Undergraduate Research and Creative Achievement Day

2006

Student Abstracts

Listed In Alphabetical Order

Studying the Protein-Protein Interactions Involved in HIV-1 Assembly

Nerg D. AchiriMofor, *Sampson Kyere*
Michael F. Summers, Professor, Department of Chemistry and Biochemistry

The purpose of my research is to characterize the protein interactions involved in HIV-1 assembly using NMR and X-ray Crystallography. Knowledge from these studies could provide new therapeutic targets for the treatment of AIDS. The assembly of HIV-1 is mediated by the Gag polyprotein. Prior to budding, exposure of the N-terminal myristyl group of the HIV-1 matrix region of Gag is coupled with Gag trimerization, via myristate interactions. This targets Gag to lipid rafts in the plasma membrane of the host cell during viral assembly whereby unknown Gag interactions occur.

Evidence of the presence of trimeric Gag has been demonstrated by analytical ultracentrifugation and electron microscopic studies of Gag proteins assembled on lipid monolayers. Unfortunately, efforts to study trimeric myristoylated Gag constructs by NMR have been inhibited by aggregation and precipitation at concentrations that favor the trimeric species. To overcome these issues, a chimeric Gag-like construct was designed. Constructs were expressed in *E. coli* BL21 cells and prepared by affinity and ion exchange chromatography. Analysis by gel chromatography shows that the initial constructs GCN4-MA and GCN4-MACA readily form trimers and give rise to high quality NMR spectra, indicating studies of larger trimeric constructs including other Gag domains are now possible.

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Effect of Zinc on ROS Production in Prostate Carcinoma DU145 Cells

Anthony A. Agyapong
Renty B. Franklin, Professor, Department of Biomedical Sciences, University of Maryland Dental School, Baltimore

Prostate cancer is associated with a decrease of zinc accumulation. Although zinc is essential for normal cellular function, high levels can be toxic. Evidence suggests that mitochondria are potential targets of zinc's toxic effects. Acute elevation of zinc dissipates the mitochondrial membrane potential in neuronal cells, thereby enhancing the accumulation of reactive oxygen species (ROS). We hypothesize that the loss of zinc accumulation by prostate cancer cells is a protective mechanism through a reduction in ROS generation, which allows for the survival of the cancer cells. Thus, this research sought to identify potential zinc targets in the electron transport chain (ETC) by measuring ROS generation in response to zinc treatment. Prostate carcinoma DU145 cells were treated with zinc (20 μM) overnight. After treatment, cells were collected and incubated with ETC complex specific substrates. ROS production was measured over time. Preliminary results suggest a decrease in ROS production after zinc treatment. Thus, zinc did not increase ROS by inhibiting the ETC. However, further study is required to determine whether the lack of a zinc effect on mitochondrial ROS is specific for DU145 cells or whether unlike neurons, prostate epithelial cell ETC activity is not affected by zinc at the concentration used.

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Selecting for Troleandomycin Resistant Mutants in *Deinococcus Radiodurans*

Anthony T. Allen*, Janice Zengel*
Janice Zengel, Research Scientist, Department of Biological Sciences

Troleandomycin and other similar compounds act as antibiotics by inhibiting protein synthesis in bacteria. However, the mechanism behind the process is not fully understood. Troleandomycin resistant mutants of *Deinococcus radiodurans* were isolated to identify changes in the ribosome that eliminate the inhibitory effect. Separate cultures of wild type *Deinococcus* were spread onto 12 TGY plates with a troleandomycin concentration of 15μL/mL and incubated at 30^{o}C for a week. After the mutants grew, one colony from each plate was selected. The mutants were first analyzed using whole colony PCR and DNA sequencing to determine if there were changes in any of the three likely targets: 23SrRNA and ribosomal proteins L4 and L22. Once a change in one of the three targets is found, the bacteria in which the mutation occurred will be studied further by finding if they are resistant to any other antibiotics.

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Individual Differences in Endogenous Pain Control: The Effects of Adrenocortical Function and Catastrophizing

Mark E. Allshouse
Lynanne McGuire, Assistant Professor, Departments of Mathematics and Psychology

Pain, the most common presenting medical complaint and a significant risk factor for morbidity and mortality in many diseases, is a critical national and international health problem. The limited existing laboratory studies of endogenous pain control processes, that is, those processes originating within the human body, have not examined the influence of adrenocortical function or in vivo pain-related catastrophizing. This study used standard laboratory procedures (i.e., Diffuse Noxious Inhibitory Controls or DNIC) to assess endogenous pain control. The magnitude of reduction of painful responses to pressure pain stimulus during concurrent administration of cold water pain to a different body site (forearm and upper trapezius) indicates the effectiveness of endogenous pain control. Subjects completed questionnaires assessing their level of in vivo catastrophizing and salivary cortisol samples were collected to assess adrenocortical function. To date, 35 subjects have satisfactorily completed the study. Preliminary results show higher baseline cortisol is significantly associated with greater magnitude change in DNIC, indicating more endogenous pain control. Greater pain-related in vivo catastrophizing is significantly correlated with weaker magnitude change in DNIC, indicating less effective endogenous pain control. One future research direction suggested by these results is examination of the effects of a psychological intervention targeted at reducing pain-related catastrophizing on DNIC

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

Decay of Organic Matter in Eastern Deciduous Forests: Impact of Invasive Tree Species

Ramya Ambikapathi
Christopher Swan, Assistant Professor, Department of Geography and Environmental Systems.

Understanding the impact invasive species have on ecosystems is of particular interest to ecologists. In forest ecosystems, the decomposition rate of senesced leaf litter is a critical ecosystem process since it is involved in nutrient cycling. Few studies have investigated how leaf litter from native tree species may decay in adjacent habitats dominated by non-native trees. *Ailanthus altissima* (Tree of Heaven; TOH) is a non-native species that quickly overtakes newly cleared areas and excludes virtually all other tree species. Furthermore, leaf litter of this species decays incredibly fast, leaving no litter layer to be inhabited by detritivorous invertebrates. I investigated the impact such alterations to the litter layer, and the subsequent exclusion of invertebrates, can have on the decay rate of native leaf litter. We report decay rates of leaf litter from Tulip Poplar, White Oak and the mixture of these two species left to decay in litter bags for one year in forest plots of either native tree assemblages, or a monospecific stand of TOH.

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

Long-Lived, Long-Wavelength Luminophores for Immunosensing Applications

Cameron Bardliving, *Amelita Bartolome*
Leah Tolosa, Assistant Professor, Department of Chemical and Biochemical Engineering

Our research focuses on the development of low-cost fluorescence-based sensor devices that can be used for clinical diagnosis of diseases, detection of food toxins, high throughput screening of drugs, etc. Fluorescence spectroscopy is a useful technique for measuring a variety of biochemical interactions, in particular, the association of an antibody with its respective antigen. Since our sensor must be low-cost, it is desirable that noise arising from the biological sample be minimized while maximizing the signal from the sensor. This should be done without resorting to expensive optics, electronics and software. One strategy that we are developing is the use of long-lived, long-wavelength luminophores. These luminophores are fluorescence resonance energy transfer (FRET) pairs where the donor (ruthenium) decays at a slow pace (long-lived), while the acceptor (Texas Red) emits at wavelengths relatively longer (red-shifted), than those of the biological sample. Thus, the background noise/emission from the biological sample which is short-lived and blue-shifted can be easily distinguished from the sensor signal. To demonstrate the utility of these novel luminophores, we will use fluorescence measurements to observe the binding of RET donor anti-bovine serum albumin (BSA) labeled with a ruthenium metal-ligand complex to RET acceptor BSA labeled with Texas Red.

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Qualitative Implications of Heritage DNA Testing: *africanancestry.com*

Kara Barnes
Christel N. Temple, Assistant Professor, Department of Africana Studies

The online service for African heritage DNA testing, *africanancestry.com*, offers African Americans the opportunity to discover their African matrilineal and patrilineal ancestries. However, this scientific innovation has a variety of historical, contemporary, and future qualitative implications that can either empower or de-center African Americans. Discovering exact dimensions of heritage is a catalyst for creating new meanings of the historical concept of Back-to-Africa, articulating an American-based version of African globalism, strengthening the reparations movement, and relating African American ancestry to more concise regions of origin. The results of DNA testing will re-shape African American identity and re-invigorate Pan-Africanism, which is viewed as an ideology rather than a genetically-based and tangible practice of unity and cooperation with global communities of African descent.

Using content analysis and historical research within an African-centered paradigm, this project will evaluate the *africanancestry.com* website and will explore qualitative implications of science and technology on the discipline of Africana Studies based on the discipline's credo-- which asks, "to what extent will *africanancestry.com* create knowledge and inspire behaviors that will increase the life chances and life experiences of people of African descent?"--and on five of the discipline's fifteen categories of inquiry: Pan-Africanism, history, psychology, community development, and health/science/technology.

"Begin By Looking Inward"

Amy L. Baumgarten
Doug Hamby, Associate Professor, Department of Dance

"Begin By Looking Inward" explores the dichotomy between Soviet Communism and American Democracy. President Kennedy said in a 1963 speech that in order to bring peace and stability among nations, each must begin by acknowledging its own practices, by looking inward. Such perspective into one's own strengths and weaknesses allows for greater understanding of others'. My travels last spring sent me far behind the Iron Curtain to Prague, Berlin, Krakow, and Budapest—at one time, all beacons of Communist might. I observed in each of these cities a common awareness of how fragile their budding civil freedoms truly are, yet so many I spoke with dismissed any notions of democratization ensuring those freedoms. At least under a Communist regime citizens were guaranteed basic necessities. I began this project pondering the differences between the two political ideologies. I found that despite the rhetoric of Cold War American politicians hailing democratic principles and repudiating those of the Communist bloc, the two worlds are nevertheless more similar than originally imagined. I ascertain that the more we villanize the "other", the more we become him. My presentation combines video, text, and dance, as they portray the various perceptions of the Cold War "other."

The Utility of a Cytosensor for Measuring Glucose Oxidation in Myotubes

Lorraine K. Beraho
Craig Beeson, Associate Professor, Department of Pharmaceutical Sciences, Medical University of South Carolina

The main role of insulin is to regulate glucose metabolism. Type II diabetes is a metabolic disorder in which the body is unresponsive to insulin. In this study, a cell-based model was developed to study glucose utilization in response to insulin in skeletal muscle tissue. C2C12 myoblasts were differentiated into myotubes, which are similar to muscle. Different types of growth media used for differentiation included varied concentrations of Fetal Calf Serum and insulin. A Cytosensor Microphysiometer was used to measure total acid extrusion and oxygen consumption. These values provided information about levels of anaerobic glycolysis and glucose oxidation taking place in the cell. Two metabolic modulators were used, azide and oxamate. Azide blocks glucose oxidation and oxamate blocks anaerobic glycolysis. Results show that the metabolic state of myotubes is dependent on growth media used for differentiation. Myotubes grown in ITX exhibited metabolic responses similar to muscle cells of diabetic patients. They also exhibited high rates of fatty acid oxidation in the presence of high glucose concentrations. When myotubes were grown overnight in media with serum and then switched to media containing no serum and 100 nM insulin they became oxidative with normal metabolic responses.

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Characterizing L4 and L22 Mutations in *E. coli* Strains Resistant to Oleandomycin Triacetate

LaToia Bryant*, Janice Zengel, Lasse Lindahl*

Janice Zengel, Senior Research Scientist, Department of Biological Sciences
Lasse Lindahl, Professor, Department of Biological Sciences

Macrolide antibiotics, such as oleandomycin triacetate, inhibit bacterial protein synthesis by binding to the 50S ribosomal subunit in the peptide exit channel. Interestingly, many ribosomal globular proteins such as L4 and L22 have extensions (tentacles) that reach into the mass of rRNA within the ribosome. L4 and L22 tentacles extend such that the ends of the tentacles form a constriction at the beginning of the peptide exit channel. Mutations in the L4 and L22 tentacles result in oleandomycin triacetate resistance in *E. coli*. Resistance is conferred through the inhibition of oleandomycin triacetate binding or such that the binding of oleandomycin triacetate does not inhibit bacterial protein synthesis. Oleandomycin triacetate resistant colonies were isolated, and colony PCR was performed to amplify L4 and L22 genes. Following PCR purification, L4 and L22 genes were sequenced in order to classify mutations in L4 and L22 tentacles that confer oleandomycin triacetate resistance. Following the confirmation of oleandomycin triacetate resistant *E. coli* strains, additional assays will be performed to characterize the oleandomycin-resistant mutants. Additional assays will determine temperature sensitivity, resistance or dependence on oleandomycin triacetate for viability, and growth rate. Finally, assays will show the extent of oleandomycin triacetate resistance, by determining the highest concentration of oleandomycin triacetate by which the mutants sustain life. This study contributes to a greater understanding of the mechanisms in which antibiotics inhibit the function of bacterial pathogens.

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Characterization of *rlsD*, a Paralog of a Master Cell-fate Determination Gene in the Green Alga *Volvox carteri*

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Stephen Miller, Assistant Professor, Department of Biological Sciences

Volvox carteri is an excellent organism in which to investigate mechanisms of cell differentiation. It is a spherical, multicellular green alga that possesses just two cell types, making *V. carteri* an excellent organism for investigating mechanisms of cell differentiation and how cells evolve. The *regA* (for *somatic regenerator*) gene encodes a putative transcription factor (RegA) that is expressed only in somatic cells and negatively regulates reproductive functions in them. Analysis of the recently sequenced *V. carteri* genome revealed four paralogs (*V. carteri* homologs) of *regA* that have been named *rlsA-D* (for *regA*-like sequence *A*, *B*, *C*, and *D*). Nothing is known about the function of these paralogs, but we hypothesize that one or more of them might function in cell-fate determination as *regA* does. In this study we focus on characterization of the *rlsD* gene, which is the closest relative of the only *regA*-like gene in *Chlamydomonas*. We are using RT-PCR and northern analysis to determine the structure of the *rlsD* gene (and to compare this structure to that of the *regA* gene), and to determine if *rlsD*, like *regA*, is expressed in a cell-type specific manner. Thus far we have identified two exons and the 3' boundary of *rlsD*.

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Religion as a Factor for Judicial Decision-making on the Supreme Court

Rosemarie Capozzi
Jeffrey Davis, Assistant Professor, Political Science Department

In this research project I examine whether religion impacts judicial decision making of Catholic Supreme Court Justices. With the confirmation of John Roberts and Samuel Alito, the Supreme Court has a majority of Catholics. For the purposes of my study, I define religion as a personal or institutional belief system derived from the existence or non-existence of a supernatural power or guidance from a spiritual leader. Political ideology, on the other hand, is a doctrine regarding a political, social, or economic system and is typically based on logic and reason. I examine how religion impacts the decision making of Catholic justices, and the extent to which their religion, rather than their political ideology, impacted their jurisprudence.

I conduct content analysis of the biographical data available for every Catholic Supreme Court Justice as well as the cases decided by the jurist. I then compare this to the viewpoint of the Catholic Church on controversial cases and issues to find how out how closely the justice agreed with the church. In addition I performed detailed case studies on Justices Brennan and Scalia to more carefully analyze the relationships identified in my content analysis. Quantitatively, I created an index which provided numerical values for the different ways that religion might be manifested in judicial decision making. This research found that political ideology is a more compelling source for judicial decision making than religious ideology.

Investigating the Role of the Chloride Binding Site (H181) in the Activation of Green Human Cone Opsin by Site-Directed Mutagenesis

Joseph M. Castellano
Phyllis R. Robinson, Associate Professor, Department of Biological Sciences

Vertebrate visual photopigments are members of the superfamily of G-protein coupled receptors (GPCRs), which includes the well-characterized photopigment rhodopsin, found in the membranous disks of the outer segment of the rod. In rhodopsin, light absorption causes the protein's covalently-bound chromophore, 11-*cis* retinal, to isomerize to an active state, causing the active photopigment to excite its G-protein transducin. While it is known that mutating residues of the salt bridge in rhodopsin causes constitutive activation of transducin, similar mutations in M/LWS-class opsins result in suboptimal activation. To investigate the additional structural features of the binding pocket that may be involved in the activation of transducin, we test to see if the chloride binding site (H181) helps regulate the inactive state. To accomplish this, H181A and H181A/E113Q mutants were created and assayed using a transducin activation assay.

Mutants were generated in Human green cone opsin cDNA using Quik-change site-directed mutagenesis or cassette mutagenesis. Mutant constructs were transfected into COS-1 cells using a chloroquine/DEAE-dextran-mediated procedure, providing heterologous expression of the mutant opsins. COS-1 membranes containing mutant opsin were isolated and used in transducin activation assays to investigate the mutant opsin's ability to activate its G-protein. Based on our results, H181A does not appear to cause any observable transducin activation, indicating that the chloride binding site alone does not play a role in activation, while the double mutant yields similar levels of activation. Presently we are investigating other structural features of the binding pocket to account for additional transducin activation.

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Lactoferrin-Dependant Activation of MAP Kinase Pathways in Human Adipose Tissue and Intestinal Epithelial Cells

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Omentin 1 and 2, also known as lactoferrin receptor 1 and 2, have been associated with insulin resistance and poor metabolic outcomes in genetic studies. Previous data shows that omentin 1 is expressed largely in visceral fat depots, may be involved with insulin sensitivity, and is reduced in obesity. Omentin 1 can be a soluble receptor found in the blood stream or attached to the plasma membrane. We have shown in expression studies that omentin 2 is expressed more highly in the intestine and lung than visceral fat. Lactoferrin receptor 1 (omentin 1) has been shown to activate p42/44 MAP kinase after stimulation with lactoferrin. These results will be confirmed in human visceral adipose tissue extracts and in CACO-2 human intestinal epithelial cells. These results will also be extended to look at omentin 2 signal transduction after lactoferrin stimulation. p42/44 MAP kinase phospho-specific antibodies will be used to determine the increase in MAP kinase activity by western blotting cell and tissue lysates. Additionally, omentin 1 and omentin 2 will be over-expressed in CACO-2 cells to further verify receptor specificity of the response to lactoferrin. These studies will further elucidate the structural and functional differences between omentin 1 and omentin 2.

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Direct Methods in Calculus of Variations: An Application to Rod Mechanics

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In one-dimensional calculus, a function defined on a closed and bounded interval attains both a maximum and a minimum value. If, however, the function is defined for all real numbers, the function may not attain either a maximum or a minimum.

Functionals are generalizations of functions, where the domain of the functional is infinite dimensional. In this case, showing the existence of minima is difficult. In this work, we consider a particular functional, whose minima represent a stable configuration of an elastic rod. Direct methods from the unconstrained calculus of variations are used to prove existence of minima. Using a modification of these methods to include the isoperimetric constraint and non-homogenous boundary conditions, necessary conditions for the existence of minima are determined as a special case of a more general existence theorem. Ideas from mathematical analysis courses must be used to prove existence.

Applications of this elastic rod model include supercoiling of DNA minicircles and twisting of filaments. Extensions of this result to more general rod models, including non-linearly elastic rods and generalized boundary conditions, are currently under consideration.

Design and Synthesis of Isoadenosine Analogues as Potential Inhibitors of *S*-Adenosyl-L-homocysteine Hydrolase

Luis J. Cocka**,** *Sylvester L. Mosley*
Katherine L. Seley, Associate Professor, Department of Chemistry and Biochemistry

Enzymatic inhibition of biological pathways essential for viral replication has shown promise in the design of viral chemotherapeutics. In that regard, *S*-adenosyl-L-homocystine hydrolase (SAHase) and methyltranferases (MeTase) are attractive targets due to their role in biological methylations. Disruption of this critical process has been shown to be particularly effective by the use of a novel class of nucleoside analogues. As a class, carbocyclic nucleoside derivatives are structurally modified such that they mimic the natural nucleosides enough to be recognized, but ultimately disrupt subsequent biological processes. The aim of this research project is to synthesize carbocyclic nucleoside analogues based on isoadenosine (IsoA). These targets feature three specific modifications: 1) replacement of the ribose sugar with a cyclopentyl ring to create stability that previously synthesized IsoA analogues lacked; 2) optimization of the heterocyclic ring system to mimic both purines and 5,6-disubstitued pyrimidines; and 3) alteration of the connectivity between the sugar and the heterocyclic base moiety to further increase the stability of the target compounds. These combined features have the potential to theoretically produce IsoA analogues that may exhibit synergistic inhibition and subsequently, greater potency as antiviral agents.

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Analysis of GFP-GlsA Fusions in Live *Volvox* Embryos

***Koriand'r L. Conyers**, Akelia Wauchope, Peter Hong, Stephen M. Miller*
Stephen Miller, Assistant Professor, Department of Biological Sciences

Asymmetric cell division is essential for creating cellular diversity in nearly all multicellular organisms, but little is known about how it is regulated. Previous studies have shown that two chaperone proteins in the green alga *Volvox carteri*, Gonidialess A (GlsA) and Heat shock protein 70A (Hsp70A), are essential for the asymmetric cell divisions that occur during embryogensis to produce the two cell types possessed by adults. Interestingly, Hsp70A begins to accumulate predominantly in the anterior region of the embryo just before the asymmetric divisions begin, suggesting that its increased accumulation may cause cells there to divide asymmetrically. In order to investigate how the redistribution of Hsp70A occurs, we are generating transgenic *Volvox* lines that express an Hsp70A-GFP fusion that will permit the visualization of Hsp70A in live embryos. To test for potential effects of GFP (Green Fluorescent Protein) on the localization of the fusion, two control constructs were created and are being tested: one contains β-tubulin-gene and *glsA* regulatory sequences, and the other a β-tubulin-gene promoter and β-tubulin-gene 3' regulatory sequences. Here we report the progress to date on making the GFP fusions and expressing them in live *Volvox* embryos.

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Woman Like Me

Sarah E. Crowell
Linda J. Dusman, Professor, Department of Music

This project provides the audience with a complete understanding of what I believe is the makeup of my musicianship. The importance of this project was finding a way to overcome the boundaries of many different types of music in an attempt to combine them all in a unified, cohesive whole. The methods used to complete this project were developed using compositional techniques studied throughout my classes as a composition major.

The instruments involved in this project are the piano, cello, violin, oboe, flute, and lastly, my own voice. This six-piece ensemble cascades through six different styles of music, including rock, jazz, atonal, hip-hop, opera and classical. The result is a very diverse, yet grounded musical production that communicates my musical influences and my musical knowledge since studying here at the University of Maryland, Baltimore County, and the directions I will likely be traveling in composing music throughout the rest of my life.

Artificial Blood Based on Cell-Free Hemoglobin

Margaret Dabek, *Timothy A. Roach*
Ramachandra Hosmane, Professor, Department of Chemistry and Biochemistry

The search for a safe and effective alternative to whole blood or packed red blood cells (RBC) has long been the focus of the biomedical and chemical communities. The scarcity of donated blood for transfusions, especially when rare types are needed, the possible transmission of diseases such as AIDS and hepatitis associated with donor blood transfusion, the limitations on storage stability of intact blood, and the necessity for blood typing and cross-matching before transfusion give compelling impetus to pursue a suitable substitute for whole blood. Hemoglobin is a logical choice for a blood substitute. It is an abundant protein found in RBCs, which (a) can be easily isolated from outdated human blood, (b) does not need any typing or cross-matching before transfusion, (c) can be made totally free from viruses and bacteria by heat and/or radiation treatment, and (d) can be stored as a dry powder for indefinite periods of time in a refrigerator. However, without proper chemical modification, the cell-free hemoglobin will not stay in circulation for more than a couple of hours and delivers little, if any, oxygen to the tissues. My overall research goal is to make the cell-free hemoglobin work outside the RBCs through covalent chemical modifications. To this end, we carry out the design and synthesis of novel polyfunctional organic reagents that will not only modify the cell-free hemoglobin, but also will covalently link several of those modified hemoglobin molecules with a dendrimeric bridge to make it a larger entity, analogous to the human red blood cells. Such large polyhemoglobin molecules cannot be easily filtered and excreted by kidneys, while at the same time are expected to enhance the extent of oxygen delivery to the needed tissues. These polyhemoglobins will, in addition, solve another major problem facing the current blood substitute industry, in that they will not easily sieve through the endothelial lining and subsequently react with the vasorelaxing nitric oxide (NO), which would result in elevated blood pressure. We present here the current status of research on the design, synthesis, and hemoglobin cross-linking studies of a novel polyfunctional organic reagent, called Tetradiol, which is anticipated to simultaneously modify and dimerize the cell-free hemoglobin.

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Improving Software Maintenance through Better Documentation

Sumita Das
Wayne Lutters, Assistant Professor, Department of Information Systems
Carolyn Seaman, Associate Professor, Department of Information Systems

Finding and using software documentation has long been a challenge in supporting (modifying, enhancing, adapting) operational software. The purpose of this study is to better understand the sources of information that are helpful when maintaining software and identify best practices in using these resources. As part of a larger study, we conducted contextual, semi-structured interviews with seven software maintainers who were working on large governmental aerospace projects. We analyzed the data by coding these interview transcripts, searching through them for common themes. We produced a list of the most worthwhile behaviors and properties of documentation. The findings of this study are meant to assist software personnel in making documentation a more dependable and valuable source of information during the maintenance process. We identified some structural properties of documents that are particularly useful (e.g. indices, subheadings, glossaries, acronym lists). Source code appears to be the "ultimate documentation", i.e. the most trusted, so it's important that comments in the source code are readable and well-organized. We also found that when maintainers could not find needed documentation, they relied on word-of-mouth for information. Participating organizations are eager to use the results of this study to improve their current documentation processes.

Structural Determination of the FeLV Ψ-site RNA Packaging Signal Bound to the Nucleocapsid Protein

Amanda R. De Four
Carolina F. Carvalho, Jonathan A. Martin, Laurel A. Wright, Michael F. Summers, Professors, Department of Chemistry and Biochemistry

The Feline Leukemia Virus (FeLV) is an oncogenic retrovirus, similar in structure to HIV-1 and the Moloney Murine Leukemia Virus (MMLV). The genome packaging of FeLV is mediated by specific sequences in the Ψ-site of the viral genome bound to the nucleocapsid (NC) protein, which is part of the gag polyprotein. Previous findings showed the existence of a UAUCUG sequence in the Ψ-site of MMLV that is required for NC to bind. We aim to find a similar sequence in the Ψ-site of FeLV that would show high affinity binding of RNA to the NC protein. Preliminary isothermal calorimetry experiments have shown that the UAUCUG in MMLV does not bind with high affinity to FeLV NC implying there might be another sequence in FeLV RNA that is binding tightly to the NC protein. This leads to speculation that FeLV may adopt an alternative packaging mechanism than that of MMLV. The goal of this project is to find the specific sequences in the FeLV Ψ-site that bind with high affinity to the NC protein and determine its three-dimensional structure using NMR analysis. The three-dimensional structural determination of the FeLV RNA:NC complex will enable a better understanding of the viral packaging of FeLV.

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A General Synthetic Route to Cyclobutadiene Derivatives

Tebebeyesus Defaru
Bradley Arnold, Associate Professor, Department of Chemistry and Biochemistry

A general synthetic route to stable cyclobutadiene (CB) derivatives has been proposed that involves the photochemical oxidation of alkyl-substituted acetylenes. Many relatively slow chemical reactions can be accelerated in the presence of catalytic oxidizing or reducing species. The dimerization of alkyl-acetylene derivatives to form substituted cyclobutadiene is slow under usual conditions but is very rapid when the acetylene has been oxidized. The proposed synthetic scheme takes advantage of this accelerated reaction to produce substituted CB derivatives. Specifically, tetracyanobenzene (TCNB) was irradiated in acetonitrile in the presence of benzene the TCNB radical anion and the benzene radical cation were produced. In turn, the benzene radical cation is capable of oxidizing the alkyl acetylene, which should undergo ring closure by reacting with neutral acetylene to generate the radical cation of CB. CB is then reduced by the TCNB radical anion to produce CB and regenerate the catalyst, TCNB. The results of several attempts to produce substituted CB derivatives will be presented.

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"By the Gate at Dawn": A Study and Re-interpretation of Limon Dance Technique

Jenifer A. Dobbins
Doug Hamby, Associate Professor, Department of Dance

My project was to create an original choreographic work and teach a master class for the UMBC Dance Department that confers the principles of dance technique, performance quality, and dance composition methods unique to the Jose Limon Technique of Dance.

A historically significant dance technique based on the work of modern dance pioneers Doris Humphrey and Charles Weidman, and formalized by Jose Limon, the Limon Dance Principles have become a underpinning for contemporary modern dance, and the Limon Dance Foundation is the definitive source for studying this technique at an advanced level.

Research began at the Jose Limon West Coast Summer Intensive and culminated with the creation of an original choreographic work entitled, "By the Gate at Dawn." This work brings the viewer on a journey into the internal landscape of three young women and was presented at the UMBC Dance Department's Senior Dance Concert in the fall of 2005. Video documentation of the work is available at the UMBC media center. The work has been revised for URCAD, and will be presented in its current form throughout the region. Additionally, a master dance class was held at UMBC to share the findings of this research.

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

Women's Writing and the *Querelle des Femmes*

Shayla H. Donmoyer
Amy M. Froide, Assistant Professor, Department of History

Before the "women's question" of contemporary history a similar but less acknowledged question presented itself several centuries before and sparked a debate that spanned several countries and centuries. To understand the feminist movement of the 19th and 20th centuries, it is important to recognize patterns of gender bias in previous eras. An earlier "question" influenced women's lives up to the time of the organized and defined women's movement. Beginning in the Renaissance, the *querelle des femmes*, or "question of the place of women", slandered women and belittled their place in society. Originally about the inferiority of women, over time this "question" began to encompass all aspects of women's life, such as work, education and religion. It was at this time that women began to write, publish, and publicly ask questions about their place in society by responding to published stereotypes about the weaknesses of women.

The defined concept of feminism is relatively new. However, women had been writing about living conditions and their position in society for half a millennium before any defined movement took shape. This project will examine examples of women's writing from the fifteen to the eighteenth centuries to define key trends and concepts of the *querelle des femmes.*

Aquatic Insect Feeding on Speciose Leaf Litter is Altered by Predation Pressure

Michael W. Dunbar
Christopher M. Swan, Associate Professor, Department of Environmental Science

Leaf litter entering streams during autumnal leaf fall is an important energy source for stream food webs. Decomposition rate of the litter varies by leaf species, and the intensity of feeding by in-stream detritivorous invertebrates. Since detritivores feed at different rates, speciose leaf litter forces invertebrates to make choices as they actively seek out the highest quality resources. However, in the presence of a predator, I predicted that a reduction in foraging activity should result in less of a preference for higher quality resources. I performed a laboratory experiment where aquatic isopods, a common stream detritivore, were exposed to single and mixed litter resources, the presence and absence of a predator, and the presence and absence of an omnivore. In mixed litter treatments, high quality litter (Red Maple) was lost at a higher rate than poor quality litter (Red Oak). However, in the presence of the predator, the preference disappeared, likely due to reduced searching activity of the isopods. However, the presence of the omnivore did not result in a similar interaction. These results support the notion that loss of biodiversity, either reduction in leaf or predator species can result in altered of tri-tropic interactions in aquatic food webs.

The Evolution of Enitharmon through Pity in Blake's *The Four Zoas*

Kirsten E. Ederer
Gail Orgelfinger, Senior Lecturer, Department of English

William Blake (1757-1827) uses his many works of illustrated poetry and engravings to respond to the rapidly changing ideas about women's roles in 18th century English society. *The Four Zoas*, written in 1797, retells the creation, fall, and redemption of Los and Enitharmon, Blake's Adam and Eve, within his unique system of mythology. As argued by feminist scholar Susan Fox, Blake's female characters tend to be either "passive" or "pernicious." However, scholars have failed to address the stunning character evolution of Enitharmon in *The Four Zoas*.

In this poem, Enitharmon evolves from a subjugated figure of ineffectual protest in Night the First to a liberated figure of dynamic creation in Night the Eighth through the emotion of Pity. By her compassionate unification of lost bodies and souls, which creates Jerusalem, the Universal Female, Enitharmon gains subjectivity and agency in a positive way that is unique to Blake's poetry. The resulting harmony between Los and Enitharmon represents Blake's most utopian dream: equality between the sexes. Blake's literary utopia recognizes the beginning of the struggle for women's rights, which we are still pursuing today.

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

The Role of *N-Cadherin* and the Planar Cell Polarity (PCP) Pathway in Posterior Axis Morphogenesis

Foyin C. Fasanmi, *Michael Harrington*, *Rachel Brewster*
Rachel Brewster, Assistant Professor, Department of Biological Sciences

Convergent extension (CE) is a critical developmental process, required for the elongation of the embryonic head-to-tail axis. During CE, cells migrate in a medial direction using protrusive activity. Therefore cells undergoing CE have to acquire polarization directionality and exert traction on neighboring cells in order to migrate. Polarization is mediated by the planar cell polarity (PCP) pathway and traction is regulated by adhesion molecules. Although cadherins, calcium-dependent homophilic cell adhesion molecules have not been directly implicated in this process, preliminary data suggests that zebrafish *Neural Cadherin (N-Cad)* cooperates with *Strabismus (Stbm)*, a member of the PCP pathway to mediate posterior axis elongation.
Indeed, loss of *N-cad* function enhances the CE defects observed in *Stbm* mutants. The goal of this research project is to further investigate the nature of the interaction between the two genes. Towards this goal, we have analyzed the tail defects in embryos in which the *N-Cad* and *Stbm* proteins are lacking to various degrees, using different allelic combinations of N-Cad and different concentration of *Stbm* morpholino. We show that both full and partial loss of *N-Cad* appear to enhance the tail elongation defects in *Stbm* morphants. The observation lays the groundwork for future investigation on the molecular mechanism underlying CE.

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Heregulin-mediated Breast Cancer Cell Growth Is Maintained Despite Overexpession of the Ebp1 Transcriptional Repressor

Adrian A Feijoo, *Yuexing Zhang*, *Damilola Akinmade*, *Anne W Hamburger*
Yuexing Zhang, Damilola Akinmade, Anne W. Hamburger, Professors, Department of Pathology, University of Maryland, Baltimore School of Medicine.

We are investigating the ability of receptor tyrosine kinases (RTKs) to modulate proliferation of normal and malignant cells. The ErbB family of RTKs consists of cell-surface receptors associated with the phosphorylation of tyrosine and have a crucial role in oncogenesis. Heregulin (HRG) promotes cell proliferation through binding to the ErbB-3 receptor. Ebp1 is a transcriptional repressor associated with the ERbB3 receptor. HRG increases phosphorylation of Ebp1 and induces its dissociation from ErbB3. Understanding the effects of HRG on Ebp1 physiological functions will help us exploit the repressor activity of Ebp1 in developing cancer therapies. The implication of Ebp1 as a transcriptional inhibitor is poorly understood; thus, the aim of this study was to investigate the impact of Ebp1 on HRG-induced signaling/proliferation. To determine whether Ebp1 has an inhibitory effect on HRG-mediated cell growth, *ebp1* was cloned in a CMV10 plasmid with a FLAG Tag. The plasmid was transfected into the MCF7 breast cancer cell line. The control plasmid CMV10 was also transfected into MCF7 cells. The effect of HRG on the cell lines was compared. Results show that Ebp1 had no effect on HRG-mediated cell proliferation. This suggests the growth repressor activity of Ebp1 is associated with another growth factor or pathway and is currently under investigation.

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"Protesting Prodigies or Apathetic Academics?
Comparing 1966 and 2005 UMBC Students' Views of Higher Education"

Maddy M. Fickes
Edward Orser, Professor, Department of American Studies

Students who entered college in the 1960s were part of an enlarged cohort of college-bound students who were significantly different from traditional college students with regard to their views of higher education and reasons for selecting new universities. This research examines whether students who attend these same universities nearly forty years later hold similar or different expectations of their college experiences. UMBC was one such university that arose in response to increased enrollment. Interviews with two six-student groups (one from 1966 and the other from 2005) who attended UMBC reveal the characteristics of these groups of students in a multi-dimensional perspective that evaluates their demographics, views of higher education, and reasons for selecting this particular university. The standard understanding has been that the contrasting social climates and educational experiences of the two groups would make them more different than similar. However, this study suggests important areas of commonality and continuity. The sixties marked the start of a higher education pattern that continues today in which attending college is viewed as a more openly accessed societal norm. Thus, this transition helps to explain the continued large enrollment and illustrates the similarities of the two groups of students, despite their generational gap.

This work was funded, in part, by the UMBC McNair Scholars Program.

The Drama of German Lieder

Christie M. Finn, *Stefanie Watson, Pianist*
David Smith, Lecturer, Department of Music

My work this year consisted of a diverse patchwork of smaller areas of artistic research. The bulk of my project was conducted this summer in Rome as I performed in operas and recitals and researched audition techniques. Part of my artistic research this year led me to romantic and post-romantic German song—how these works dramatically changed the genre of the art song and how best to bring intense emotion across quickly without the background of the dramatic action of an opera. I will be performing and discussing works by Franz Schubert and Hugo Wolf, works that I performed in the fall of 2005 at my junior recital. These were also works that I studied in Italy this summer and used for some auditions over the past year.

Translations:

Gretchen am Spinnrade:
My peace is gone,
my heart is sore,
never shall I find
peace ever more.

Where he is not,
there is my grave,
all the world
to me is gall.

My poor head
is crazed,
my poor wits
destroyed.

Only for him I gaze
from the window,
only for him I go
from the house.

His superior walk,
his noble air,
his smiling mouth,
his compelling eyes.

And his words—
their magic flow,
the press of his hand,
and ah, his kiss!
My heart craves
for him,
oh, to clasp
and to hold,

and kiss him,
just as I liked,
and in his kisses
pass away!

Auch kleine dinge:
Even small things may delight us; even small things may be precious.
Think how gladly we deck ourselves in pearls; for much they are sold, and are only small.
Think how small the olive is, and yet it is sought for its virtue.
Think only of the rose, how small it is, yet smells so sweet, as you know.

Wer rief dich denn?:
Who called you then? Who sent for you? Who bade you come, if burdensome it is?
Go to that love who pleases you the more, go there, where you have your thoughts. Go where your intention is, your mind! From coming to me, I gladly will excuse you.
Go to that love who pleases you the more!
Who called you then? Who sent for you?

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

Differential Gene Expression in Cultured Rodent Malaria Parasite

Ayanna J. Flegler, *Calvin Williams*
Abdu Azad, Professor, Department of Microbiology and Immunology, University of Maryland Baltimore, School of Medicine

There are over 200 million new malaria cases each year and it still kills more than one million people a year, mostly children. In addition, malaria may increase at an alarming rate because of decreased effectiveness of control measures, declining economic conditions in many endemic countries, and global warming that favors mosquito-borne pathogen transmission. The liver stage malaria parasite has become an attractive target for vaccine design because such vaccines not only prevent the disease but also block transmission. As part of our ongoing work with axenic culture of rodent malaria parasite Plasmodium yoelii we were interested to examine the transcriptional dynamics during the sporozoite-to-hepatic stage transition. We applied RT-PCR to detect differences in gene expression between culture-derived and mosquito-derived parasites. The UIS4, a gene essential in the development of the liver stage, was targeted in our study. UIS4 was expressed in the mosquito-derived but not culture-derived sporozoites. We concluded that our observed low infectivity of the culture-derived parasite correlates with the lack of expression of UIS4. Our ongoing research is now focused on modifying the culture conditions to restore UIS4 gene expression and confirm the role of its gene product in infectivity.

*This work was funded, in part, by UMBC through the NIH National Research Service Award GM 08663 to the Minority Access to Research Careers (MARC) Undergraduate Student Training in Academic Research (U*STAR) Program* at *UMBC.*

Tumor Cells can be Genetically Modified to Activate a Tumor-Specific Immune Response: Upregulation of MHC II and Downregulation of MHC II-Associated Invariant Chain in a Mouse Tumor

Albert Forero*, James Thompson, Suzanne O. Rosenberg*
Suzanne O. Rosenberg, Professor, Department of Biological Sciences

Tumors can be modified to present their own endogenous peptide antigens via class II Major histocompatibility complex (MHC II) to CD4+ T-helper cells (Th), which are necessary for an effective anti-tumor immune response. MHC II is normally co-expressed together with an accessory molecule called the class II associated invariant chain (Ii), which drives presentation of externally processed peptides. In the absence of Ii, a cell presents a different repertoire of peptides derived from various internal organelles and cytosol. By modifying tumor cells to present its own peptides via MHC II, it may be possible to create a tumor vaccine which alerts the immune system to the presence of tumors. We have successfully genetically modified a mouse tumor cell line with a retrovirus expressing a small hairpin RNA that down regulates Ii by greater than 95%. Ii expression was evaluated by immunohistochemistry and Western blotting. These MHC II+ Ii- cells will be tested for tumorigenicity in mice and their ability to present model antigens, activating T-cells in *vitro* and *vivo*. Modifying well understood biological mechanisms such as MHC II antigen presentation to better present tumor antigens may help the body better recognize and fight tumor.

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Dwelling on *The Floor of Heaven* -- John Tranter's Verse Novel

Katherine E. Furgol
Piotr K. Gwiazda, Assistant Professor, Department of English

Contemporary Australian poet John Tranter's verse novel *The Floor of Heaven* (1992) describes therapy-seeking individuals who share their life stories with one another, leaving the reader to wonder: "what does it all mean?" In what I intend to be the first-ever in-depth analysis of Tranter's text, I answer precisely this question, focusing on the ways in which the poet challenges his readers' expectations of literary form and meaning. My discussion addresses the key stylistic and thematic elements of *The Floor of Heaven*, including the hybrid nature of the work, the juxtaposition of traumatic and grotesque situations, the emblematic image of "the floor of heaven," and the central role art and photography play in Tranter's text. As I argue in my project, Tranter's refusal to offer a clear pattern of meaning throughout *The Floor of Heaven* forces its readers to reassess not only how they read, but also how they approach life.

Analysis of *E-cadherin* Misexpression in the Developing Neural Ectoderm

Amber D. Gaither*, Michael Harrington,Rachel Brewster*
Rachel Brewster, Assistant Professor, Department of Biological Sciences

The classical cadherins, N-cadherin (N-cad) and E-cadherin (E-cad), are traditionally known to regulate intercellular adhesion between neighboring cells. However, recent studies have demonstrated a more complex role for these molecules in regulating tissue specific morphogenesis. During development of the amphibian and mammalian central nervous system (CNS), *N-* and *E-cad* expression is observed in complementary domains within the ectoderm. Our hypothesis is that the non-overlapping expression of these molecules reflects a differential role for both genes. Within the non-neural ectoderm, *E-cad* may promote strong, stable cell-cell contact, while *N-cad* may facilitate cell motility. We will first confirm that *E-cad* expression is also restricted to the non-neural ectoderm in the zebrafish (ZF) embryo. We will then missexpress *E-cad* in the neural ectoderm to address whether *E-cad* can suppress neural tube morphogenesis.

Toward these goals, we have successfully cloned the ZF homologue of *E-cad*. ZF *E-cad* was subcloned into two expression vectors, the TOPO Gateway and the TOPO TA, allowing us to synthesize an anti-sense riboprobe and fuse ZF *E-cad* with green fluorescent protein (GFP), respectively. Future experiments include analysis of *E-cad* RNA expression by *in situ* hybridization and analysis of neural tube morphogenesis when *E-cad* is ectopically expressed in the neural ectoderm.

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Xenobiotic Effects on Microtubule Morphology

Melat Garedew
Ashiwel Undie, Associate Professor, Department of Pharmaceutical Sciences, University of Maryland Baltimore School of Medicine

Microtubules are targets for various xenobiotic compounds that are used to induce cell death in the treatment of cancer. Hence, significant efforts have been directed at investigating if and how exposure to environmental chemicals might contribute to the cause of neurodegenerative diseases such as Parkinson Disease. The possibility that some environmental neurotoxins may act by interfering with microtubule function has not been thoroughly investigated. The major goal of this research is to study chemical modulation of microtubule formation, conformation, and function, and to explore the relationship between microtubule structure and function both *in vitro* and *in vivo*. The present phase of the research has established a method for assessing the effects of microtubule polymerizing compounds on microtubule tertiary structure. Structural studies, involving observation of polymerized microtubules under a fluorescence microscopy are being conducted. Additionally, endogenous molecules such as catecholamines, and xenobiotic molecules such as the anticancer drugs paclitaxel and vincristine, will be tested. Data collected from these studies is expected to contribute to our understanding of how various compounds affect microtubule dynamics and cellular viability, and ultimately aid in the development of preventive treatments for undesirable chemical-induced cell death.

*This work was funded, in part, by UMBC through the NIH National Research Service Award GM 08663 to the Minority Access to Research Careers (MARC) Undergraduate Student Training in Academic Research (U*STAR) Program* at *UMBC.*

Development of an Organophosphate Neurotoxin Sensor

Anton Geisz Jr.
Theresa A. Good, Associate Professor, Department of Chemical and Biochemical Engineering

The use of a dangerous family of chemicals called organophosphate neurotoxins is becoming increasingly common in pesticide and chemical warfare applications. We are creating a fast and sensitive analytical device for their detection and quantification.

Our approach takes advantage of competitive enzyme inhibition. We start by attaching a nanogold particle to an enzyme (specific to organophosphates) making the gold-enzyme complex a fluorescent modifier. We then add to the system a fluorescent inhibitor, and the organophosphate that we wish to identify. We can then either measure the rate of change of the signal strength to determine the neurotoxin, and the total amount of change to determine the concentration of the neurotoxin, or we can measure the total change in fluorescent signal with different fluorescent decoys and/or gold labeled enzymes to determine both identity and concentration of neurotoxin.

Through experiment, we have concluded that the system is feasible. Via mathematical modeling we have established a range of system parameters necessary for optimal sensor performance, including ability to discriminate between various organophosphates and simultaneous organophosphate identification and quantification.

This work was funded, in part, by NSF Grant CTS0330189 and the Pfizer Undergraduate Research Program.

Laughing and Smiling in Children with Angelman Syndrome

***Eric W. Gernat**, David M. Richman, Heather Teichman*
David M. Richman, Associate Professor, Psychology Department

This study examined the effect of the presence or absence of social stimuli on smiling and laughing in young children with Angelman syndrome (AS). Previous research has indicated that laughing and smiling may occur independently of environmental social situations such as playing with parents or engaging in preferred activities. That is, smiling and laughing in children with AS are frequently considered to be repetitive behaviors that are part of the behavioral phenotype of the disorder and relatively unaffected by social stimuli. However, only one study has previously attempted to systematically address this issue via direct observation, and results of this study indicated that laughing and smiling were affected by social stimulations. The current study evaluated laughing and smiling exhibited by two young boys with AS. The children participated were observed during two conditions that were conducted repeatedly in random order. The *social interaction* condition consisted of continuous access to preferred toys and adult attention from the child's caregiver. In the *no interaction* sessions, the child had no interaction with the caregiver, and did not have access to any toys. Results of this study indicated that laughing and smiling in both participants were unaffected by the presence or absence of social stimulation. Thus, future research should focus whether the variables that are responsible for some behaviors associated with specific genetic disorders change across the lifespan from predominantly biological to environmental.

This work was supported by grant R03 HD045419 from the National Institute of Child Health and Human Development.

An Exploration of Melanopsin's Function Through Site-Directed Mutagenesis

Marcus J. Gillis
Phyllis R. Robinson, Marquis T. Walker, Department of Biological Sciences

Melanopsin is a G-protein coupled receptor in the mammalian retina that closely resembles a variety of visual opsins and is believed to be involved in the photoentrainment of circadian rhythms. Melanopsin is expressed in a subset of retinal ganglion cells that project to the suprachiasmatic nucleus, which controls circadian rhythms. In our laboratory, we can express mouse melanopsin in mammalian tissue culture cells. The expressed protein can be purified and studied in a spectrophotometer. We hypothesize that tyrosine, an amino acid sequence at position 145, functions as a counterion to the protenated Schiff-base at the sited chromophore attachment. To address this, we are in the process of constructing a mutant of melanopsin (using QuikChange mutagenesis) in which the tyrosine amino acid is being replaced with an alanine. The approach we are using is to mutate the bases one nucleotide at a time, since mutating three together has proved unsuccessful. The construction of the mutant gene is in process. Once constructed, the mutant will be assayed photometrically.

*This work was funded in part by the Howard Hughes Medical Institute and by UMBC through the NIH National Research Service (NRSA) Award GM 08663 to the Minority Access to Research Careers (MARC) Undergraduate Student Training in Academic Research (U*STAR) Program* at UMBC.

The Role of Metal Binding in Cytotoxicity of UK-1 and Analogs

Frank J. Gooden
Paul J. Smith, Associate Professor, Department of Chemistry and Biochemistry

UK-1 is a natural product produced by a strain of Streptomyces, and has been found to be a potent anticancer agent. This activity may result from its ability to inhibit Topoisomerase II, an enzyme involved in the regulation of DNA topology that is necessary for cell division. Previous experiments done in methanol showed that UK-1 and analogs to bind divalent metal ions, and it was proposed that magnesium-dependent DNA binding might serve as the basis for Topoisomerase II inhibition. We recently found that magnesium binding is very weak in aqueous methanol as compared to that in pure methanol. As the former is a more biologically relevant solvent, this result suggests that complexes with a metal or metals other than magnesium may be responsible for the cytotoxicity (and perhaps that Topoisomerase inhibition is not even involved). Consequently, we have reinvestigated the binding of two analogs of UK-1 with a series of divalent metal ions including Cu^{2+}, Ni^{2+}, Co^{2+}, and Zn^{2+}, in aqueous methanol. Association constants obtained using spectrophotometry will be presented; these suggest mechanisms other than Topoisomerase inhibition that may be responsible for the cytotoxicities of these compounds.

This work was funded by NIGMS (National Institute of General Medical Sciences)/NIH.

Cocaine Exposure Causes Changes in the Flexibility of Learned Behavior

Nishan Gugsa*, Gregory Bissonette*, *Matt Roesch*
Geoffrey Schoenbaum, University of Maryland School of Medicine
Carlo DiClemente, Professor, Department of Psychology

The use of psychostimulants causes changes to prefrontal circuits, which are critical to flexible behavior based on the value of expected outcomes. Our lab has recently shown the inability to alter responding for a conditioned stimulus after reinforcer devaluation in cocaine-experienced rats. To ask whether this effect would generalize to other settings, we trained cocaine-treated rats in on a Pavlovian place preference (CPP) task and also in an odor-guided instrumental choice task. After the animals were trained, we manipulated the value of the expected outcome using devaluation, size of available reward, and time to reward. As expected we found no effect of prior exposure to cocaine on development of a conditioned place preference or in the ability of the animals to use odors to guide instrumental choices. However, we did find that cocaine exposure changed the sensitivity of these behaviors to the subjective value of the reward the rats' expected to receive. This was particularly true in the choice task, in which we found cocaine-treated rats to be more sensitive to changes in reward size and the delay to receipt of reward. These data are consistent with effects of prefrontal damage in this task, suggesting that exposure to cocaine results in long-lasting changes in the efficacy of prefrontal processing.

This work was funded by a fellowship award from NIDA to Nishan Gugsa, in association with NIDA R01-DA015718 to Dr Geoffrey Schoenbaum.

Reassessing the Phylogeny of Euplotid Ciliates Using Ribosomal Sequences

Yara K. Haddad
John A. Kloetzel, Associate Professor, Dept. of Biological Sciences

The order Euplotida represents a grouping of large ciliated protozoa, conspicuous in freshwater and marine environments worldwide. Within the family Euplotidae, the genus *Euplotes* is a cosmopolitan and widely studied taxon, with over 60 named species. In 1995 Borror and Hill split this traditional genus *Euplotes* into four subgroups, based on morphological and developmental criteria. Each subgroup was raised to the level of genus, with new generic names provided. Using universal eukaryotic ribosomal primers and polymerase chain reaction (PCR), we have determined the sequence of the ribosomal small subunit gene (SSU-rDNA) from *Euplotes ("Euplotopsis") muscorum*, a rare small euplotid none of whose genes are available on public databases. We have used this sequence, in combination with genomics software and SSU-rDNA sequences for many *Euplotes* species available on GenBank, to construct a phylogenetic tree for these species. The idea was to see whether or not our molecular phylogeny confirms the species groupings erected by Borror and Hill on cytological grounds. The results of this comparison are displayed here.

The Development of the Steel Guitar in Country and Western Music

Jack L. Hamlett
Joseph C. Morin, Lecturer, Department of Music

The purpose of this project was to conduct the first in-depth study of the development of the steel guitar in traditional country and western music in the 1930s, 1940s, and 1950s to the present. Due to the advanced age of many of the pioneers of the steel guitar, it was critical that this project be carried out at this time. Within the research phase of this project, more than one hundred interviews were conducted with ninety-three individuals including surviving pioneers of the steel guitar as well as colleagues and relatives of deceased pioneers of the instrument.

This research maps out for the first time in detail the complex history of the evolution of playing styles of the steel guitar under the period in question. It also indicates that the development of the steel guitar incorporated significant patterns and similarities as well as considerable creativity and individualism among the most significant pioneers of the steel guitar. The study also makes clear important regional distinctions in the development of the styles and techniques, with players located east of the Mississippi River tending to play more traditional and commercial country music while players west of the Mississippi most often leaned toward western swing in their styles.

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

Photography of Jaromir Stephany

Emily A. Hauver
Preminda S. Jacob, Associate Professor, Department of Visual Arts

The Photography of Jaromir Stephany serves to explore and document the rich personal history and distinguished career of American photographer Jarmoir Stephany (b. 1930). Although Mr. Stephany has had his work exhibited by several respected institutions, including the Baltimore Museum of Art, there is unfortunately a dearth of writing addressing his biography and artwork, a situation this project attempts to rectify.

A series of six interviews with Mr. Stephany reveal numerous anecdotes from interactions with many great American photographers, including Ansel Adams and Minor White. All of the conversations were recorded on tape to create a source of information for future scholars. These interviews also inform an analysis of Mr. Stephany's own photographic work, which is characterized by his thoughtful embrace of the history of the medium and simultaneous move away from the traditional camera-based approach taken by most photographers.

The results of this research are presented in the form of an essay on the evolution of Jaromir Stephany's photographic career as well as an exhibition of his artwork. The latter consists of a group of Mr. Stephany's photographs, installed in The Commons at UMBC, that illustrate the *cliché verre* technique—a type of camera-less photography—that is Mr. Stephany's signature style.

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

Trends in the Entropies of Diatomic Gallium and Indium Compounds

Paul A. Hoover
Joel F. Liebman, Professor, Department of Chemistry and Biochemistry

In this research project, the problem undertaken was twofold: first, the hypothesis of a recently published formula to explain patterns in the total entropies of certain compounds was analyzed in regards to two "new" elements, gallium and indium; second, thermochemical data on the compounds of gallium and indium with the Group 1, Group 13, and Group 17 elements were studied because these molecules had not been analyzed in previous research. The importance of this research is based on its theoretical merit, specifically, in trying to develop explanations to thermochemical patterns.

One of the thermochemical factors that affect chemical reactions is the disorder created in the reaction, called entropy. This project was a continuation of prior research to determine why trends in the total entropies of selected compounds appear. With the aid of SPARTAN, a computer program that provides quantum chemical data for molecules of interest, the entropies of specific gallium and indium compounds were derived.

The overall results from the investigation supported the validity of the equation for the past research. However, many more avenues of research exist on the subject: for example, future research will include more elements in the study.

Calculation of Dye-labeled Protein Structure by Biological Computational Modeling for Fluorescent Biosensor Design

Thomas Hsu
Leah Tolosa, Assistant Professor, Department of Chemical and Biochemical Engineering

Bioinformatics is an important and unique computational tool developed to maintain the enormous amount of biological and chemical information generated by and for scientists and engineers. Here we report the use of the Rosetta software in predicting the photophysical properties of dyes covalently attached to important proteins, particularly binding proteins meant for sensor development. The Rosetta software is a bioinformatics tool which simulates Monte Carlo statistical analysis on protein conformation. It is developed by the University of Washington in collaboration with John Hopkins University bioengineering faculties.

One of the challenges of designing optical biosensors is the uncertainty that labeling a specific site on a protein will provide a sufficient signal correlated to the analyte being measured. As an example, the Q26C mutation of the glucose binding protein (GBP) shows variable responses to glucose depending on the dye attached to the cysteine mutation. Using Rosetta software, we calculated the structures of GBP labeled with the dyes iodoacetamido-anilinonaphthalene sulfonate (ANS) and N-(1-naphthyl) ethylenediamine (EDANS) on position-26. However, the existing software contains codes only for the amino acids. Thus, several codes are being developed for the specific dyes labeled to GBP. Further direction may lead to the development of a database for labeling dyes.

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Dialogue Mapping

Emily J. Hunter
Irene Chan, Assistant Professor, Department of Visual Arts

In “Dialogue Mapping,” overheard conversation is recorded and visually diagramed in order to better understand the way that people interact. This work is intended to provoke thought about the nature of dialogue and interaction between human beings. Handwriting is employed in the creation of these visual diagrams because it is the most universal way to understand sound through images.

“Dialogue Mapping” attempts to create a visual understanding of non-visual material (sound, logic, flow, content.) Traces of sound are interpreted and translated into graphic representations resembling maps. These maps are then projected into a three-dimensional space, allowing the dialogue to re-enter the atmosphere, where it inevitably distorts and dissipates. The resulting images resemble blueprints – evidence of what has already occurred as well as a plan for something that may happen in the future. Much like dialogue, the images elicit different interpretations from different people. Meaning is blurred, emphasizing the subjective experience of language. “Dialogue Mapping” both examines and encourages understanding of human communication.

Myeloid Suppressor Cells Inhibit Activated T Lymphocytes

Uzoma Iheagwara, *Erica M. Hanson, Suzanne Ostrand-Rosenberg*
Suzanne O. Rosenberg, Professor, Department of Biological Sciences

Breast cancer is the second most common cancer in women and research is ongoing to discover more effective therapies. As tumors grow and progress, anti-tumor immunity becomes complicated due to suppressive factors such as myeloid suppressor cells. Myeloid suppressor cells are immature precursor myeloid cells that have been shown to play a role in suppressing anti-tumor immunity to 4T1 mammary carcinoma tumors. Suppressive CD11b+GR1+ myeloid suppressor cells have been shown to play an important role in T-cell regulation. We hypothesize that myeloid suppressor cells suppress activated CD4+ and CD8+ T lymphocytes in the 4T1 mammary carcinoma model. Suppression will be tested by assessing the responses of T lymphocytes isolated from mice that are transgenic for T cell receptors specific for an antigen. Myeloid suppressor cells will be isolated from BALB/c mice injected with 4T1 mammary carcinoma cells. Transgenic CD4+ or CD8+ T lymphocytes in the presence or absence of the appropriate peptides will be cultured with these myeloid suppressor cells and proliferation will be measured to determine if suppression occurs. We will then identify signaling pathways of T lymphocytes that may be affected by myeloid suppressor cells in order to further the search for new effective therapies for breast cancer.

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Effects of Non-Linear Membrane Elasticity on Capsule Deformation

Mustapha Jamal, *Andres L. Gonzalez-Mancera, Charles D. Eggleton*
Charles D. Eggleton, Associate Professor, Department of Mechanical Engineering

The deformation of a capsule under hydrodynamic loading is affected by the mechanical behavior of its membrane. An axisymmetric implementation of the boundary integral method is used to simulate the deformation of capsules while varying the capillary number, Ca, which measures the ratio of viscous to elastic forces based on the area-dilatational modulus. Comparisons are made between capsules with membranes modeled using four classic, elastic constitutive equations. The deformation of each capsule type was observed for Ca between 0 and 0.5. Our results show that the neo-Hookean capsule deforms infinitely once a critical capillary number is surpassed. For all other membrane types the capsules reach an equilibrium shape where the viscous stresses are balanced by the elastic tensions on the membrane. This is true for the range of Ca investigated. By matching our computer simulations of different capsule types with experimental observations it will be possible to accurately measure the mechanical properties of cells and artificial capsules.

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Fluorescent O_2-sensors Prepared Using Silica Nanoparticles

Hasina Jamal
Yordan Kostov, Assistant Professor, Department of Chemical and Biochemical Engineering

Oxygen concentration around and inside cells is one of the most important parameters that affects their differentiation and proliferation. It is especially difficult to measure the concentration of O_2 inside living cells, as the sensing "device" should be inert and small enough not to interfere with the cell machinery. Silica nanoparticles are excellent candidates for this purpose. Other groups have attempted doping them with oxygen-sensitive dyes, but this resulted in oxygen insensitive particles. In this study, we describe a new process for preparation of oxygen sensitive dye-doped silica nanoparticles. Tris (4,7–diphenyl-1, 10-phenanthorline) ruthenium (II) was used as oxygen-sensitive dye, octyltriethoxysilane (O_3EOS) and Tetraethylorthosilane (TEOS) as particle precursors. The particles have been synthesized via the standard sol-gel process using ammonia-catalyzed hydrolysis. Different water content was used to vary the degree of the precursor hydrolysis. The particles were collected via centrifugation. For immobilization purposes, they were dispersed in silicone rubber and tested on their response to varying oxygen concentrations. The fluorescence spectra in nitrogen and air were also analyzed. The stability of the nanoparticles was evaluated over a six-month period. For the first time, oxygen-sensitive dye-doped silica nanoparticles were created and successfully used as an O_2-sensor. It can find wide applications in areas such as biomedical research (i.e. in cell culture studies), biotechnology (production of pharmaceuticals) and environmental protection (oxygen measurements in rivers, lakes and in the ocean).

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Tribological Measurements of Carbide-Coated CoCrMo for the Improvement of Prosthetic Joints

Brandon J Johnson
L.D.T. Topoleski, Professor, Department of Mechanical Engineering

Low coefficient of friction and durability are critical factors in the development of prosthetic joints. Carbide coating (CVD) is a new development on the already established CoCrMo metal that is hypothesized to bring vast improvements to current prosthesis. We seek to test the tribological properties of this material to validate this hypothesis. A model of the surface contact for the non-uniform material will be evaluated using a surface profilometer. With this model more efficient friction calculations can be obtained and thus improve the accuracy of results. The coefficient of friction will be measured between the CoCrMo and UHMWPE samples using a pin-on-disk tribometer. To study the material *in vitro*, the same friction tests will be repeated using lubrication to imitate the environment of actual joints. Bovine serum is a popular composition of lubrication to mimic the bodily fluids surrounding joints. Further experiments will be conducted to determine the correct combination of serum and water to simulate as accurately as possible. Analyzing tribological characteristics will lessen the friction and increase the wear fracture resistance to improve the quality of artificial joints.

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Elucidation of the Bovine Leukemia Virus RNA Encapsidation Signal

Nicolas M. Johnson*, Rasheeda Johnson, Tyiesha Johnson, Timothy Simons, F. Zehra Yildiz,*
Michael F. Summers, Professor, Department of Chemistry and Biochemistry

The primary focus of this research is to examine the interaction between the Bovine Leukemia Virus Nucleocapsid (BLV NC) protein and its RNA encapsidation signal. Confirmed structures of NC bound to this RNA sequence will shed more insight on the encapsidation of viral genomes of retroviruses and offer more clues on a new therapeutic approach to battling BLV and Human T-cell Leukemia Virus infection. BLV is an oncogenic retrovirus whose simple genome lends itself to various studies on antiviral pharmaceutical agents. One of the most important, but poorly understood processes of the retroviral lifecycle of BLV and other retroviruses such as HIV-1, is the encapsidation of the viral genome. Two unspliced viral genomes are selectively packaged within a single virus particle during assembly. Our proposed Ψ site, also known as PBSSLV, includes two stemloop structures that consist of the primer binding site at the 5' end of the viral genome in the untranslated region and ends upstream of the Gag initiation codon. Conclusive data using gel mobility shift assays show that NC binds with high affinity to the entire PBSSLV sequence. Future studies of the project will include structural and biochemical studies by Nuclear Magnetic Resonance, isothermal titration calorimetry, and site-directed mutagenesis experiments.

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Elucidating the BLV Psi-site in the 5' Noncoding Region of Gag

Rasheeda J. Johnson*, Nicolas J. Johnson, Tyiesha Johnson, Timothy Simons, F. Zehra Yildiz*
Michael F. Summers, Professor, Department of Chemistry and Biochemistry

Bovine Leukemia Virus is an exogenous type C retrovirus that affects over 50% of cattle in the United States, often leading to malignant lymphoma development. Genetically similar to the Human T-Cell Leukemia Virus Type I (HTLV-1), this retrovirus is prevalent in Japan, the Caribbean, and Central Africa and infects humans through sexual contact to produce a lymphoma phenotype; with a better understanding of the encapsidation signal or Ψ–site of BLV, new means of stopping the spread of BLV and HTLV-1 can be found. My project focuses on recognizing the genome that initiates packaging of the Bovine Leukemia Virus (BLV) genome. The encapsidation signal being explored, PBBSLV, is located in the 5' noncoding region of the BLV genome and consists of two stem loops. We have made proviral DNA of our Ψ–site and a transcript containing the BLV Ψ–site. Our results obtained from titrations of Ψ–site with Nucleocapsid (NC) indicated that PBSSLV is completely bound to NC at a 1:1 ratio. Isothermal Titration Calorimetry (ITC) will be performed to determine the binding constant and Nuclear Magnetic Resonance (NMR) to elucidate the structure of NC bound to the proposed Ψ–site. We hypothesis that the encapsidation signal is PBSSLV.

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Defining Species Limits Using Color in the Orchard Oriole Complex

***Lynna M. Kiere**, Ian E. Tracy, Kevin E. Omland, Thomas W. Cronin, Jeff Leips, Christopher M. Hofmann*
Kevin E. Omland, Assistant Professor, Department of Biological Sciences

We used quantitative color measurements to investigate species boundaries in two closely related orioles: Orchard Oriole (Icterus spurius spurius) and Fuertes's Orioles (Icterus spurius fuertesi). One apparent difference between these birds is their male plumage coloration. Male Orchard Orioles generally appear chestnut, whereas Fuertes's Orioles are described as ochre. Despite observational evidence, these color differences have not been previously quantified. We used a reflectance spectrometer to gather quantitative color measurements of plumage. We found that Orchard and Fuertes's Orioles' colored plumages have unique characteristics, with no overlap in color between Orchard and Fuertes's orioles. These findings provide further support for classifying Orchard and Fuertes's oriole as separate species. Our findings have particular significance for Fuertes's Oriole, which if declared a distinct species would be more eligible for conservation efforts in its restricted geographic range in Mexico. In a broader context, this research is important in demonstrating the utility of quantitative measurement of color as a tool for examining species boundaries, which could apply to many organisms.

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Validation of a Revised DAS: A Measure of Romantic Relationships

***Stefanie Kirk**, Jennifer Ficco, Meagan Arnold, Brian Jobe*
Stanley Feldstein, Professor, Departments of Mathematics and Psychology

This study will establish the validity of the Dyadic Adjustment Scale Revised (DAS-R), comparing it to the original Dyadic Adjustment Scale (DAS; Spainer, 1976) in a college-aged sample of romantically involved students. The DAS was originally developed to assess the qualities of cohabiting couples in romantic relationships by determining perceptions of agreement within the couple on various issues regarding their relationship. Topics include overall happiness in the relationship, agreement on making major decisions, and level of shared interests. The original DAS, with 32 items, has been revised to a shortened version of only 19 items (DAS-R). The validity of the DAS-R will be compared to the DAS from our participants of college students involved in romantic relationships. University of Maryland, Baltimore County undergraduate students will complete both the DAS and DAS-R, approximately two weeks apart. Results of this study will assist in an ongoing study on the characteristics of romantic relationships to add essential information about the validity of the DAS-R in the target population to investigate whether there are characteristics of partners and their interactions in romantic relationships that may be able to predict the outcome of the relationship.

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Structural Elucidation of HIV-1 Packaging Signal

***Andrew S. Kohlway**, Julian T. Eaton*
Daniele Fabris, Associate Professor, Department of Chemistry and Biochemistry

The structural elucidation of the packaging signal (Ψ-RNA) of HIV-1 is made difficult by its large size and flexibility. NMR and crystal structures are only available for separate subdomains, while there are no high resolution data for the full length construct (~120 nt) and its dimer. We have recently proposed an alternative strategy based on chemical crosslinking and mass spectrometry detection (called MS3D), which is not limited by considerations of size and flexibility. The effective utilization of the spatial constraints provided by this approach requires the development of new computational techniques.

We are investigating the possibility of using torsional angle matching and binning, "RNA worm" structural comparison, and MOLPROBITY to achieve RNA motif classification and evaluation. Our goal is to improve existing models of Ψ-RNA, to better understand the role of the packaging signal of HIV-1. Using a database of RNA crystal structures, 6486 residues were analyzed using a perl script. This produced a listing of each residue's six conventional torsional angles (α,β,γ,δ,ε,ζ), base plane χ angle, and two pseudotorsions(η,θ). Each residue was placed in one of 96 torsional conformations, and labeled with an ASCII character. A C++ pattern recognition program separated the alpha helical and non-canonical residues according to their 'character labels', and binned distinct patterns of three or more non-canonical residues. Further analysis of non-canonical residues will help elucidate and characterize additional RNA motifs and torsional constraints. In addition, the volume of each RNA structure from the database was calculated using Richards' Rolling Probe Method. Combined with sequence data, the approximate volumes of each base can be calculated to create volume constraints for modeling of the Ψ-RNA.

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The Analysis of Curvatures of Discrete Surfaces with Boundary

Brian J. Krummel
John W. Zweck, Assistant Professor, Department of Mathematics and Statistics

The curvature of a surface is a function that measures how the surface deviates from its tangent plane at each point. The study of the curvature of discrete surfaces is important for understanding the structure of anatomical surfaces. Discrete surfaces arise as level surfaces extracted from three-dimensional imaging data, such as in medical imaging. We represent discrete surfaces by triangulated meshes, which are formed as the union of triangles whose vertices are the data points on the level surface. There currently exists a rich theory concerning the curvature of triangulated surfaces. However, this theory assumes that the surfaces involved do not have a boundary. Using an approach developed by Cohen-Steiner and Morvan, I will describe formulae for computing curvatures of discrete surfaces with boundary and error bounds comparing the curvature of a discrete surface to the curvature of the smooth surfaces that it approximates.

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Life History Adaptation of a Parasitoid by Optimal Host Tracking

Kate L. Laskowski, *Syed Ahmed*
Jeffery W. Leips, Assistant Professor, Department of Biological Sciences

The purpose of this project was to define the optimal host species of *Drosophila* for the parasitoid wasp, *Leptopilina sp.* and to evaluate the hypothesis that the breeding phenology of the wasp evolved to match that of its optimal host. This project allowed us to assess the influence of host community structure on the life history evolution of parasitoids. A three year field study identified four parasitoid wasp species and at least seven possible *Drosophila* host species. The breeding phenology of one wasp species, *Leptopilina sp.* was confined to the later half of the summer which coincided with the highest density of *Drosophila melanogaster* and *D. simulans* and the time of the lowest species diversity of *Drosophila*. We measured wasp host preference and the hosts' immune response against the wasp by exposing size matched larvae of five potential *Drosophila* species to *Leptopilina* females. *Leptopilina* attacked and was most effective against three fly species, including the two late emergence species and completely avoided two species found only early in the summer. Our results indicate that *Leptopilina* can discriminate among host species and support the hypothesis that the breeding phenology of the wasp has evolved to track that of their optimal hosts.

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Fluorescence Detection of Glucose/Glutamine Based on Glucose/Glutamine Binding Protein Immobilized on Dextran Modified Glass Capillary

Debora W. Lin*, Amelita Bartolome, Govind Rao and Leah Tolosa*
Leah Tolosa, Assistant Professor, Department of Chemical and Biochemical Engineering

Continuous glucose monitoring is desired to avoid the myriad of diabetes complications such as blindness, amputation, heart and kidney diseases. Despite the availability of glucose monitoring kits in the market today, the search for continuous minimally invasive glucose monitoring devices continues. We present here our initial study to develop a continuous quantitative fluorescence detection of glucose using immobilized dicysteine bearing periplasmic glucose binding protein (GBP). two amino acid mutations (L255C/E149C and L255C/A71C) were achieved by site-directed mutagenesis. The L255C mutation is located in a more obscure position near the hinge of the GBP while the other two mutated amino acids (E149C or A71C) are positioned opposite L255C and are more exposed to the solvent. Covalent immobilization was done by conjugation of one of the more exposed thiol groups (E149C or A71C) to dextran modified glass capillary surface. The immobilized GBP was subsequently labeled with acrylodan at position L255C. The resulting system binds glucose with a corresponding decrease in acrylodan fluorescence. Results suggest that immobilization did not hinder substrate binding to the conjugated protein. The immobilized glucose sensor responded to 0.000016 μM-1.6 μM glucose.

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Women and Body Hair: An Intimate Relationship

Jacqueline A. Little
Jodi Kelber-Kaye, Visiting Assistant Professor, Department of Women's Studies

The growth of body hair is natural, and there are no proven biological benefits to its removal. Despite this, a large majority of U.S. women shave their legs and/or underarms on a regular basis. The "hairless norm" is more than just women's responses to cultural beauty standards. As feminist theories repeatedly assert, women are active participants in a continual process of adhering to and resisting socio-political and cultural norms and expectations. Simply, women negotiate individual choices regarding body hair through the framework of their particular realities, concerns, and experiences within their particular cultural contexts. These choices may be influenced by a number of complex interweaving factors including: marketing, race, ethnicity, gender identity, sexual orientation, class, family influences, shaving as a rite of passage, age, socio-cultural beauty standards and norms, and intimate relationships. While research has been focused on how one or two of these factors influence women's decisions to remove and/or keep their body hair, no research to date examines how all these factors work together to construct real women's experiences and decision-making regarding the removal or non-removal of body hair. This film project uses more than fifty interviews, archival film footage, photographs, and current and historical research, to construct an intimate and in-depth contextual look at women's relationships to their body hair.

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Laser-Stimulated Raman Spectroscopy as a Method for Remote Atmospheric Sensing Technology

Matthew S. Loftus
Lisa A. Kelly, Associate Professor, Department of Chemistry and Biochemistry

Modern unconventional weaponry often incorporates aerosolized chemical and/or biological agents that can only be detected at close range. Few systems capable of detecting these agents from a distance have been developed for defense use. This project seeks to use Laser-Stimulated Raman Spectroscopy (LSRS) to probe various gases and vapors and eventually provide both theoretical and experimental fundamentals of LSRS for building remote, or stand-off, sensing systems in homeland defense or other atmospheric applications. Raman spectroscopy is a promising field for optical detection of these agents because it can characterize different substances based on peak wavelength, its peak strength is directly related to concentration, and the remote sensing can be done by monitoring back scatterings. The initial stages of the work have been devoted to finding optimal conditions in terms of pressure and laser power in order to rationalize the signal intensities and developing a system for characterizing gases like hydrogen, methane, and propane. Later stages, which may last until spring 2007, will involve measuring LSRS signals from a variety of pure gases and gas mixtures. All work will be carried out under the supervision of Hao Hao Ke as part of the ongoing research project in Dr. Lisa Kelly's lab.

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On Our Duties to Animals

Theresa L. Lopez
Susan J. Dwyer, Associate Professor, Department of Philosophy

The main aim of my research is to develop an account of the moral status of animals and address the significance of their moral considerability. Given the various ways humans interact with animals I believe this is an especially important question. Historically animals have been accorded little or no moral status, but in the past 30 years many have attempted to extend moral standing to animals. My analysis and critique of two such attempts, those of Peter Singer and Tom Regan, provide a backdrop against which I tease out significant theoretical points regarding what about certain animals makes them morally considerable, and further, what considerations we need to take into account when judging the moral permissibility of our practices involving animals. I argue that we should observe constraints on our treatment of animals because of their subjective awareness, which confers the ability to experience pain and suffering. I defend the use of this criterion against charges that investigation into the mental lives of animals is unscientific. While I ultimately conclude that there can be no universal principle to guide our treatment of animals, I do discuss what considerations are relevant, and how we might begin to analyze our current practices.

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The Aryl Hydrocarbon Receptor (AhR) May Alter Cytochrome P450 Enzyme Levels in the Mouse Ovary

Candace B Mainor, *Jodi Flaws, Kimberly Barnett*
Kimberly Barnett, Graduate Assistant, University of Maryland School of Medicine
Jodi Flaws, Associate Professor, University of Maryland School of Medicine

The AhR is a ligand-activated transcription factor that mediates the toxic effects of environmental contaminants. Previous studies have shown that in comparison to wild-type mice (WT), AhR deficient (AhRKO) mice have reduced fertility, which could be due to defects in estrogen biosynthesis. During estrogen biosynthesis, cholesterol is taken across mitochondrial membranes by steroidogenic acute regulatory protein (StAR). Cholesterol is then converted into androgens and finally into E2 by cytochrome P450 side chain cleavage (CYP 450scc), CYP17α (CYP 17), aromatase, 17-beta hydroxysteroid dehydrogenase (17β-HSD), and 3-beta hydroxysteroid dehyrogenase (3β-HSD). To determine whether levels of these enzymes are altered in AhRKO ovaries compared to WT ovaries, ovaries were collected from WT and AhRKO mice on postnatal day (PD) 90. Total RNA was extracted, reverse transcribed to cDNA, and subjected to both semi-quantitative and real-time polymerase chain reaction (PCR). Real-time PCR analysis showed that the levels of CYP17 in AhRKO ovaries were lower than those of WT ovaries (WT=1.23±0.02, AhRKO=0.05±0.0005 genomic units, n=3, $p<0.0001$). Further, the levels of StAR were lower in AhRKO ovaries compared to WT ovaries (WT=0.7±0.09, AhRKO=0.38±0.06 genomic units, n=5, $p<0.02$). Collectively, these data suggest that AhR deficiency reduces the levels of key steroidogenic enzymes in the mouse ovary.

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Hypnosis and Meditation as an Intervention for Pain, Anxiety, and Catastrophizing

David D. Maron
Robert Anderson, Associate Professor, Department of Psychology
Robert Provine and Lynanne McGuire, Professors, Department of Psychology

Meditation and hypnosis have been shown to be effective in reducing chronic pain. However, sufficient research demonstrating the benefits of combining meditation with hypnosis is lacking. Further, measurements of the benefits of meditation have been conducted primarily on those with little to no experience with meditation. To gain better knowledge of meditation's benefits derived from those experienced with meditation, this study measured meditation and hypnosis used by both novice and experienced meditators as an intervention for reducing physical pain, catastrophizing, and anxiety. Meditation practitioners with over two years of daily practice qualified as experienced meditators for this study. The cold pressor test (CPT), a task where participants place their non-dominant hand in a cold-water bath kept at 1°C for as long as they can endure it, was used to create laboratory pain. The participants performed a baseline CPT, and were then administered the intervention. Then the participants performed another CPT. The participants in the novice and experienced meditators group had their heart rate, blood pressure, pain, catastrophizing, and anxiety levels recorded and were then compared against each other and the control group.

This work was funded, in part, by the UMBC Honors College.

Supreme Court Nomination Hearings: How Justices Answer Questions

Jeffrey B. Martin
George LaNoue, Professor, Department of Political Science

During their nomination hearings, do all Supreme Court nominees refuse to answer certain questions about specific topics, or will a question be answered dependent upon the individual nominee and his or her preference? If the latter is true, then specific justices would be deserving of criticism for avoiding questions. However, if the former is true, then the Senate Judiciary committee should re-evaluate the types of questions it asks, avoiding topics that require the nominee to pre-judge issues. To answer my question, I read Justice Ginsburg's, Justice Breyer's, and Justice Roberts' nomination hearings. My analysis was quantitative, with outright refusals scored a "0," indirect refusals scored a "1," and complete answers scored a "2." I focused on five controversial categories: abortion; capital punishment; separation of church and state; separation of powers; and affirmative action and civil rights. The analysis concluded that the three justices answered anywhere from 65% to 72% of the total questions asked, and 46% to 58% of the total amount of questions asked from the five categories. The similarity of these percentages shows that recent nominees do not deserve to be criticized for avoiding questions. The committee needs to make some changes for future nomination hearings.

White Mountain Summer Dance Festival: Tears of a Clone

Elina D. Mavashev
Doug Hamby, Associate Professor, Department of Dance

The goal of my research was to study ballet, modern, composition, anatomy, kinesiology, yoga, repertory, Bartenieff Fundamentals and Laban Movement Analysis at the White Mountain Summer Dance Festival in order to enhance my performance and choreographic skills, and to produce a dance based on the knowledge I gained at the festival. As the oldest form of art that ever existed, dance has the power to tell a story, to convey a message, to invoke certain feelings, and to touch an audience in a way incomparable to other art forms. Without one spoken word, a dance can communicate an idea more effectively than a two hour lecture. In order to put theory into practice, I created a fifteen minute dance titled "Tears of a Clone" incorporating composition and movement techniques learned at the festival. The dance attempts to speak to the audience about one specific value embraced by the American culture – smiling, which can also be synonymous with suppression of feelings – and encourages the audience to reevaluate the message our culture embraces.

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

Coupled Consumer and Resource Biodiversity Effects on Ecosystem Functions

Corrie F. Maxwell
Christopher Swan, Assistant Professor, Department of Geography and Environmental Systems

Input of resources from streamside forests profoundly impacts stream food webs. Since the majority of this material takes the form of senesced leaf litter, and the quality as a food resource for stream consumers changes with tree species, leaf species composition should alter the way consumers respond to these resources. Furthermore, consumers feed at different rates, differentially regulating leaf breakdown in streams. Because loss of biodiversity is of current ecological interest, a laboratory study was performed where Red Maple and Red Oak litter were offered alone and in mixture to three aquatic insects (e.g., shredders). Shredders were allowed to feed alone and in the presence of other shredder species. Leaf disks and invertebrates were placed in screened chambers, submerged in bins with inoculated deionized water, and kept in environmental chambers for six weeks. The results indicate a relationship between leaf type and leaf mass consumed. Generally, consumption rates were fastest on Red Maple, followed by Red Oak, and slowest in the mixture. Preliminary analysis suggests that this pattern held regardless of shredder species composition. These results indicate that loss of tree species may be more important than loss of aquatic consumer species when examining patterns of decomposition rates in streams.

Determination of PKCI Localizations in Mouse Central Nervous System by Immunohistochemistry Techniques

Donnetta S. McFadden, *Qing Li, Jia B. Wan*
Qing Liu, Post-Doc Fellow, University of Maryland at Baltimore
Jia B.Wan, Associate Professor, Department of Neuropsychopharmacology, University of Maryland at Baltimore

Immunohistochemistry (IHC) is a technique used to locate the presence of specific proteins in tissues. It does this by binding a primary antibody to a specific antigen and amplifying the signal of that antigen-antibody complex with an enzyme conjugated secondary antibody. This forms a chromatic alluvium, which can then be detected visually using a light microscope. Our laboratory is interested in a special protein, protein kinase C interactive (PKCI), because of prior evidence supporting its potential interactions with the mu opiod receptor (MOR) and its function in opiate addiction. However, the role of PKCI in CNS is unclear, therefore, the information of PKCI distribution in CNS will be help to understand its function in CNS. There has not been a previously known light microscopic distribution of PKCI. IHC technique was applied to detecting protein kinase C interactive (PKCI) protein of mouse central nervous system (CNS). The analysis of IHC staining of floating sections (25μm) of mouse brain and cervical spinal cord has shown that PKCI positive cells were localized in the mouse CNS with intense expression in the cerebral cortex, olfactory bulb, spinal cord, hippocampus, hypothalamus, and cerebellum. There were also positive expressions of PKCI shown in the striatum, septum, and thalamus.

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Enhancing Literacy Promotion through a Web-Based System

Christine D. Medina, *Robert M. Lyv*
Tate O. Redding, Senior Lecturer, Department of Information Systems

The tedious, unattractive, and inefficient paper-based system currently used by the Literacy Program of the Free Library of Philadelphia is preventing the Program from recruiting and retaining more participants. The Program's main objective is to promote literacy by allowing patrons to read or write book reviews. This goal has not been met completely due to the existing inefficient process. Currently, patrons interested in reading the reviews must travel to the central Philadelphia branch of the library.

This project is crucial in creating a convenient, user-friendly system that encourages youth and adults to participate in the program. The team created a system that would enable the participants to read and write reviews online. Throughout the development process, the team continuously conducted interviews, surveys, and research in order to gather information, requirements, and feedback from multiple stakeholders. Through surveys, 85% of teens polled said that they are more willing to read and write reviews through the proposed website due to added convenience, features, and the friendly interface.

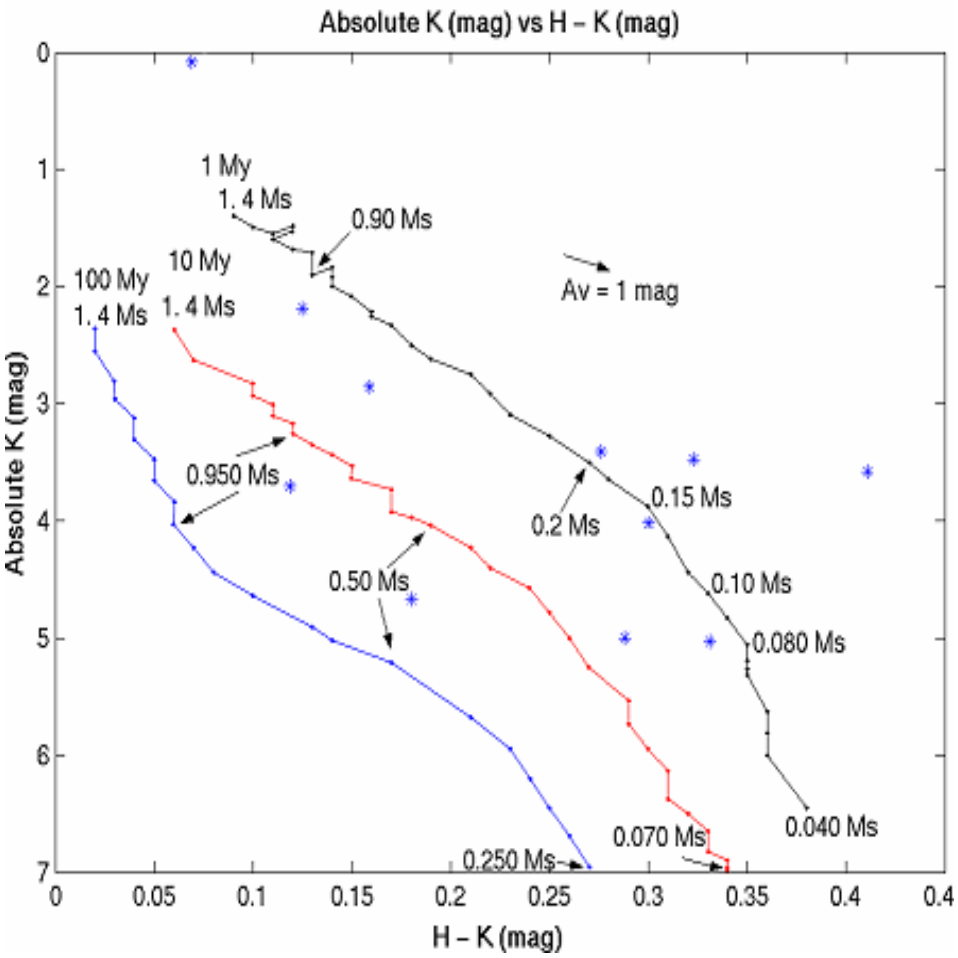
The project team plans on using feedback to enhance the appearance and functionalities of the system prior to presenting an updated version to the Free Library of Philadelphia.

The X-ray Emission from the HH212 Region

Kushal T. Mehta
Eric S. Perlman, Research Associate Professor, Department of Physics

The purpose of this project was to examine XMM-Newton (X-ray Multi-Mirror Telescope) observations of HH212, a protostellar jet system on the outskirts of the Orion Nebula Cluster. The primary goal of the observations was to detect X-ray emissions from either the protostar or its jets. We detected more than 40 X-ray sources, two of which are bright enough to do low-resolution spectroscopy. However, we did not find any X-ray emission from HH212 or its jets. One of the two brightest sources is extended in the X-rays and is identified with a bright star. We studied the characteristics of the X-ray sources in the field using color-color diagrams as shown in the figure below. In color-color diagrams, we plot the absolute magnitude in one band vs. a color in order to obtain information about each star's age, mass and their extinction. In the image shown below, we have plotted the absolute magnitude in the K band vs. H-K magnitude for our 11 brightest X-ray sources. We used multiple color-color diagrams extensively to gain important results about the various X-ray sources we analyzed.

This work was funded by NASA, XMM-Newton Guest Investigator Program.



The Impact of Anxiety and Race on Chronic Pain Treatment Outcomes

Brian C. Merry
Lynanne McGuire, Assistant Professor, Department of Psychology
Robert R. Edwards, Assistant Professor, Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine

This study examined whether anxiety, and the interaction of anxiety with race, explained differences in treatment outcomes among chronic pain patients. Identifying factors that explain individual differences in treatment outcomes is a crucial step to providing improved care to chronic pain patients. One hundred seventy four chronic pain patients undergoing treatment at a multidisciplinary pain treatment center completed the State-Trait Anxiety Inventory (STAI) to measure trait anxiety before and after treatment. Treatment outcome was assessed using the Multidimensional Pain Inventory (MPI) subscales: Pain Severity, Pain-related Interference, Life Control and Affective Distress. Results showed that pre-treatment trait anxiety was significantly associated with changes in life control following treatment. In addition, decreased trait anxiety over the course of treatment was associated with improvements in perceived life control. A significant interaction between race and anxiety was found for life control outcomes. African American pain patients whose trait anxiety increased during treatment reported diminished life control, whereas White pain patients did not report decreased life control. These results suggest that assessing pre-treatment trait anxiety, and the change in anxiety from pre to post-treatment, may be useful in understanding individual differences in pain treatment outcomes.

New Approaches to Acting Technique

Matthew B. Metzger
Wendy Salkind, Associate Professor, Department of Theatre

During the summer of 2005, I attended the Summer Training Congress at the American Conservatory Theatre (ACT) in San Francisco, California. While attending the 12-week program, I took master-level classes in speech, movement, acting, dancing and clowning from professionals in the field of acting. One of these opportunities was clowning. With the newfound knowledge I have obtained through my participation in the clowning class, I have developed a clowning performance piece, with the assistance of my mentor. My final project consists of the clowning piece supplemented by an oral presentation of the history of clowning, and a description of the clown techniques I have learned. My piece will showcase what I have learned from the research of a particular clown character. My clown character is based on my research of the auguste clown, which is a less educated, elegant, and skilled clown. This clown is unable to follow instructions, and misunderstands how to perform simple tasks. The auguste clown is a victim of pranks, who can never seem to win.

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

Starvation: Does It Affect Eating?

Lindsay H. Morrell
Frank E. Hanson, Professor, Department of Biological Sciences

Complex animals broaden their food preferences when faced with starvation conditions. Is this true for simple animals as well? I hypothesized that the more caterpillars are starved, the more willing they will be to accept food laced with feeding deterrents. To test this, four groups of animals fed with different starvation treatments were compared using the classical two choice behavior test for caterpillars. Animals were then separated by each feeding method, into groups to be tested on separate days. After one, two, three, or four days of different feeding treatments the animals were tested. Results show that, surprisingly, the starved animals, animals fed agar, and animals fed 1/3 nutrients are still deterred by caffeine regardless of the number of days of treatment, whereas animals fed with a complete nutrient diet are less deterred the longer they are fed. One potential reason for this occurrence is that as the fed animal gains weight it also matures and the hormone composition changes, both of which may cause its preferences to change. Due to this, I hypothesize that starvation does not affect feeding choices, however, maturation does. To test this, injections of hormones will be administered to keep the fed animals physiologically young.

*This work was funded, in part, by UMBC through the NIH National Research Service Award GM 08663 to the Minority Access to Research Careers (MARC) Undergraduate Student Training in Academic Research (U*STAR) Program* at *UMBC.*

Chromatin Structure and Expression of the Prostate-Specific Tumor Suppressor Gene NKX3.1

Tanda Murray*, Malini Jagdeo, Charles Bieberich, Mauricio Bustos*
Mauricio Bustos, Associate Professor, Department of Biological Sciences

Acetylated and methylated histone H3 (AcH3K9 and MeH3K9) influences chromatin structure, and the rate of gene transcription. The human NKX3.1 gene encodes a homeobox transcription factor postulated to function as a tumor suppressor of prostate cancers. NKX3.1 is expressed in the LNCaP prostate cancer cell line, but not in the lymphoid cell line, SWE-Ig. This differential expression was used to test the hypothesis that the distribution of AcH3K9 and MeH3K9 contributes to the transcriptional status of the NKX3.1 gene. A tiling array of DNA clones covering 100 kbp around the NKX3.1 gene was created from a 204 kbp BAC (bacterial artificial chromosome) clone. DNA sequences associated with AcH3K9 or MeH3K9 were enriched by Chromatin Immunoprecipitation, PCR amplified, radiolabeled, and then hybridized to the tiling array. We detected low levels of MeH3K9 in both cell lines; and discovered a marked increase in AcH3K9 in LNCaP cells relative to SWE-Ig over several regions. One such hyperacetylated region lies upstream of a regulatory domain that is sufficient for prostate-specific NKX3.1 expression, and downstream of a related Hox gene, NKX2.6. Further investigations into the functionality of this region could lead to an improved understanding of the connection between NKX3.1 expression and prostate cancer.

*This work was funded, in part, by UMBC through the NIH National Research Service Award GM 08663 to the Minority Access to Research Careers (MARC) Undergraduate Student Training in Academic Research (U*STAR) Program* at *UMBC.*

Big Potassium Channels in Cortex and Hippocampus of Neonatal Male and Female Rats

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Susan L. Zup, Post Doctoral Fellow, Department of Physiology, University of Maryland School of Medicine
Margaret M. McCarthy, Professor, Department of Physiology, University of Maryland School of Medicine

Large-conductance calcium-activated potassium channels (BK) play important roles in neuronal ion regulation. The BK channel is present in the cerebral cortex and hippocampus of adult rats; however, little is known about its role during brain development, including sexual differentiation. To explore the role of BK channels during the development of the male and female brain, we determined the presence and level of BK channel protein in neonatal male and female rat cortex and hippocampus. Western Blot analyses indicate that the BK alpha subunit is present in all tissues examined; preliminary data show that the concentration of BK protein may vary by sex. Interestingly, the androgenic hormone, dihydrotestosterone, may affect BK protein levels; estrogen has been shown to affect BK channels in adult animals, but a potential androgen effect is novel. Furthermore, preliminary results show that the injection of an oil vehicle may reduce the concentration of BK protein in both sexes compared to uninjected controls. Further Western Blot experiments will expand on the preliminary data, and estradiol-injected groups will be added. Other future experiments may include immunocytochemistry to determine the cellular location of BK protein and use of primary cell cultures to avoid the changes seen with a vehicle injection.

*This work was funded, in part, by UMBC through the NIH National Research Service Award GM 08663 to the Minority Access to Research Careers (MARC) Undergraduate Student Training in Academic Research (U*STAR) Program* at *UMBC.*

Tissue Distribution of Omentin 1 and Omentin 2 and Molecular Phenotyping of Stromal Vascular Cells in Adipose Tissue

***Kelechi N. Ndubuizu**, Jessica Pray, Celia Batista, John C. McLenithan*
Jessica Pray, Resident Assistant, Department of Medical Endocrinology, University of Maryland School of Medicine

Obesity is reaching epidemic proportions worldwide and is a risk factor for diabetes and cardiovascular disease. Omentin is expressed and secreted from visceral adipose tissue stromal-vascular cells and increases insulin-stimulated glucose transport in 3T3-L1 adipocytes. Both Omentin 1 and Omentin 2 have been shown to be associated with diabetes and metabolic disorders in genetic studies. We have quantitated gene expression of Omentin 1 and Omentin 2 over a wide range of tissues, by using Taqman real time RT-PCR, to determine a difference between tissue specificity of each isoform. Omentin 1 was primarily expressed in visceral fat with lower levels of expression in the heart and lung. Omentin 2 was predominantly expressed in the intestine with lower levels of expression in lung and visceral fat. In visceral fat, Omentin 1 levels were 50-fold greater than Omentin 2. Gene expression of CD68, PECAM1, Cytokeratin 18, and Adiponectin was determined in visceral and subcutaneous adipose tissue from six patients; to potentially identify the cellular sub population most highly correlated with omentin expression. The mesothelial cell marker, Cytokeratin 18 most closely matched the expression of Omentin 1 and Omentin 2 between subcutaneous and omental fat.

*This work was funded, in part, by UMBC through the NIH National Research Service Award GM 08663 to the Minority Access to Research Careers (MARC) Undergraduate Student Training in Academic Research (U*STAR) Program* at *UMBC and the University of Maryland School of Medicine, Division of Endocrinology, Diabetes, and Nutrition (UMD/GL Grant to JCM, IRB#H-22888).*

My Life in Disney

An T. Nguyen-Gia
John Sturgeon, Professor, Department of Visual Arts

Disney movies have a strong place in childhood culture. These movies portray specific values and norms that have an impact on children. In a video art piece I will take memories and events from my life and relay how they compare to expectations I formed as a child from the Disney movies. My project looks specifically at the animated princess movies (*Snow White, Sleeping Beauty, The Little Mermaid, etc.*) because, as well as being my favorites, they are probably some of the most well known fairy tales. I expect some of my revelations to not be unique, such as Disney's definition of beauty, and that will resonate with other people's experiences. I hope my project will get viewers to think of the influence movies and other media have had on them. My stories will be shown in a series of vignettes with various combinations of video footage, text, dialogue, voiceovers, and audio/video from the Disney movies. The stories will include lighter aspects such as fears I developed for certain characters and locations, and heavier aspects, such as body image.

Identification of the Protein-Protein Interaction Between δ-Subunit of Cellular Adaptor Protein-3 and HIV-1 Matrix Protein

Nguyen K. Nguyen, *Sampson Kyere*
Michael F. Summers, Professor, Department of Chemistry and Biochemistry

Studies of the assembly of the human immunodeficiency virus-1 (HIV-1) have shown that the Gag polyprotein facilitates the trafficking of viral particles to late cellular endosomal compartments before their budding from the plasma membrane.[1] This trafficking is mediated by the matrix (MA) domain of Gag which also functions in membrane targeting.[1,2] The cellular factor adaptor protein-3 (AP-3), which functions in lysosomal and late endosomal sorting, has been recently proposed to interact with the matrix domain through its δ subunit.[1] This protein-protein interaction has been shown to be critical for the trafficking of Gag through cellular compartments and viral particle assembly.[1] However, it is presently unclear what interfaces are involved in this interaction. By using NMR, our laboratory will identify the residues that are part of the protein-protein interface. This finding will contribute greatly to the knowledge of HIV-1 particle assembly and can serve as a potential target for new HIV-1 inhibitors.

*This work was funded, in part, by UMBC through the NIH National Research Service Award GM 08663 to the Minority Access to Research Careers (MARC) Undergraduate Student Training in Academic Research (U*STAR) Program* at *UMBC.*

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2. Turner, B.G. and Summers, M. F. *J. Mol. Biol.,* **1999**, 285, 1-31

Drug Interactions with the N-Terminal Domain of HIV-1 Capsid

***Khadijatou L. Njimoluh**, Sampson Kyere, Michael F. Summers*
Michael F. Summers, Professor, Department of Chemistry and Biochemistry

During the late phase of the HIV-1 replication cycle, the gag polyprotein mediates assembly of matrix, capsid (CA), and nucleocapsid proteins. Inhibition of HIV-1 CA formation was targeted for further investigation because previous studies have shown that proper capsid formation and stability are needed to render an infectious virus. Initial drug binding assays that were performed in this lab revealed compounds (CAP-1 and CAP-2) that bound to the N-terminal domain of capsid (CA-NTD) and led to reduced viral infectivity. We hypothesize that compound derivatives of CAP-1 and CAP-2 that bind with a greater affinity will render the HIV-1 virus less infectious. Our lab cloned DNA encoding the CA-NTD, expressed the protein on *Escherichia coli* cells, and purified it using affinity chromatography. Through structure-based drug design, we screened derivatives of CAP-1 and CAP-2 for increased specificity to the CA-NTD using NMR. During titration of the ligands, we found chemical shifts, which indicated binding to the N-terminal domain of capsid, and showed a greater affinity for the same region. Knowledge of how these compounds bind to the capsid protein and interfere specifically with assembly of the capsid core could lead to the production of new agents aimed towards fighting AIDS.

*This work was funded, in part, by UMBC through the NIH National Research Service Award GM 08663 to the Minority Access to Research Careers (MARC) Undergraduate Student Training in Academic Research (U*STAR) Program at UMBC, the HHMI Undergraduate Scholars Program at UMBC and the Howard Hughes Medical Institute. S.K. is funded by the NIGMS initiative for Minority Student Development Grant (R25-GM55036) and the Proctor and Gamble Company.*

Saturation Mutagenesis of the *Saccharomyces cerevisiae* Ty3 Retrotransposon Frameshift Site Stimulator

***Laura Norris,** Carla Guarraia*
Philip Farabaugh, Professor, Department of Biological Sciences

The central dogma of genetics states that information stored as DNA is transcribed into RNA, which is then translated by a ribosome into a protein. In a gene, each codon (three nucleotides) is translated into one amino acid of the protein. The ribosome can occasionally skip ahead by one nucleotide, resulting in a +1 frameshift. Certain sites induce frameshifting by creating a pause in the progression of the ribosome. These frameshift sites can be further induced by stimulatory sequences. The +1 frameshift site of the Ty3 retrotransposon of *S. cerevisiae* has a 14 nucleotide stimulator sequence downstream of the frameshift site that causes a 7.5-fold increase in frameshifting. In order to investigate how this stimulator sequence interacts with both eukaryotic and prokaryotic ribosomes, we created plasmid constructs with the stimulator sequence downstream of either the Ty3 frameshift site or the *E. coli* prfB +1 frameshift site. The gene for beta-galactosidase, added downstream of the frameshift site, allowed us to quantify the efficiency of frameshifting. Through saturation mutagenesis of the stimulator, we were able to disprove the proposed base-pairing model of the stimulator in the eukaryotic ribosome, and suggest that stimulator function is different in prokaryotes.
This work was funded, in part, by grant GM 29480 from NIH.

Characterization of the Focal Adhesion-associated Protein Leupaxin in Prostate Cancer Cells

***Stephanie M. Núñez**, Surasri N. Sahu*
Anandarup Gupta, Assistant Professor, Department of Biomedical Sciences, University of Maryland Dental School

Prostate cancer (PC) cells are highly migratory cells that metastasize to bone by relying on the formation and disassembly of focal adhesions, which are comprised of structural and signaling proteins that respond to cues from the extracellular matrix causing changes in adhesion, cell shape and migration. One of these proteins is Leupaxin (LPXN), a member of the paxillin superfamily of adaptor proteins. This study examined whether LPXN is associated with focal adhesions in PC cells and plays a role in their migration. For this study, the human cell line PC-3 was chosen. First, Western blot analysis determined that LPXN is present in PC-3 cells. Second, several cytokines that activate protein kinase C were found to increase serine phosphorylation of LPXN. Third, LPXN was shown to be constitutively tyrosine-phosphorylated in PC-3 cells. Fourth, an adenoviral-mediated overexpression of LPXN in PC-3 cells increased cell migration. Finally, when the protein tyrosine phosphatase, PTP-PEST, was similarly overexpressed, cell migration significantly decreased. Previously, LPXN has been shown to associate with PTP-PEST, which is known to regulate focal-adhesion turnover. This study implicates LPXN as an important component of prostate cancer cell migration.

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The Localization of Parvalbumin in the Human Prefrontal Cortex: An Electron and Light Microscopy Study

Chinyere N. Nwaneri
Rosalinda Roberts, Professor, Department of Psychiatry, University of Maryland School of Medicine

Schizophrenia has been characterized by abnormalities in the prefrontal cortex (PFC), a brain region associated with working memory. In the prefrontal cortex, Parvalbumin (PV), a calcium-binding protein, is co- localized with GABA in a population of cortical interneurons. The goal of this study is to observe the ultrastructure of postmortem brain tissue in the human prefrontal cortex. Normal human cortical tissue (n=3) was processed for PV immunoreactivity (PV+), prepared for light and electron microscopy, and analyzed using quantitative and qualitative techniques. Most PV labeled neurons (63%) had a round nucleus, centered in the middle of the cell and a moderate amount of cytoplasm. The remaining labeled neurons (27%) had notched nuclei that were ectopically centered. The majority of synapses were asymmetric (75%). Synapses were formed at approximately equal frequencies onto spinous (51%) and dendritic (49%) profiles. Synapses formed by PV+ axon terminals comprised 4.2% of total synapses. These terminals formed synapses at roughly equal frequencies onto spines and dendrites, were predominantly symmetric (83%), and mostly formed synapses onto unlabeled profiles (67%). The findings describe the morphology and ultrastructure of parvalbumin containing cells and serves as a normative analysis for future studies.

*This work was funded, in part, by UMBC through the NIH National Research Service Award GM 08663 to the Minority Access to Research Careers (MARC) Undergraduate Student Training in Academic Research (U*STAR) Program at UMBC and by grants from the Stanley Foundation and MH53494.*

Pretend Play Differences Between Children with Down Syndrome and Autism

Albee Therese S. Ongsuco
David M. Richman, Associate Professor, Department of Psychology

Pretend play involves the use of an object or action in a "make-believe" way (e.g., using a paperclip as a banana, pretending to be a superhero, or creating an imaginary friend). Childhood pretend play behaviors can be accurately categorized into increasingly more complex levels, and children's cognitive and language development correlate with levels of pretend play. Children with Down syndrome and children with autism exhibit pretend play behaviors, but there are important differences in patterns of development of pretend play skills between these two diagnostic groups. Children with Down syndrome display the same pretend play behaviors and progress through the same levels of pretend play as typically developing children, but they develop pretend play behaviors at a slower pace. However, children with autism do not typically exhibit pretend play behaviors at the correct developmental age level, they produce less frequent pretend play acts, and they spend less time engaging in pretend play unless they are provided with environmental stimuli that model and prompt specific pretend play behaviors.

This project, supported by the National Institute of Mental Health grant R25 MH62575, was completed in fulfillment of the Summer 2005 Clinical Psychology Research Program at the University of Oregon in Eugene, OR led by Dr. Gordon Nagayama Hall.

Estradiol Activates Phosphatases in the Developing Hypothalamus

Frances U. Onyimba, *Jaclyn Schwarz*
Margaret M. McCarthy, Department of Physiology, University of Maryland, Baltimore

The hypothalamus is a target for steroid-mediated sexual differentiation. Exposure to androgens and estrogens directs development of sexually dimorphic circuits. In the developing brain, most testosterone is converted to estradiol, which increases levels of spinophilin. At birth, males have higher levels of spinophilin, but females treated with estradiol have levels equal to males. Recently, we found that estradiol has rapid effects on spinophilin by activating intracellular signaling pathways, including MAPKinase. Counteracting kinases, phosphatases act on signaling pathways through dephosphorylation. The primary focus of this work is to see if estradiol induces spinophilin by inhibiting/ activating Protein Phosphatase 2A, a regulator of signaling and transcription factors. Using a nonradioactive approach, phosphatase activity was measured in neonatal males and females treated with estradiol and vehicle. To detect phosphatase activity, endogenous phosphates were extracted from samples of hypothalamus, prior to calorimetric assay. Females treated with estradiol for 6 and 3 hours had higher concentrations of phosphates than both male and female groups. These results lead to the preliminary conclusion that estradiol increases PP2A activity. We are currently trying to see if blocking PP2A with the inhibitor, okadaic acid, blocks estradiol's effects on phosphatase activity and synaptic proteins, such as spinophilin, ERK, and CREB.

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Faulkner's French Appeal: A Historically Contextualized Perspective

Asynith H. Palmer
Christoph Irmscher, Professor, Department of English

In the 1930s-1950s, when most of his novels were out of print in the U.S., French readers welcomed William Faulkner's novels, which, in their eyes, helped re-invigorate their post-war literature. The continuing appeal of such a distinctly American author in France has implications for our understanding of the relationship between our countries' histories and values. Why did French readers find Faulkner's work meaningful before Americans took significant interest in him? This question compels new interest in 2006, when political differences have strained social and cultural relations between France and the U.S., and the French perception of Americanness has taken on new relevance. Asynith Palmer has investigated Faulkner's French appeal by interviewing American and French critics and translators of Faulkner's work, by studying French reviews and critical articles at the Université de Rennes's Faulkner Foundation, by systematically reading Faulkner's novels alongside their French translations, and by researching the political and artistic context of the French 30s-50s. She argues that Faulkner's introduction to the French market was carefully strategized by the Gallimard publishing house. Faulkner also owes his reputation to the French appreciation of his sense of time and fatality, "brutal" subject matter, innovative style, and an odd fascination with his "puritan morality."

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

Structural Study of Nuclear Factor Y (NF-Y) Complex

Sang K. Park
Colin Garvie, Assistant Professor, Department of Chemistry and Biochemistry

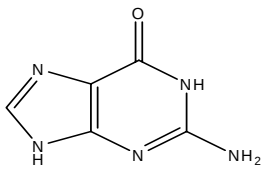
Major Histocompatibility Class II (MHCII) molecules are essential for mammals to respond to bacterial and other types of infection. Lack of MHCII expression results in a severely compromised immune system. Nuclear factor Y (NF-Y) is an important component of a large multi-protein complex that regulates production of MHCII molecules. NF-Y is comprised of three proteins – NFYA, NFYB, and NFYC – that bind to DNA with one of the highest affinities amongst DNA binding proteins. The full structure of the NF-Y complex and how it binds DNA is currently unknown. Knowledge of its structure will give us insight into how it binds DNA and interacts with other proteins involved in regulating MHCII production.

Our aim is to solve the crystal structure of the NF-Y ternary complex. We have expressed the minimal domains of NFYA, NFYB, and NFYC that are required to form the ternary complex and bind DNA. To aid in crystallization, we expressed the minimal domain of NFYA as a fusion protein with the maltose binding protein. We have shown that the presence of this fusion protein did not affect formation of the ternary complex. We are currently optimizing the purification protocol for the complex and intend to perform crystallization trials shortly.

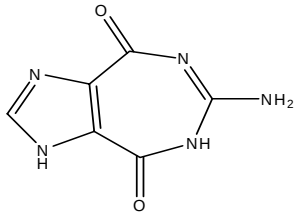
Synthesis of Ring Expanded Nucleoside Analogues for Inhibition of the Hepatitis B and C Viruses

Irene S. Pastis, *Peng Zhang*
Ramachandra Hosmane, Professor, Department of Chemistry and Biochemistry

Viral hepatitis is the one of the major causes of morbidity and mortality in the world. It is caused by hepatitis B and C viruses. The annual death toll from Hepatitis B is more than 1.5 million people, and more than 175 million people have been infected with HCV. This project focuses on the organic synthesis of ring expanded nucleic acid bases. These bases have the ability to base pair with the naturally occurring bases but with the only difference that the expanded ones, if incorporated into nucleic acids, will not allow the DNA chain to continue because they produce a "kink" in the DNA strand. The synthetic challenge in the lab is to replace the 5:6-fused heterocyclic system of the naturally occurring purines with the expanded ring system of 5:7-fusion. After extensive research, our lab has discovered that a number of compounds containing the 5:7-fused imidazole [4,5-*e*][1,3]diazepine ring, possess potent anti-HCV and anti-HBV activities. My research goal is to enhance the potency of these nucleosides/tides by modifying the above ring system with substitutions at positions 1, 2 and 6 (see Figure) as well as to study the relationship between the structure and its biological activity. *This work was funded by the National Institute of Allergy and Infectious Diseases (Grant # 5 R01 AI055452-07) of the NIH.*



Guanine



Ring-Expanded Guanine

Polarized Light Vision in Goldfish

Quynh Huong V. Pham
Thomas Cronin, Professor, Department of Biological Sciences

This project is designed to determine whether or not goldfish can use linear polarization orientation from light as a visual stimulus to discriminate the differences between a linearly polarized target and a nonpolarized target and between a horizontally polarized target and a vertically polarized target. Understanding the role of polarized light will lead to better comprehension of the mechanisms behind the goldfish's polarization sensitivity. Utilizing food reward as an incentive, five goldfish in separate tanks were each trained to select a specific polarization orientation over another one. Three of the goldfish were trained to recognize polarization orientation in visible light while the other two were trained to recognize polarization orientation in visible and ultraviolet light. All five goldfish were also trained to select a specific colored target over another one. Four of the five goldfish learned to select the correct colored target with high performance. However, all five fishes did not learn to select the correct linearly polarized target. Therefore, it is concluded that although polarized light plays a role in the vision of goldfish, goldfish are not able to use linear polarization orientation as a visual stimulus to distinguish the differences between two targets with different polarization properties.

This work was funded, in part, by the Air Force Office of Scientific Research.

Depression and Reciprocity as Predictors of Dyadic Adjustment

Lindsay J Phebus*, Stanley Feldstein, Theresa Schmitz*
Stanley Feldstein, Professor, Department of Psychology

The purpose of our study was to investigate the effects of depression of one or both partners and positive partner reciprocity on dyadic adjustment in romantic relationships.
Forty-two couples completed three questionnaires: the Center for Epidemiological Studies Depression scale (CES-D), the Reciprocity Scale (RS) and the Revised Dyadic Adjustment Scale (DAS-R). It yielded one significant main effect and two interaction effects. The main effect was a negative relation between the CES-D and the DAS-R. The interaction effects were RS by CES-D and Gender by RS. With low depression, high reciprocity was associated with greater dyadic adjustment than low reciprocity, whereas with high depression, high reciprocity was associated with somewhat lower dyadic adjustment than low reciprocity. Only low depression and high and low reciprocity were related to higher dyadic adjustment. The interaction of gender with reciprocity was such that for men, high reciprocity was associated with low dyadic adjustment. However, for women, high reciprocity was associated with high dyadic adjustment. This may occur because men are not affected in their judgment of adjustment in regards to high positive reciprocity. They may only report low adjustment when experiencing high negative reciprocity.

Intercultural Communication through Theater: Bilingual Performance

Erin M. Pressman
Alan Kreizenbeck, Associate Professor, Department of Theatre
Susan McCully, Assistant Professor, Department of Women's Studies

My project is a ten-minute performance of the bilingual play "*Coser y Cantar*" by Dolores Prida. This piece has two characters, She and Ella, who are different sides of an immigrant woman living in New York City. Ella speaks almost completely in Spanish and She speaks almost completely in English. The two of them discuss, fight, joke and confront the pressures of bilingual immigrant women living in the United States. To accompany the performance I did research on the life of immigrant women and how language, history and acculturation form their place in society. I focused mainly on Cuban-American women since Cuba is the implied nationality of She/Ella. There will also be discussion of certain performance processes such as the creation of each character. My presentation will include presenting my research and discussing my findings as well as a small selection of the performance itself as an example of my work.

The Effect of Stimulants on Alertness and Mood during Sleep Deprivation

Jessica M. Richards*, William D.S. Killgore*
Lynanne M. McGuire, Assistant Professor, Department of Psychology

Sleep deprivation causes decrements in both alertness and mood; therefore, it is desirable to find pharmaceutical aids that sustain alertness without producing severe alterations in mood. The current study examined the effects of caffeine, dextroamphetamine, and modafinil on alertness and mood. Fifty-four volunteers completed measures of alertness and mood every two hours during 61 hours of sustained wakefulness. After 44 hours, participants were administered a single dose of caffeine (600mg), dextroamphetamine (20mg), modafinil (400mg), or placebo. A repeated measures ANOVA showed that all three stimulants significantly reduced subjective sleepiness and increased objective alertness relative to placebo, but did not differ significantly from one another. Caffeine increased Fear, Confusion, Energy and Tension, and significantly decreased Happiness and Tiredness. Dextroamphetamine produced significant increases in Energy and Happiness, while Sadness and Tiredness significantly decreased. Modafinil significantly increased Energy and decreased Tiredness. Overall, caffeine produced the most significant elevations of negative moods whereas dextroamphetamine yielded a modest improvement in mood state that remained well within the normal range. Compared with the other stimulants, modafinil produced the smallest increase in objective alertness, but caused minimal alterations in mood. These findings suggest a potential use of modafinil for sustaining performance during sleep loss.

This work was funded by a Competitive Research Proposal Award from the United States Army Medical Research and Materiel Command to MAJ William D. Killgore, Ph.D.

Dental Bur Effects on Dentin as a Function of Age

Aftin M. Ross*, Duck H. Wang, Dwayne D. Arola*
Duck H. Wang, Professor, Department of Mechanical Engineering, Kyungnam University
Dwayne D. Arola, Associate Professor, Department of Mechanical Engineering

Dental burs are commonly used to prepare tooth surfaces for fillings and other orthodontic procedures. Currently, similar bur types are used irrespective of the patient's age. At this time, the impact of the burs on the mechanical properties of the teeth as people age is not clearly understood. As such, this study seeks to determine the characteristics of tungsten carbide and diamond coated dental burs on teeth as a function of age. Teeth ages 20±5 years and ages 56±5 years were acquired and beams of rectangular shape were cut from the coronal dentin. The specimens were then machined using the two bur types and subjected to four-point bending tests. The flexure strength and energy to fracture obtained from this testing will provide insight as to how teeth respond to bur characteristics as people age. Results from this analysis may influence the future design of dental burs, especially for older people.

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Propaganda and Character: Flavian Sculpture in the Roman Empire

Clare F. Ryan
Carolyn G. Koehler, Associate Professor, Department of Ancient Studies

Ruling in between the splendour and scandal of the Julio-Claudians and the glory of Trajan and his successors, the Flavian Dynasty is often overshadowed and overlooked. Vespasian ushered in a new imperial dynasty when he was proclaimed Emperor AD 69 at the end of a turbulent year. The Flavians used propaganda and portraiture to promote their ascendency and legitimize their line. Seeking to disassociate themselves with the last despotic emperors of the Julio-Claudian line, they emphasized an earthier, more realistic image that was copied in their sculpture and art.

The last Flavian emperor, Domitian, instituted a return to the artistic style of the late Julio-Claudians in an attempt to legitimize his own power that foreshadowed his own unstable character. He emulated the Julians, especially emperor Nero, last of Augustus' direct successors, in his portraits and statuary. While these stylistic similarities can be partly ascribed to his economically expedient reclamation and reworking of Nero's statues as his own, they also hint at Domitian's own political and moral values.

Reflection

Amarilis M. Sarango
Vin Grabill, Associate Professor, Department of Visual Arts

My goal is to create a video/film collage that will reflect my artistic visions of combining several disciplines of the arts. This project will serve as an avenue to express my passion, respect, and experience as a multidisciplinary artist. It will be a development of my senior capstone project which will reflect the creative aspects of my interest in combining the fields of Film/Video, Graphic Design, and Dance under the Visual and Performing Arts-Interdisciplinary Studies Program. After extensive research and experimentation, the final product will be a video presentation of my work.

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

Decriminalization and Legalization of Marijuana and Prostitution

Elan D. Schnitzer
Jeffrey Davis, Assistant Professor, Department of Political Science

My writing addresses the issue of our nation's policy of criminalization of so-called "victimless crimes." This issue becomes ever-more important as our society faces increasing questions of the values of American government and increasing strain on police and judicial resources.

I begin with a discussion of the philosophical basis for legalization of victimless crimes – complete reversal of laws prohibiting such actions – and relate these to the libertarian foundations of our nation. This includes references to philosophers such as Locke, Mill, and Rousseau, and the incorporation of their writings into our Constitution. This is followed by definition of the concept of "victimless crimes" – activities which themselves cause less harm to society than their punishment, because they only directly affect the individual performing them – and the specific inclusion of marijuana use and prostitution as examples.

After raising the moral concerns of critics of legalization – namely, opposition to the moral condoning of such activities that, arguably, comes along with removing laws against them – I offer decriminalization as a compromise between legalization and criminalization. Decriminalization involves leaving laws against these crimes on the books, but calls for the removal of the attached criminal sanctions. It is therefore stripped of moral judgments, but addresses the practical and philosophical issues of criminalization of "victimless crimes" by ending the enforcement of laws prohibiting actions that negligibly harm society.

Solitons in Birefringent Optical Fibers: A Dynamical Systems Perspective

Vlad Seghete*, Brian S. Marks* (University of Illinois)*, Curtis R. Menyuk, Jianke Yang* (University of Vermont)
Curtis R. Menyuk, Professor, Department of Computer Science and Electrical Engineering

A system of coupled nonlinear Schrödinger equations describes pulse propagation in weakly birefringent optical fibers. We prove the existence of several solitary wave solutions of this system and find them through a numerical shooting method. We employ Poincaré surface of section plots – a standard dynamical systems approach – to analyze the proximity in phase space of these solutions among chaotic and oscillating solutions. Choosing multiple values for the parameter that determines where the surface of section is taken, we construct a series of plots showing the evolution of the solitary wave solutions relative to chaotic and oscillating ones. We find that many of the soliton solutions lie in the midst of chaos, an observation that raises questions as to their stability. Using a linear stability analysis, we quantitatively determined the soliton response to small perturbations. The results show that the special solitons that exist inside chaotic regions are unstable.

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

The Roles of the Antennae in Detecting Stimuli in the Caterpillar

Da Shi
Frank E. Hanson, Professor, Department of Biological Sciences

The antenna acts as one of the mechanical and sensory organs for the tobacco hornworm, larval *Manduca sexta*, and is believed to be important for obstacle and water detection. Experiments show that when the caterpillar moves across an elongated linear chamber, it stops and explores the end of the chamber with its antennae. When the antennae are surgically ablated, this end detecting behavior is eliminated. In addition to detecting the caterpillar's physical surroundings, the antennae play a role in water detection as well. Control caterpillars usually detect and drink the water quickly, whereas covering the antennae with beeswax or ablation of the antennae shows various levels of impairment. Thus the antennae have hygro-sensory capabilities as well as mechanical sensory functions that probably are useful in foraging for food. Future experiments will investigate further properties of the antennae in finding other environmental cues that may help them locate their food plants.

This work was supported, in part, by the Biology Department Designated Research Fund.

TRAIL Enhances Autoantibody Production and Renal Disease in Chronic Graft-versus Host Disease

Shayla Shorter*, Vinh Nguyen , Violeta Rus*
Vinh Nguyen, Post Doctorate Fellow, University of Maryland School of Medicine
Violeta Rus, Assistant Professor, Department of Medicine, University of Maryland School of Medicine

Tumor necrosis factor-related apoptosis-inducing ligand (TRAIL) is a member of the TNF superfamily that induces apoptosis and also exerts immunoregulatory functions. Systemic Lupus Erythematosus (SLE) is an autoimmune disease characterized by autoantibody production and immune complex formation. Our previous studies show an increased expression of TRAIL on T-cells in active SLE.

To determine the role of TRAIL *in vivo*, we used the murine chronic graft-versus-host disease (cGVHD) model to compare markers of disease progression such as production of anti-DNA autoantibodies and severity of renal disease in F1 mice injected with either TRAIL+/+ or TRAIL-/- CD4+T cells. TRAIL-/- injected mice demonstrated decreased ssDNA antibody production as determined by ELISA (9.4±1.04 AU/ml) compared to TRAIL +/+ injected mice (21.07 AU/ml ±1.0; $p<0.005$). In addition, the severity of renal involvement measured by the glomerular score was significantly lower in TRAIL-/- injected mice (1.25±0.5 vs 2.4±; $p<0.05$) indicating less severe renal involvement than in the TRAIL+/+ injected mice.

These results suggest that TRAIL may play a role in enhancing the production of autoantibodies and the subsequent end-organ damage. Further studies will investigate the mechanism by which TRAIL enhances cGVHD in murine models and assess whether TRAIL can be used as a potential therapeutic agent.

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Further Investigation of Violin Playing

Rachele Sills
Airi Yoshioka, Professor, Department of Music

As a violinist, I want all people to experience an insightful look into music and as a teacher I want my students to experience this insight as well. This past summer I attended the Musicorda Summer Music Festival in Mount Holyoke, MA. There I studied with Rachel Barton Pine, a renowned concert violinist from Chicago, IL. This type of research is very important because music is an integral part of our society. It seems to have a profound effect on people's lives and that effect seems to draw more and more people to music. Additionally, this was an amazing experience because I had a chance to improve my violin technique and study with other string students from all over the world. At Musicorda, I was selected to participate in a Master Class given by celebrated fiddle player Mark O'Connor. I played one of his pieces called, *Caprice No. 1 in A major for Unaccompanied Violin*. This was wonderful because I heard his interpretation of the piece and how he wanted some of the sections to be played. This is the piece that I will be performing. Music is such an important part of our lives and I'm very happy to share the gift of music to all.

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

FRET-based Glucose Monitoring for Bioprocessing

Lauren A. Smalls-Mantey*, Amelita Bartolome, Debora Lin, Govind Rao, Leah Tolosa*
Leah Tolosa, Assistant Professor, Department of Chemical and Biochemical Engineering

The glucose-mediated conformational changes in the glucose binding protein (GBP) have been exploited in the development of fluorescence based glucose sensors. The fluorescence response is generated by a polarity sensitive dye attached to a specific site. Such fluorescent sensors respond to submicromolar glucose at diffusion-controlled rates mimicking the wild type. However, such sensors have been limited to *in vitro* glucose sensing because of the preliminary dye-labeling step. In this study, the dye-labeling step is omitted by genetically encoding the GBP with two green fluorescent mutants namely, the green fluorescent protein (GFP) and the yellow fluorescent protein (YFP) in the N- and C-terminal ends, respectively. These two GFP mutants comprise a fluorescence resonance energy transfer (FRET) donor and acceptor pair. Thus, when glucose binds with GBP, the conformational changes affect the FRET efficiency yielding a dose-dependent response. A potential application for this FRET-based glucose biosensor is online glucose sensing in bioprocessing and cell culture. This was demonstrated by the measurement of glucose consumption in yeast fermentation. Further development of this system should yield *in vivo* measurement of glucose in bioprocesses.

This work was supported by the US Army (Award #W81XWH-04-1-0781) and the NIH (Awards # DK062990 and #DK072465). We also thank Dr. Kaiming Ye of Arkansas State University for the plasmid.

Composition and Sequence-Dependent Binding of RNA to the Nucleocapsid Protein of Moloney Murine Leukemia Virus

Adjoa R. Smalls-Mantey*, Anwesha Dey, Michael F. Summers*
Michael F. Summers, Professor, Department of Chemistry and Biochemistry

Moloney Murine Leukemia Virus (MLV) selectively packages two copies of its full length RNA genome. Packaging specificity is mediated principally by interactions between the nucleocapsid (NC) domain of the assembling Gag polyproteins and a cis-acting segment located in the 5' leader region of the MLV viral genome called the Psi-site. We recently discovered that genome packaging of MLV may be mediated by a riboswitch mechanism in which high affinity NC binding UCUG segments within the Psi-site are sequestered by base pairing in monomeric RNA and become exposed for NC binding upon dimerization. Similar sequences in the down stream region of the Psi-site suggested that additional NC binding sites may exist. Using ITC and NMR, we have identified short RNAs (ACAG, UUUG, and UCCG) that can bind NC with significant affinity (K(d) = 94-315 nM). Our findings suggest that binding is dependent upon an unpaired guanosine, enhanced in short RNAs containing terminal phosphates, and that the binding affinity can vary by more than one order of magnitude depending on the nature of the three upstream nucleotides. Our findings extend a previously published model for genome recognition, in which the NC domains of assembling Gag molecules interact with multiple X(i-3)-X(i-2)-X(i-1)-G(i) elements (X is a variable nucleotide) that appear to be preferentially exposed in the dimeric RNA.

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Solid and Sweet: The Effect of Orosensory Properties of Food on Satiety in an Animal Model

Elena A. Spieker
Zoe S. Warwick, Associate Professor, Department of Psychology

Eating behavior consists of episodes or periods of ingestion (meals, snacks) followed by a reduced willingness to consume additional food: this reduced willingness is defined as postprandial satiety. It is repeated cycling of food intake and postprandial satiety that is the behavioral basis of long-term caloric intake and body weight maintenance. The purpose of this study is to investigate factors influencing postprandial satiety. Previous research has focused on testing the differences in satiation between liquid and solid foods in a short-term setting (0-4 hours). Some have concluded solids enhanced satiety to a greater degree than equicaloric liquid preloads while other have found the opposite or been inconclusive altogether. Current research is manipulating both physical state (liquid vs. solid) and taste (sweet vs. plain) to determine possible effects of these food components on postprandial satiety over 24 hours as opposed to a shorter interval. The method used is the suppression test: three-day intake of normal rat food (chow) is measured as baseline. Then a 48-calorie "snack" is given daily for an additional three days, and chow intake measured. The satiety effect of the snack is indicated by the percent suppression of chow intake during the snack phase relative to baseline. It is hypothesized in this study that a liquid snack will produce less satiety than a solid snack, indicated by less suppression of chow intake and higher overall chow consumption. Since sweetness can markedly influence food intake during a meal, it is of interest to determine whether sweetness can also impact satiety. Findings may have relevance for individuals attempting to limit food intake. Based on the properties of the food eaten at a meal it may be possible to enhance postprandial satiety for longer intervals between meals.

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

Post-ischemic Hypothermia in Traumatic Brain Injury

Danielle Stephenson, *Yunjian Wang*
Liang Zhu, Associate Professor, Department of Mechanical Engineering

Brain inactivity due to stroke or head injury remains a major cause of death worldwide. Studies suggest that hypothermia has protective effects in reducing the temperature of brain tissue for head injury patients. However, the major problems facing clinicians involve developing a cooling approach, which can be initiated as early as possible to uniformly reduce the temperature of the brain tissue with minimal complications. My research involves developing a cooling device to place on the surface of the common carotid artery in the neck to rapidly induce and maintain hypothermia in the brain tissue. We expected that the cooling cuff would cool the carotid arterial blood by several degrees within a reasonable time frame to be supplied to the brain tissue. *In vivo* animal experiments have been performed on rats using a prototype of this device. Temperature at the surface of the device was controlled at 12° C or 18° C, depending on the temperature of the water circulating inside the device and the pump speed. Based on the measured temperatures inside the rat brain tissue, the device was effective in fast inducing a 3° C to 5°C decrease in temperature of the brain tissue.

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Synthesis of Platinum-Based Nucleic Acid-Protein Crosslinkers

Steven F. Stone*, Qingrong Zhang*
Daniele Fabris, Associate Professor, Department of Chemistry and Biochemistry

Protein-nucleic acid interactions play a crucial role in the packaging of genomic RNA in human immunodeficiency virus type 1 (HIV-1). The process involves the formation of a complex between a nucleocapsid (NC) protein and a highly conserved RNA region, Ψ-RNA. A complete structural elucidation of this complex requires the identification of the points of contact between its components.

This report describes the synthesis, purification, and characterization of platinum-imino ether compounds to be utilized as Mass Spectrometry 3D (MS3D) structural probes. NMR and electrospray ionization-Fourier transform mass spectrometry (ESI-FTMS) were employed whenever possible to analyze reaction mixtures and optimize/troubleshoot the different steps of the synthesis. ESI-FTMS was also applied to characterize the stable adducts formed by treating model oligonucleotide and peptide substrates with the synthetic platinum-imino ethers. In addition, we have initiated the synthesis of similar platinum-based reagents, which incorporate different spacers between the reactive functional groups. For example, a series of bis-platinum compounds are being synthesized with diamines of different chain lengths. This novel type of crosslinking reagents will allow us to probe protein/nucleic acids functional groups, which are located at different distances from each other in the folded substrates.

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Capsid and p12 Interactions during Maturation of Murine Leukemia Virus

***Sherika Sylvester**, Nguyen Nguyen, Khadijatou Njimoluh, Nerg Achirimofor, Sampson Kyere*
Michael Summers, Professor, Chemistry and Biochemistry Department

The assembly of the murine leukemia virus (MLV) is mediated by the Gag polyprotein, an intrinsic characteristic of retroviruses such as HIV-1, and is responsible for the general packaging and maturation of the virus. Located from N-terminus to C-terminus in MLV Gag are the independently folded domains: matrix (MA), p12, capsid (CA), and nucleocapsid (NC). Previous studies have shown the presence of a strong interaction between the p12 and CA proteins due to noticeable changes in infectious activity when MLV p12 and MLV CA are unable to interact; however, the mechanism by or through which the proteins interact is not clearly understood. By analyzing p12 and CA constructs *in vitro*, the active sites leading to p12 and CA synergy will be identified and used for targets in future drug-binding studies.

Genes encoding for MLV p12 CA were successfully incorporated into the genome of *Escherichia coli*. The isolation of MLV p12 CA followed the induced expression of *E. coli* for the preparation of protein purification and structural analysis. Current efforts are preparing for future nuclear magnetic resonance (NMR), mass spectrometry, and x-ray crystallography studies.

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Structural Basis for Targeting HIV-1 Gag to Assembly Sites on the Plasma Membrane

Janet Tai, Jaime Miller, *Andrew Kim, Ruba H. Ghanam, Jamil S. Saad*
Michael F. Summers, Professor, Professor, Department of Chemistry and Biochemistry

During the late phase of HIV-1 replication, newly synthesized retroviral Gag proteins co-localize at specific cellular membranes, where they assemble and bud to form immature virions. Membrane binding is mediated by the matrix (MA) domain of Gag, a 132-residue polypeptide containing an N-terminal myristyl group that can adopt sequestered and exposed conformations. Although exposure is known to promote membrane binding, the mechanism by which Gag is targeted to specific membranes has yet to be established. Recent studies have shown that phosphatidylinositol-(4,5)-bisphosphate ($PI(4,5)P_2$), a factor that regulates localization of cellular proteins to the plasma membrane (PM), also regulates Gag localization and assembly. Here we show that $PI(4,5)P_2$ binds directly to HIV-1 MA, inducing a conformational change that triggers myristate exposure. Structural studies reveal an unexpected binding mode, in which the inositol head group and one of the fatty acid chains bind to a hydrophobic cleft, and the remaining fatty acid and exposed myristyl group bracket a conserved basic surface patch previously implicated in membrane binding. Our findings indicate that $PI(4,5)P_2$ acts as both a trigger of the myristyl switch and as a membrane anchor, and suggest a structure-based mechanism for the specific targeting of HIV-1 Gag to membrane rafts enriched in $PI(4,5)P_2$.

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Structural Characterization of Myristoylated SIV Matrix Protein

***Kenneth P. Tai**, Michael J. Spliedt, Kalola J. Andrews, Michael F. Summers*
Michael Summers, Professor, Department of Chemistry and Biochemistry

The three-dimensional structure of myristoylated Simian Immunodeficiency Virus (SIV) Matrix (MA) protein and its role in the assembly and budding of retrovirus particles have yet to be determined. How myristoylated SIV MA functions inside an infected cell expands the scientific knowledge of how different retroviruses behave. Plasmids coding for myristoylated and unmyristoylated isoforms of SIV MA were induced to express protein in *E. coli* cells. The cells were then lysed and the protein purified through His-tag/cobalt resin purification and FPLC. Concentrated protein (0.6-1.2 mM) was used for nuclear magnetic resonance (NMR) studies. Our work aims to show that unlike HIV-1, SIV MA does not depend on a concentration driven myristoyl switch mechanism. This is supported by simple two-dimensional NMR data (HSQCs) that shows that the myristate group remains sequestered within the structure even upon concentration of the myristoylated protein. Several additional multi-resonance NMR experiments [HSQC-NOESY, TOCSY, HNCA, HN(CO)CA, CNNOE] have been collected for the determination of the three-dimensional structure of SIV MA and myristoylated SIV MA. Future experiments include titrating myristoylated SIV MA with phosphatidylinositol-2-phosphate, a plasma membrane associated cofactor that may drive myristate exposure.

This work was funded, in part, by NSF Grant DEB-0349856.

Mechanochemical Synthesis of Organometallic Complexes

Linda M. Thompson
Laszlo Takacs, Associate Professor, Department of Physics

Research was conducted to see if mechanochemical synthesis could be used to prepare ferrocene from dicyclopentadiene and iron (III) chloride. Ferrocene and its derivatives have many uses such as anti-knock agents and cancer drugs. A typical organic synthesis involves boiling the reagents together for a given amount of time. In a mechanochemical process, energy is delivered to the reactants mechanically rather than thermally; therefore the synthesis of molecules that do not form by conventional organic methods may be possible. Mechanochemical processes are usually carried out through a process called ball milling, which shakes the chemical reagents with several metal balls in a sealed vial. Preliminary results indicate that ball milling has induced a chemical change and identification of the product is ongoing. Future steps include identification of a possible mechanism, synthesis of derivatives and optimizing the procedure.

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

Identification of Genes Affecting Fecundity in *Drosophila*

Ivana A. Todorova, Jeff W. Leips
Jeff W. Leips, Assistant Professor, Department of Biological Sciences

The aim of this project is to identify genes that produce variation in fecundity, the number of eggs laid by females, using the fruit fly, *Drosophila melanogaster*. Evolution by natural selection requires heritable genetic variation in fitness. One of the most important components of fitness is fecundity as this trait sets the baseline number of offspring that can be left to the next generation. Presently, nothing is known about the genes that produce natural variation in this trait. Previous experiments identified a large region on the second chromosome that produced variation in fecundity. We used fine-scaled genetic mapping to narrow down the region of interest to identify candidate genes that may be responsible for producing this variation. We chose candidate genes by scanning the annotated *Drosophila* genome in this region and picking genes with the potential to affect fecundity. We used quantitative complementation tests to investigate the influence of genetic variation in two genes, *cactus* and v*asa*, on fecundity. Our results will shed light on whether or not these genes produce variation in fecundity and will allow future studies to explore the factors that may be responsible for maintaining genetic variation in this trait in natural populations.

This work was supported in part by NSF Grant DEB-0349856.

Video Game Development: Scarred Steel

UMBC Game Development Club
President/Programmer: ***Eric Jordan***
Programming: ***Charles Bushong, Andrew Hunt, James Lee, Craig Lewis***
Mercury 3D Engine Programming: ***Josh Allen, Charles Lohr***
Web Design: ***Daniel Mirchandani***
Art: ***Chris Conley, Arthur Gould, Robert Jones, Marcus Lepage, Patrick McNeely, Adam Petrone, Kiran Sudhakara***
Sound Effects: ***George Aninwene II, Kenny Trimmer***
Penny Rheingans, Associate Professor, Department of Computer Science and Electrical Engineering

Project Scarred Steel has brought together students from a variety of science and art-related backgrounds who shared a single purpose: the creation of a computer game. This endeavor embodied both creativity and technical achievement. Our artists were challenged with 3D modeling, computer animation and texturing. Meanwhile our programmers had the daunting task of coding a 3D game complete with online capabilities. Together the members of the UMBC Game Developer's Club have built teamwork, learned a trade and created an exiting new game.

In this game mechanized gladiators battle for dominance in breathtaking vistas. Armed to the teeth with cutting edge technology, these goliaths show no mercy in the heat of battle, engaging in both melee and ranged combat amongst fully destructible 3-Dimensional environments. Players are allowed to customize the weapons, armament, and exterior of their mechs. In online multiplayer mode up to eight players can join in the fray.

Also on display at the Game Developer's table will be the Mercury 3D engine created by some of the club members interested in 3D engine design.

Implications of Transgenic Corn Cultivation on the Ecology of Agricultural Streams

Lie`Ann T. Van-Tull
Christopher Swan, Assistant Professor, Department of Geography and Environmental Systems

Corn is a common transgenic crop made by introducing a gene that codes for a toxic protein from bacterium, *Bacillus thuringiensis,* into corn DNA. With the use of transgenic crops on the rise, research is being done to consider its environmental effects on non-target taxa. Stream ecosystems occupy topographic low points in the landscape and thus are affected by agricultural land use, including Bt hybrids. In streams, the main energy source is from terrestrial organic detritus, mostly in the form of dead leaves and wood, delivered via wind or natural leaf fall. Given insect larvae are critical to the transformation of energy from detritus to higher trophic levels, the implications of detritus containing advanced pesticides like Bt may be substantial. Experiments were designed to reveal the effect of Bt vs. non-Bt leaf litter from corn in a stream ecosystem. The experiment found that decay rates were lower with Bt present but differ with site and type of Bt present. It was also shown that consumption rates and shredder colonization rates differed.

*This work was funded, in part, by UMBC through the NIH National Research Service Award GM 08663 to the Minority Access to Research Careers (MARC) Undergraduate Student Training in Academic Research (U*STAR) Program* at *UMBC.*

Genetic Analysis of the *Saccharomyces ceresisiae* Ribosomal Protein L17

Sabrina Walborn
Janice Zengel, Research Scientist, Department of Biological Sciences
Lasse Lindahl, Professor, Department of Biological Sciences

Genetic analysis is being used to determine the role of the *Saccharomyces cerevisiae* (yeast) ribosomal protein L17. A part of this protein is thought to form part of the lining of the peptide exit tunnel, through which newly synthesized proteins exit the ribosome. This location would make L17 a candidate for affecting ribosomal protein synthesis and antibiotic resistance. Without ribosomal protein synthesis, all living cells would die, and antibiotic resistance has been growing among many organisms, making these research topics applicable to our everyday lives. To study the role L17 plays in these processes in yeast, we will mutate the part of the protein that lines the peptide exit tunnel and characterize the effects of these changes on ribosome structure and function. Since *S. cerevisiae* contains duplicate genes, RPL17A and RPL17B, encoding the L17 protein, a new strain of yeast has to be constructed that contains only one copy of the L17 gene in which we can introduce mutations. We are in the process of creating this strain, and once completed, hope to be able to learn more about the function and important structural regions of the L17 protein.

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

The Importance of Role Model Influence on Goal Achievement among Kenyan Women

Wambui Wamae-Kamiru
Leslie Morgan, Professor, Department of Sociology and Anthropology
Mikhel Kushner, Director, Women's Center

A trip to Kenya over Summer 2005 became a journey through self-discovery.

The research conducted compares and contrasts Kenyan women's expectations for themselves and each other and how each woman defines success, respect and leadership. Overall, 30 Kenyan women were interviewed, 22 individually and 8 through a focus group discussion. The 30 women were divided into three age and achievement groups: Nine mature women (ages 60+) with continued personal success, 13 publicly influential women (ages 26 - 60), and eight young women (ages 19 – 25), who are starting educational, family and career paths. The interviews were video recorded with two audio taped only, at the request of the participants.

The analysis assesses the importance of mentors and role models in shaping the women's attitudes and ambitions, I asked the influential women about their life histories, obstacles and achievements. The mature women provided a historical aspect of the research and context to understand change in the role and status of women. The young women provided the discussion of future goals and how they were working to achieve them. Current results will be presented as a website/blog, research paper and a short video diary.

Honors College Summer Special Session and Research Scholarship 2005, McNair Scholar Program.

Stratified Pluralism

John W. Weller
Richard L. Wilson, Lecturer, Department of Philosophy

The focus of the paper is to propose a new theory of ethical pluralism, in other words, a theory which merges different kinds of ethical theory ("Stratified Pluralism"), which attempts to explain the differing views of the three main branches of ethical theory (*Virtue Ethics*—value-based, *Deontology*—duty-based, and, *Consequentialism*—action-based) by showing that ethical reasoning works in separate stages, and that each type of ethics is focused mainly on only one of these, and that we must take each one of them into account in reference to every action when considering morality in a given situation. I refer to specific problems with each branch of theory and show how they can be avoided with the proper normative cross-application of the other two, as well as inherent problems which are better solved by eliminating mechanics in each branch that are better handled by one or both of the other two. I conclude that rather than trying to decide between the three and considering them in isolation (as is standard practice), we must find the proper balanced application of all, and that rather than leading to moral relativism (the view that morality itself has no absolute basis) or subjectivity on the level of theory and/or practice, the resulting product clarifies many issues that have been of much debate.

The Effects of Videogame Experience on Virtual Reality Distraction

Jessica Wentling, Joseph Keller, Cyrus Mistry, Monica Jimeno*, Lindsay K. Dillinger, Claire E. Sonntag*
Lynnda M. Dahlquist, Professor, Department of Psychology

The impact of previous videogame experience on distraction techniques used to increase a child's pain tolerance was examined. Pain tolerance was defined as the number of seconds the child was able to keep his or her hand submerged in water maintained at five degrees Celsius. Thirty-one children (48% male, 52% female) between the ages of six and fourteen were sampled from a larger study involving virtual reality distraction and its effect on pain tolerance. Parents recalled and documented their child's frequency of videogame play over the prior week. Children were randomly assigned one or two baseline evaluations to control for habituation effects. A subsequent measurement of pain tolerance was taken while the child was actively engaged in videogame play with the aid of a head-mounted display (HMD). Children who were actively engaged by the videogame demonstrated improved pain tolerance (Baseline: M=31.90sec. SD=41.75sec.; HMD: M=49.92sec. SD=66.75sec.). There was, however, no significant difference in pain tolerance between groups of "high" and "low" videogame-experienced children regarding the degree of pain tolerance improvement ($F(1,28)=0.058$, $p>.05$) during the distraction intervention. Findings validate using videogames for distraction regardless of the child's past experience with videogames.

Funding provided by the Believe in Tomorrow Foundation and the NIH.

The Effect of Species Leaf Litter on Tri-trophic Interactions in a Detritus-based Stream Ecosystem

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Little is known about the predator-prey interactions within naturally-occurring leaf litter assemblages where stream insects occur and consume leaf material. Therefore, I manipulated the types of leaf species that detritivores have access to and the presence and absence of insect predators. Cylindrical chambers were filled with commonly found tree species and predators: Red Oak, Red Maple, or a mixture of the two, and crossed with a perlid or ptero, either already added or prevented from entering, using different mesh sizes. A total of 126 chambers were set out in Fishing Creek, in Frederick, Maryland for a total of 5 weeks. Once the chambers are taken out of the stream, the insects and the leaves remaining will be separated. Leaf mass loss with be determined, in addition to the number of insects colonizing the chambers. The results of this work will demonstrate how predation on aquatic detritivores can alter the decay rate of different species of leaf litter and understanding how the loss of streamside tree species can alter trophic interaction in aquatic food webs.

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Developing an Effective, Inexpensive Autonomous Ground Vehicle

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This research attempts to show that effective autonomous ground vehicles such as those seen in DARPA's "Grand Challenge" can be designed and built inexpensively. The estimated cost to build the 2005 Grand Challenge winner was $500,000, while the robotic ground vehicle described in this paper was designed for Oakland University's "Intelligent Ground Vehicle Competition" (IGVC), and cost less than $4,000. The IGVC competition is an event similar to the "Grand Challenge", albeit on a much smaller scale. The ground vehicle uses inexpensive FireWire video cameras, exclusively, and an off-the-shelf laptop computer to detect obstacles rather than high-cost laser range finding systems. While the progress made thus far on this project is significant, there is still work to be done before the robot described can navigate an entire obstacle course independently. When the systems on this ground vehicle are robust enough to handle the IGVC competition with ease, they will be extended in order to create a low cost contender in a competition like the DARPA Grand Challenge.

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The Syntactic Particle *i* in Old Japanese

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In the traditional presentation of Old Japanese grammar, the syntactic particle *i*, which was falling out of use at the time of early texts, functions as a nominative case marker. The vowel difference between free and bound forms of many Japanese words can, according to some scholars, be attributed to the effect of this nominative suffix on the free form. This hypothesized nominative marker *i* would seem to be related then to the Korean subject marker *i*.

However, a newer approach to Old Japanese *i* is to classify it as ergative marker, or perhaps a clitic pronoun attached to an active verb, suggesting a possible relation here to the Altaic pronouns. This dissociation of the marker from nouns could also have had an effect on the bound/free sound change. Given these alternative approaches, I propose to survey the phonetic sections of the Man'youshuu poetry collection for signs of a sound change in the free form of a word, which would be indicative of past coupling with *i*. If these free forms are found in non-active verbal constructions, then *i* cannot be an active case marker and must be treated as a nominative particle.

Late Bloomers: Exploring the Potential for Age Acceptance

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The purpose of this project is to encourage people to realize their own preconceived notions about aging. Ours is a visual culture, and our norms are dictated and reemphasized largely by the images with which we are barraged daily. The efforts of American society to stop the natural aging process are nowhere more evident than in fashion photography. This series of 'fashion images'- ten 16 inch x 20 inch digital photographs- was inspired by actual fashion advertising, and mimics many of their formal qualities, including composition, lighting, and poses. Like traditional fashion photography, these images also reference the age-old marketing strategies of sex appeal and humor. However, this work deviates from tradition in one integral way- the individuals that appear in the images are all aged fifty-five and over. Since, in modern society, individuals of this age rarely appear beyond ads for denture adhesive, this project initiates a dialogue about why people find these images out-of-place, and is therefore an active part of promoting age acceptance.

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Aesthetic Music Education for Elementary School Students

Robert A. Zuzin
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The purpose of my work was to visit a local elementary school and enhance the existing music program with aesthetic music education. I designed lesson plans that encourage hands on learning and experiential exploration of musical works and concepts. Fourteen visits were planned over the course of the school year where students had the opportunity to explore music and the tools to create original music of their own.

The goal of aesthetic education is to gain understanding through "doing." An important approach to this end is the use of multiple intelligence theory, where a concept to be explored such as dynamics is related to another process, such as mathematics or kinesthetic intelligence. Another example is to convey the concept of rhythms created by long and short notes with their relationship in size to physical objects, such as a yardstick and ruler. The activities in my lesson plans are founded on the idea that abstract musical concepts can be explained using an approach that is more experiential to the student. The end result is to create a gateway for students to begin experiencing music on a deeper level.

Each lesson explored elements found in works that would apply to the music they were to create. One lesson in particular explored the melodic contours of a piano sonata by Beethoven. In a later visit, we used that experience to relate to a graphic notation. This approach enabled students who cannot write traditional music notation at this point in their education to create, notate, and perform a composition entirely their own.

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