of myself and other individuals and by applying body language in a laboratory. This skill must be refined for the successful performer. Suzuki training works with the ability to manipulate the body's center. Viewpoints polishes one's ability to control and maintain space and time. Delsarte System of expression is a unique formulaic method of introducing body mechanics, gestures and physical chemistry. Performers instructed with these methods have the ability to collaborate, bringing essential elements of their own imagination and dynamics of the given space to life. The goal of understanding body mechanics and expression is to be able consciously relate to another individual. This work is being applied to workshops for the UMBC community and will culminate in a performance for URCAD.

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

Life of an Assassin

Daniel Vakharia
Frederic Worden, Associate Professor, Department of Visual Arts

With the recent emergence of digital single-lens reflex (DSLR) cameras in the film industry, it has become much easier to produce high quality videos that rival the film medium. My video *Life of an Assassin* is a short video that illustrates the DSLR camera's ability to generate the "film look." In the making of this video, I took advantage of the camera's 1080p high-definition resolution and interchangeable lenses to create a high-resolution picture with a shallow depth of field. In addition, I employed the technique of double-system sound recording to make up for the camera's weak internal microphone. The use of DSLR cameras, such as the one I used for my film, is gaining in popularity with professional filmmakers. In my film, I deal with the narrative challenge of working in an established genre and finding a fresh approach that leads to truly surprise ending. I had to think of visual ways to set up the surprise and had to pace it in a certain way to deliver the surprise at the end in the most effective manner possible. I also experimented with the hybrid mixture of comedy and suspense in a short narrative. The screening of *Life of an Assassin* will demonstrate the results of this revolutionary new method of filmmaking and will highlight the rapid technological developments that characterize contemporary filmmaking.

Detection of Attaching/Effacing *E. coli* in Human Tissue

Claudia P. Valenzuela
Michael S. Donnenberg, Professor, Department of Medicine
University of Maryland Baltimore, Division of Infectious Diseases

Enteropathogenic *Escherichia coli* (EPEC) use a type III secretion system to attach to host cells and efface microvilli (A/E). Preliminary data suggest a correlation between colorectal cancer and A/E *E. coli* (AEEC) colonization. In this work, bacteria recovered from colon tissue were examined to validate and further define the association between AEEC and colorectal cancer. A multiplex PCR (MPCR) that distinguished among typical EPEC, atypical EPEC, and enterohemorrhagic *E. coli* (EHEC) based on the presence of genes was optimized. No AEEC were detected from colectomy samples taken from patients who had received antibiotic treatment prior to surgery. Biopsy samples taken during colonoscopy from normal colonic tissue yielded five colonies positive for genes found in AEEC, from two patients. Further examination of these bacteria will be performed to characterize the samples as EHEC or atypical EPEC. Hence, preliminary results suggest that antibiotic pretreatment of patients may alter the microbial population prior to our examination; evaluation of this possibility through resistance screening of recovered bacteria is underway. To test the hypothesis that the incidence of AEEC colonization is higher in tumor samples than normal tissue additional assay optimization and increased sample numbers will be required.

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Effects of Environment Dimensionality on Sensory Neurons Process Outgrowth and β1-Integrin Cytoskeleton Signaling

Shelby L. Vargo, *Andreia Ribeiro*
Jennie B. Leach, Clare Boothe Luce Assistant Professor, Department of Chemical and Biochemical Engineering

The purpose of this study was to demonstrate that environment dimensionality (i.e., 2D culture substrates vs 3D "tissue-like" scaffolds) alters neuronal behavior by modulating neuronal signaling. For this study we cultured mouse sensory neurons on 2D and within 3D collagen substrates, stained the neurons using immunohistochemistry and then used confocal microscopy and image analysis to analyse location and expression levels of key signaling molecules regulating neuronal differentiation. We examined and quantified neuronal features and expression levels of β1-integrin, focal adhesion kinase (FAK) and FAK phosphorylation. We observed that 3D environments impose changes in matrix-ligand organization and alter neuronal behavior by modulating β1-integrin cytoskeleton signaling. Neurons sense the dimensionality of their environment and in 3D signaling molecules are usually more diffused throughout the neuron in response to the cell adhesion to a surrounding matrix. Furthermore, FAK phosphorylation is altered at tyrosine 397 which was demonstrated by the underexpression of this molecule in 3D. Ultimately, 3D-cultured neurons adapt a morphology that better mimics neurons *in vivo* than those cultured in 2D environments. Our work challenges the use of traditional 2D culture for understanding the *in vivo* structure of neurons and the mechanisms involved in neuronal behavior in 3D microenvironments.

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Analysis of Oxygen Levels within *S. aureus* Biofilms using Fluorescent Microparticles

***Melissa Velasquez**, Miguel A. Acosta, Mutsa Kambarami*
Julia M. Ross, Professor and Chair, Department of Chemical and Biochemical Engineering
Jennie B. Leach, Assistant Professor, Department of Chemical and Biochemical Engineering

Staphylococcus aureus is a gram-positive pathogen known to cause nosocomial infections by attaching itself onto surfaces and aggregating in hydrated polymeric matrices known as biofilms. Since *S. aureus* biofilms have become increasingly resistant to antimicrobial agents, understanding these bacterial communities is necessary in order to devise new strategies to control such bacterial infections. Studies have shown that carbon and oxygen concentrations affect the process of biofilm removal. Moreover, oxygen concentration has been demonstrated to play a key role in biofilm formation and propagation. However, the specific bacterial response to oxygen gradients within the biofilms is not fully understood, mainly due to the lack of adequate tools to measure or map these gradients. Our objective is to evaluate non-cytotoxic fluorescent microparticles as a versatile oxygen-sensing technology to study the oxygen levels within *S. aureus* biofilms. The luminescent microparticles were synthesized using the Stöber synthesis, which yields monodispersed silica particles. The microparticles were calibrated using an adapted version of the conventional Stern-Volmer model. Additionally, *S. aureus* biofilms were grown on collagen type I gels containing the microparticles for eight hours. Preliminary imaging results show fluorescence as a function of position in the biofilm. This technique will allow us to spatially assess oxygen levels in the 3D structure.

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Life on "Mars": Diversity of Endolithic Microorganisms in a Terrestrial Martian Analog

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Ian M. George, Associate Professor, Department of Physics
Stephen Freeland, Institute for Astronomy, University of Hawaii at Manoa

Though the surface of Mars is currently hostile to life as we know it, past conditions were more conducive to the development of life – and it is thought that organisms may have evolved on Mars early in its history. As the planet cooled and lost much of its atmosphere, life may have retreated to habitats within the subsurface and inside of rocks. The study of terrestrial analogs of Mars gives unique insight into the possibilities for life in extreme environments. This research focuses on the area surrounding the Mars Desert Research Station (MDRS), a Mars analog in southeastern Utah. Rock samples containing endolithic organisms were collected from seven sample sites within a five kilometer radius of MDRS. DNA was extracted from each sample, and the 16S rRNA genes were amplified and analyzed using denaturing gradient gel electrophoresis (DGGE) to determine the species distribution. This distribution was then correlated to the spatial location and rock types of each sample and compared to the Martian environment in order to determine potential habitats where similar organisms may have been able to exist.

This research was funded, in part, by the Maryland Space Grant Consortium.

Crotamine, the Protein from the Venom of the South American Rattlesnake, and its Binding to DNA

Maria D. Vitery, *Richard Karpel*
Richard Karpel, Professor, Department of Chemistry

Crotamine is a protein from the venom of the South American rattlesnake (*Crotalus durissus terrificus*). This 42-residue polypeptide is a nucleic acid binding protein that is capable of penetrating cells and targeting chromosomes. It has the ability to carry plasmid DNA into cells that are actively proliferating. Cell penetration is believed to follow interaction of crotamine with cell surface heparan sulfate proteoglycans. This quality makes crotamine a potential candidate for drug transport. The goal in the lab is to quantify salt dependence, binding site size and affinities of crotamine for DNA. Our experiments focus on studying the binding of crotamine to single- and double-stranded DNA over different ionic conditions. In these experiments, the fluorimeter is used to determine light scattering, which is a measure of particle size. In parallel, we perform experiments that include the usage of a DNA-intercalating dye, ethidium bromide. Ethidium bromide intercalates within DNA and absorbs light at 600nm, and becomes fluorescent when bound to DNA. In these experiments, the interruption of DNA and ethidium bromide fluorescence by crotamine and its reversal by heparin is being quantified.

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Developing a System to Regulate Gene Expression in the Mouse Prostate

Aminah Wali, *Varsha Rao, Charles Bieberich*
Charles Bieberich, Professor, Department of Biological Sciences

The prostate gland is prone to the development of several diseases. One such disease is prostate cancer, which kills 30,000 men in the United States each year. In around 85 percent of prostate cancer cases, levels of the NKX3.1 homeodomain protein are reduced. We hypothesize that restoring *NKX3.1* expression in prostate cancer patients will reduce cancer progression. To study the effect of regulated *NKX3.1* expression in the prostate, we propose to use the Reverse Tetracycline Transactivator (rtTA) system in transgenic mice. The rtTA hybrid protein binds to the Tet-operator (TetO) in the presence of tetracycline, or doxycycline, resulting in transcription of genes controlled by TetO. To drive the prostate-specific expression of rtTA and therefore the mouse *Nkx3.1* gene, we have employed the *Hoxb13* promoter, which demonstrates prostate- and colon-specific expression. Using the recombineering technique, we have generated a bacterial artificial chromosome (BAC) containing both *Hoxb13*-driven rtTA and the *TetO-Nkx3.1* responder. The completed construct will be introduced into mice, and administration of doxycycline to double transgenic mice will induce *Nkx3.1* expression in the prostate. This system will be used to evaluate the effects of restoring *Nkx3.1* expression at various stages of prostate cancer progression.

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A Mouse Model for Inducible Inflammation in the Prostate

Rebecca E. Walter
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The extent of morbidity associated with benign prostatic disease is staggering. Half of men in their fifties display benign prostatic hyperplasia (BPH) symptoms, and prostatitis accounts for over two million office visits annually. Clinical symptoms of BPH and prostatitis have been linked to histopathological inflammation, but no causal relationship has been identified. It has been shown that epithelial cells can exhibit epigenetic changes in response to inflammation, raising the possibility that these changes may underlie clinical symptoms. The goal of this research is to develop an inducible model of prostate inflammation to test the hypothesis that epithelial epigenetic changes occur in response to inflammatory events. Using the Tet-On system, the *IL-1* coding region was inserted downstream of the Tet operator to create a new transgene that will be inserted into mouse embryos. The Tet-O/IL-1 strain will be crossed with mice expressing the *rtTA* gene driven by a prostate-specific promoter. In double transgenic offspring, exposure to tetracycline will induce IL-1 expression and prostate inflammation. By monitoring epigenetic changes occurring in response to inflammation, we hope to understand the relationship between these epigenetic events and symptoms associated with prostatitis and BPH.

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Mesenchymal Stem Cells Provide Protection of Cardiac Ventricular Myocytes by Paracrine Mechanism

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Although human mesenchymal stem cells (hMSCs) are being used clinically to treat heart disease, their mechanism of cardiac repair is uncertain. This study explores the notion that hMSCs provide benefit to cardiac myocytes themselves. Cultured neonatal mouse cardiac myocytes (nMCM) were treated with bacterial endotoxin, LPS, and the proinflammatory cytokine, IL-1β to induce cardiac stress. In fluo-3 loaded nMCMs chaotic intracellular Ca^{2+} signaling was seen following treatments with these agents. Normal Ca^{2+} signaling was preserved when hMSCs were cocultured in transwell dishes for 24 hours, illuminating a paracrine mechanism in this protective effect. In addition, a three-hour treatment of stressed nMCMs with conditioned hMSC media reversed the damage evoked by 24-hour treatments with either LPS or IL-1β. Neutralizing antibody experiments were performed to identify potential mediators of this stress pathway. These studies reveal that IL-18, and not TNF-α, is a mediator of dysfunction caused by LPS and IL-1β. We conclude that hMSCs are able to protect and repair MCMs via a soluble factor that acts by reprogramming of a cardiac signaling cascade involving IL-18. Future studies will identify these soluble factors that underlie this protective mechanism. These new data provide a better understanding of the therapeutic benefits of hMSCs in diseased heart.

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The Past That is Always Present: The Role of Memoir in Identity

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Memoir writing is the gold rush of the twenty-first century. While memoir is certainly a mode of self-expression, it is largely crafted for the reader's understanding. My analytical essay focuses on how the combination of the first-person perspective and a rich description of memories allows memoir to connect to a reader's sense of self in ways that no other genre can. A quiet dialogue occurs, where the reader is invited to live moments of another life and, more importantly, understand how the past is always present in identity. My research includes an annotated bibliography of a handful of memoirs. For the creative component of the project, I traveled to Egypt, where my parents grew up and the majority of my relatives still reside. Based on my experiences, I wrote a series of creative nonfiction essays that explore my parents' emigration from Egypt, my relationship with each of them, and how being raised between two cultures has shaped my identity. My semester abroad in the United Kingdom played a crucial role in how I understand my parents and their immigrant experiences, and those explorations are woven into the overarching story of identity.

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Historic Preservation: Developing Sense of Place on the University of Maryland, Baltimore County Campus

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Preminda Jacob, Associate Professor, Department of Visual Arts
Carrie Sauter, Academic Advisor, Department of Interdisciplinary Studies

This exhibit, *For the Old/Towards the New: Shaping the UMBC Campus*, presents a collection of photographs depicting particular architectural and natural landscapes within the University of Maryland, Baltimore County (UMBC) campus. Some of these places still remain, while others have long disappeared. The photographs, old and new, were collected from various sources, including some that I shot myself. Summaries of the historic significance of each photograph provide an explanatory context that is designed to take the viewer chronologically through places that were lost and the constructions that replaced them, and thereby to reveal UMBC's ever-changing "sense of place." The study of preservation and "place" at UMBC requires an interdisciplinary approach, combining theories and methods from visual arts, philosophy, history, and economics. The preservation of landscapes, leading to the establishment of "sense of place," is necessary in the vitalization of the UMBC campus. Only by recognizing the design theory and public history of the grounds can social engagement come about leading to debate and civil discussion on the future preservation and development of UMBC in terms of aesthetics, sustainability, and economics.

The Role of Human Endogenous Retroviruses (HERVS) in the Pathogenesis of Acute Onset Schizophrenia

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Schizophrenia is a severe brain disorder that disturbs a person's reality, falling within the top ten of debilitating diseases and affecting one percent of the world population. We theorize that endogenous retroviruses are involved in the pathogenesis of schizophrenia. Previous studies indicate environmental factors like birth seasonality and urbanization contribute to schizophrenia. Based on this we propose that an infection could activate endogenous retroviruses that cause the symptoms during adolescence. We hypothesize that activation of proviral DNA during acute phase schizophrenia leads to an antibody response by the patient that can be detected with exogenous retroviruses. To test this hypothesis, serum of schizophrenic patients and match controls were used. Retroviruses underwent protein purification and were analyzed with Western blotting. Patient samples were tested against the retroviral proteins from each retrovirus using ELISA. The results demonstrated that 1) antibodies against unfractionated proteins were present in a greater percentage of schizophrenic patients than controls and 2) purified retroviral envelope gp70 was a better target antigen for identifying than other unfractionated protein fractions. In conclusion, this study supports the theory that retroviruses may contribute to the etiology of some cases of schizophrenia.

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A Digital Skeleton Key to Art: Symbolism of Light and Dark in European Oil Painting from 1500-1900

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Painters of the High Renaissance through Romanticism (1500-1900) used chiaroscuro (contrast of light and dark) as a stylistic and compositional tool to impart symbolic meaning to their work. To aid the study of chiaroscuro, I have devised and codified an algorithm that heightens and abstracts the varying values of light and dark in a digital copy of a painting, permitting a visual analysis that is both qualitative and quantitative. The purpose of such an analysis is to uncover facets of a painting, primarily regarding composition and content, so as to illuminate an artist’s intentions and demonstrate the uses of chiaroscuro. This project has followed a dual track where, on one hand, I had to research the evolution of chiaroscuro to provide historical context, and on the other, I developed a computer program that allows art historian and layman alike to inspect paintings. As an example of how to use the program, I investigated a “vignette,” an inquiry into paintings with a common theme. Example vignettes would include: How do Christian artists portray light around the dead Christ? Do artists convey the sublime in dark or light landscapes? What we think to be the case might or might not be.

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Optimization of Metal Film on Nanostructure SERS Substrate

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Surface Enhanced Raman Scattering (SERS) is a highly sensitive Raman optimization method which has potential applications in national security, disease diagnosis and prevention, and environmental science. SERS measurements provide spectra with narrow bandwidth and vibrational fingerprints, allowing for determination of both the identity and quantity of analytes from ultra-trace level to single molecules. To develop highly SERS-active and reproducible substrates for intracellular analysis, our lab is investigating the substrate fabrication protocol that produces the optimal SERS effect with a well characterized molecule, mercaptobenzoic acid, and applying the protocol to characterize various biomolecules. To do this, a solution of silica spheres was drop-coated onto glass slides to achieve the appropriate surface roughness. Silver was evaporated onto the spheres at various thicknesses to achieve SERS activity. UV-visible reflectance measurements were then conducted to ensure that the wavelength of the surface plasmon absorption was within the range of the SERS excitation. Using mercaptobenzoic acid of $1x10^{-5}$ M concentration, SERS enhancement factors as much as 10^6, relative to spontaneous Raman, were achieved using the optimized substrates. The optimal silver thickness for SERS enhancement was 160 nm. Future work includes using gold substrates to analyze biomolecules including elastin, collagen, hemoglobin, and albumin bovine serum.

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The Costly Tradeoff between Immune Response and Enhanced Lifespan in *Drosophila melanogaster*

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Many studies on a wide range of taxa have found that the ability of individuals to fight infection declines with age. There are also studies suggesting that immunity and life span are linked genetically. To understand and test the genetic basis for the relationship between these traits we used the fruit fly, *Drosophila melanogaster*, as a model system. Based on life history theory and results from a previous study we hypothesized a trade-off between life span and the age-specific ability to clear an artificial infection. To test this hypothesis we compared the age-specific clearance ability of individuals from two genetically distinct populations, one population that had been artificially selected for longer life span and another was not selected and served as a control population. We found that flies from the control population had better clearance ability than flies from the long-lived population, thus confirming a trade-off between these two traits. Experiments are planned to identify the genetic differences between these
populations to identify the genes underlying this trade off. Given the evolutionarily conservation genes regulating innate immunity among organisms, our results have broad implications for understanding the evolution of aging and immunity in other organisms, including humans.

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The Effect of Transgenic Manipulation of the BK Channel (*Kcnma1*) on Circadian Rhythmicity in Mice

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BK Ca^{2+} and voltage-activated K^+ channels expressed in the suprachiasmatic nucleus (SCN), the brain's master clock, regulate circadian rhythmicity. Loss of the BK channel gene (*Kcnma1*$^{-/-}$, BK KO) disrupts the expression of circadian time, mediated by the daily patterning of action potentials in the SCN. To further understand how the BK channel controls circadian behavioral activity, we analyzed the effect of a transgene containing a gain-of-function point mutation in the voltage-sensor of the channel (*Per1:R207Q*). We hypothesized that alteration of the BK current in the SCN by expression of one or two copies (1C, 2C) of *Per1:R207Q* on a wild-type background or one copy of *Per1:R207Q* with one deleted endogenous copy of *Kcnma1* (1C; BK het) would disrupt circadian wheel-running behavior. In contrast, 1C, 2C, and 1C; BK het mice had relatively normal circadian rhythms. However, compared to WT, adding one copy of *Per1:R207Q* altered the robustness of the circadian rhythm and caused a longer active interval. The disruption of distinct circadian parameters by expression of *Per1:R207Q* suggests that BK channels are important for generating normal circadian rhythmicity. Understanding the neural encoding of circadian rhythms may impact the treatment of sleep and other disorders of circadian rhythmicity.

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Increasing *Aspergillus nidulans* Chronological Lifespan via Induced Autophagy

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Filamentous fungi represent an extremely important class of organisms. As human and plant pathogens, they are responsible for excessive morbidity and mortality as well as billions of dollars in crop losses annually. In contrast, fungi have a tremendous beneficial impact and are used for the annual production of billions of dollars of pharmaceuticals and foodstuffs. Recently, augmentation of autophagy (a cellular recycling mechanism) has been implicated in extending the chronological life span (CLS) of several organisms. This phenomenon is yet unstudied in filamentous fungi. Therefore, we determined if induction of autophagy through rapamycin exposure increased CLS of *A. nidulans*. To accomplish this, we utilized the metabolically sensitive XTT tetrazolium salt to colormetrically monitor the overall metabolic activity of rapamycin treated cells. We hypothesized that cells with augmented autophagy will remain metabolically active longer than the controls when they are both deprived of a carbon nutrient source. Preliminary results suggested that wild type *A. nidulans* exposed to rapamycin have an increased CLS compared to controls without rapamycin. The next step in this project is to test an autophagy null mutant *(Δatg13)*, in order to determine the dependence of CLS changes on a functioning autophagy pathway.

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Cross-Talk Detection in Surface-Enhanced Raman Scattering Nano-imaging probes

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Surface Enhanced Raman Scattering (SERS) is a technique used for chemical detection, based on the vibrational modes of an analyte of interest. Combined with a substrate fabricated on the tapered tips of fiber bundles, it is possible to perform high resolution chemical imaging. To create SERS probes for high resolution imaging of biochemical species, fiber bundles consisting of 30000, four-micron light-transmitting elements are tapered, chemically etched and coated with a SERS active metal. The resulting probes are SERS active and have ~100 nm elements on the tapered tip, which dictates the resolution of the imaging system. Because the cladding on the tapered probe tip is so thin, it is critical to determine the amount of cross-talk taking place between elements. Any cross-talk would represent a decrease in the resolution of the technique. To evaluate this cross-talk, fluorescence analyses were performed in individual fiber elements. Florescent beads of 50 nm were chemically bound in individual wells and illuminated with the appropriate excitation wavelength light. The resulting fluorescence intensity in the center well compared to the surrounding wells was then used to quantify the amount of cross-talk. Results from these studies demonstrate that there is less than 10 percent cross-talk occurring between elements.

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The Functional Analyses of a Mutated Tentacle within the L4 Protein

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The 50S subunit of bacterial ribosomes, which conducts peptide bond formation at its peptidyl transferase center, contains an exit tunnel which nascent proteins must traverse to reach the cytoplasm to become functional proteins. The tentacle of the L4 ribosomal protein contributes to the structure of this exit tunnel. It has been shown that mutations within the tentacle of *Escherichia coli* L4 cause detrimental effects to the 50S subunit. In this research project, bioinformatic analyses were used to delineate the L4 tentacle in the following three microorganisms whose L4 proteins are orthologous to *E. coli* L4: *Haemophilus influenzae*, *Bacillus subtilis*, and *Vibrio cholerae.* This analysis resulted in identification of amino acid differences in organisms that are genetically similar to *E. coli*. Polymerase chain reactions (PCR) and site-directed mutagenesis have been used to introduce changes into the *E. coli* L4 protein. Then the function of ribosomes carrying this mutated L4 protein will be analyzed. Most of these mutations are expected to show little or no detrimental effects on ribosome assembly or function. However, mutations causing harmful effects will shed light on the role of specific amino acids in the L4 tentacle.

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Mitochondrial Gene Shows Recent Diversification of the Yellow-backed Oriole

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The yellow-backed oriole, *Icterus chrysater,* is a tropical oriole that inhabits much of Central America. It has two disjunct populations, one from Mexico to Nicaragua and the other one from Panama to Colombia. Moreover, there is a 660 km gap in its distribution in Costa Rica. Based on its extensive range, four different subspecies have been described, even though they only differ in minor plumage coloration. This research consisted of sequencing the mitochondrial DNA control region from several Yellow-backed Orioles throughout its range. These molecular results were used to examine the genetic variation within the species, and to determine whether this differentiation is related to geography. Analyses of the mitochondrial DNA data "haplotype network" did not show substantial evidence of differentiation. Indeed, there are no fixed differences separating the north and south populations. Even though there is a major split in the geography range of this group, molecular data suggest this complex should still be considered one species. In birds and other organisms, a combination of molecular, morphological and behavioral data will give us the information needed to understand tropical biodiversity.

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Combining Oncogene Activation and Tumor Suppressor Loss: Developing a New Combinatorial Mouse Model of Prostate Cancer

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The prostate is a male accessory sex gland that stores and secretes proteins into the seminal fluid during ejaculation. Prostate cancer accounts for approximately 30,000 deaths annually in the United States alone. A number of genes have been implicated in the origin and progression of prostate cancer. One possible mechanism in human prostate cancer involves both the activation of an oncogene (*MYC*) and the loss of function of a tumor suppressor gene (*PTEN*). Mouse models based only on the overexpression of *MYC* or the loss of function of *Pten* have been derived. However, no mouse model exists in which both these events are replicated. The aim of this study was to generate prostate-specific activation of *MYC* and the loss of *Pten* in a single mouse model. To achieve this goal, we have taken advantage of a prostate-specific *Hoxb13* promoter to drive the *MYC* oncogene (Hoxb13/MYC) and *Cre* recombinase (Hoxb13/Cre) with a floxed *Pten* mouse. Mice carrying these modifications were interbred and their progeny analyzed by Southern blot and PCR techniques for inheritance of all three transgenes. To date, we have identified mice that carry all three alleles. We are waiting for phenotypic analysis of these mice in terms of development of prostate cancer.