URCAD 2014
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Biobar: a sequence manipulation and editing toolkit for Microsoft Word

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

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

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

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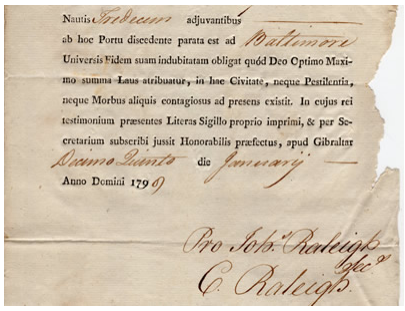
Captain Henry Dashiell's Papers and Neo-Latin, the Continued International Use of Latin in the 18th Century


Nautis Tribeum adjuvantibus
ab hoc Portu discedente parata est ad Baltimore
Universis Fidem suam indubitatam obligat quòd Deo Optimo Maximo summa Laus atribuatur, in hac Civitate, neque Pestilentia,
neque Morbus aliquis contagiosus ad presens existit. In cujus rei
testimonium præsentes Literis Sigillo proprio imprimi, & per Secretarium subscribi jussit Honorabilis præfectus, apud Gibraltar
Decimo Quinto die January
Anno Domini 1799
Pro Johe Rawleigh Esqe
C. Rawleigh

Amber B. Barnett
Esther Read, Adjunct Professor, Department of Ancient Studies
Where: UC Ballroom
When: 2:00 - 4:00 p.m.

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

(Top)

Periodic Poling of Electro-Optic Polymers for Efficient Terahertz Generation

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

In this project we utilized periodic poling as a tool to create a well phase-matched nonlinear optical system. Phase-matching increases the efficiency of the nonlinear processes which lead to the creation of terahertz (THz)

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

(Top)

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

Susanna K. Campbell
Kevin Omland, Professor, Department of Biological Sciences
Where: UC Ballroom
When: 2:00 - 4:00 p.m.

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

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

(Top)

Effects of Multitasking on Reading Comprehension and Puzzle Solving

Kim C. Casimbon
Diane Alonso, Senior Lecturer, Department of Psychology
Where: UC 312
When: 3:30 p.m.

This experimental video is inspired by the critical writings of marginalized British Recent research has examined multitasking on in-class laptop use, text messaging, and Instant Messaging (IM) during class lectures. Prior studies have found a negative

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

(Top)

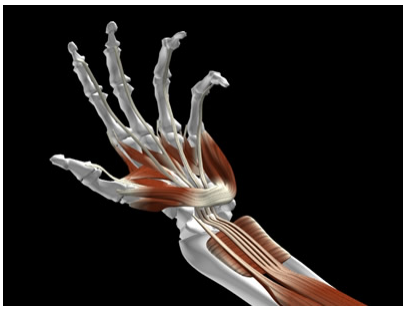
Quantum Computing

Matthew Fertig, David Andrew, Nick Greisser, Alex Guthrie
Richard Wilson, Lecturer, Department of Philosophy
Where: Engineering 023
When: 1:00 p.m.

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

(Top)

Brush and Bone



Deborah Firestone
Neal McDonald, Assistant Professor, Department of Visual Arts
Where: Engineering 023
When: 10:45 a.m.

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

(Top)

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

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

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

(Top)

Breaking Ground with Connect

Marcus Hockaday, Kathleen Greaney, Jamie Jaegers, Arielle Ngameni Mouani
Galina Madjaroff, Clinical Assistant Professor, Department of Management of Aging Services
Where: UC Ballroom
When: 12:00 - 2:00 p.m.

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

This work was funded, in part, by BreakingGround.

(Top)

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

Dalton Hughes, Chris Mullen, Madison Bondoc and Hollie Adejumo
Lee Blaney, Assistant Professor, Department of Chemical, Biochemical, and Environmental Engineering
Where: UC 310
When: 10:45 a.m.

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

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

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Clinical and Psychosocial Factors Associated with Pediatric Sickle Cell Retinopathy

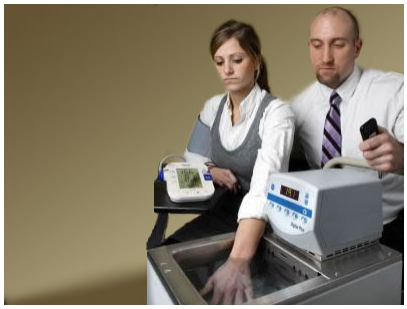
Imesha N. Kalansuriya
Shawn M. Bediako, Associate Professor, Department of Psychology
Where: UC Ballroom
When: 2:00 - 4:00 p.m.

Sickle cell retinopathy (SCR) is prevalent among children with sickle cell disease. However, the symptoms of SCR are often not diagnosed until the condition has reached an advanced stage – further complicating the disease experience and potentially resulting in permanent vision damage. Previous studies have shown a significant, but weak, association between clinical variables and SCR in pediatric samples. This suggests that other factors may be associated with pediatric SCR. This study investigates the association of both clinical and psychosocial factors with pediatric SCR. Using data from the Cooperative Study of Sickle Cell Disease, we hypothesized that psychosocial factors (e.g., perceived disease severity and parental knowledge of sickle cell disease) would be uniquely related to whether or not parents screened their child for SCR. This study is important because recognizing predictive factors of SCR can help to further identify patients at high risk and encourage earlier screening that can prevent permanent vision loss.

(Top)

Gender Differences in Pain Tolerance and Pain Intensity among College Students

Valerie Koury
Lynnda M. Dahlquist, Professor, Department of Psychology
Where: UC Ballroom
When: 12:00 - 2:00 p.m.



There is no distinct pattern of gender differences in commonly studied outcomes such as pain tolerance and pain intensity. The present study sought to examine whether gender differences exist in cold pressor pain. Participants were a sample of undergraduates (N = 69 males; N = 109 females) at the University of Maryland, Baltimore County. To capture pain tolerance, participants placed their hand in cold water for as long as they were able to tolerate the pain. After the

participants removed their hand, they were asked to rate their pain on a scale of 0 to 100; this measured pain intensity. Independent samples t-tests were conducted. There was a significant difference in pain tolerance between males (M = 52.00, SD = 45.00) and females (M = 31.16, SD = 31.16); t (176) = 3.97, p < .001. However, there was not a significant difference in pain intensity between males (M = 61.70, SD = 22.48) and females (M = 61.81, SD = 23.12); t (176) = -.032, p < .98. The results suggest that when exposed to cold pressor pain, females and males differ in their ability to tolerate the pain, but rate their experiences of pain similarly.

(Top)

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

Lauren A. Lochocki, Tyson King-Meadows
Tyson King-Meadows, Associate Professor, Department of Africana Studies and Political Science
Where: UC Ballroom
When: 12:00 - 2:00 p.m.

Walter Gadsden being attacked by dogs. Photo by Bill Hudson, AP, 1963

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

(Top)

Rogue Species Unleashed: Examining Non-Native Invasive Species, A Biological Problem With Socioeconomic Consequences

Caitlyn Maczka
Effie Siegel, Professor at Montgomery College, Department of English
Where: UC 310
When: 2:45 p.m.

Invasive species are one of the world's most severe yet most overlooked issues. Contrary to the belief of many, damage by invader animals, diseases, and plants is not just biological. Estimates for world-wide economic damage due to species invasions run into the hundreds of billions of dollars per year. This project analyzes the issue of invasive species, and how socioeconomic side effects of species invasions are felt most drastically by the world's poor. Species invasions in developing nations both exacerbate preexisting issues and create an array of new problems. This paper examines the issue via two case studies. The first is the

water hyacinth in Lake Victoria, Africa, and the second is Prosopis in the Afar region of Ethiopia. In addition to causing widespread economic damage for the surrounding communities, both plants also cause extreme social tension. Social strain in these areas stems from gender roles and responsibilities in maintaining livelihood. This paper analyzes the biological, economic, and social implications of species invasions, and the multi-faceted world-wide crisis is exposed.

This research project was completed at Montgomery College in 2013.

(Top)

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

Leslie McNamara
Anne Sarah Rubin, Associate Professor, Department of History
Where: UC 312
When: 2:00 p.m.

In 1913, Leo Frank, a Jewish factory superintendent was convicted and sentenced to death for the murder of thirteen-year-old Mary Phagan. This project first focused on the sensationalization of Phagan's murder as covered by The Atlanta Constitution and the coverage of Frank's subsequent trial. After Frank's conviction, the Frank case garnered national attention from the media which questioned Frank's conviction. This in turn led Tom Watson, a Georgia Populist leader, to write dozens of articles and editorials about Leo Frank. I analyzed Watson's rhetoric in his two publications, Watson's Magazine and The Jeffersonian. In my analysis, I concluded that Watson's rhetoric was rooted in Populist ideology but, contained aspects of anti-Semitism. First, Watson viewed the campaign to overturn Frank's convictions was simultaneously, impeding on Georgia's right for self-governance and was due to the anti-Semitic notion of Jewish control in the financial industry. Secondly, Watson provided polar opposite characterizations of Frank and Phagan in which Watson continually depicted Frank as a sexual deviant. In 1915, Governor John Slaton of Georgia commuted Frank's sentence and in the aftermath, Frank was lynched by a mob which was subsequently defended by Watson, who went on to serve as a Senator from Georgia.

(Top)

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

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

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

terms of comparison of computing times with alternative approaches and of the efficiency of permutation tests to infer biological relevance.

*This research was supported in part by a grant to UMBC from the Howard Hughes Medical Institute through the Precollege and Undergraduate Science Education Program, an Undergraduate Research Award from the UMBC Office of Undergraduate Education and the MARC U*STAR Program at UMBC through the National Institute of General Medical Sciences.*

(Top)

Using Quasi-Phase Matching for Enhanced Terahertz Generation

Timothy S. Pillsbury

L. Michael Hayden, Professor, Department of Physics

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

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

(Top)

Increase in Efficiency for Noise Cancelling in a Spin Qubit Array

Muhed Rana, Fernando Calderon

Jason Kestner, Assistant Professor, Department of Physics

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

(Top)

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

David Rivas

Markos Georganopoulos, Associate Professor, Department of Physics

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

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

(Top)

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

Amy S. Rizkallah, James T. Han

Richard Karpel, Professor, Department of Chemistry and Biochemistry

Where: UC Ballroom

When: 10:00 a.m. - 12:00 p.m.

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

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

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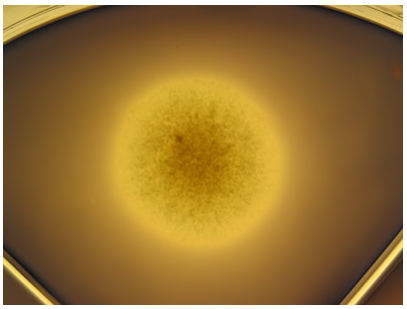
Production and Characterization of *Aspergillus nidulans* Mutants for Increased Protein Secretion



Nicholas M.K. Rogers, Victoria Taylor, Karthik Boppidi, Mark R. Marten
Mark R. Marten, Professor, Department of Chemical, Biochemical, and Environmental Engineering
Where: UC 310
When: 1:00 p.m.

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

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

Christian Sias, Victor Torres1, Jared Dixon
Anthony Johnson, Professor, Department of Physics, Department of Computer Science and Electrical Engineering

Gallium Arsenide (GaAs) is a useful III/V semiconductor material that can be used as a substrate and/or an active component for infrared optoelectronic devices in applications for health and the environment. GaAs has a direct band gap that can therefore emit light which is useful in LEDs and laser diodes. The purpose of this experiment is to examine the photoluminescence (PL) and the band gap energy of GaAs when undergoing large temperature changes by using a Titanium Sapphire laser, a cryostat to cool down the sample, and a spectrometer to measure the intensity and the wavelength of the PL. GaAs is excited with the Ti:Sapphire laser and the sample absorbs energy that is larger than the band gap energy. Electrons are excited from the valence band to the conduction band, leaving behind a positively charged hole. Electrons will lose some energy due to phonon scattering before coming to rest in the conduction band minimum. PL is the emission of the photon as the electron recombines with the hole. We are assuming that the PL intensity peak is the band gap energy, and the main purpose is to measure the temperature dependence of the GaAs band gap.
This work is based upon work supported by the National Science Foundation under Grant No. EEC-0540832.
(Top)

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

Caleb Simmons
Dr. Ivan Erill, Rank, Department of Biology
Dr. Muruhan Rathinam, Rank, Department of Mathematics and Statistics

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

This work was funded through NSF Grant No. DBI 1031420 - Undergraduate Biology Math Training Program.
(Top)

Using Structural Parameters in Transcription Factor Binding Site Prediction

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

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

This work was funded through an Undergraduate Research Assistant Support award from the UMBC Department of Undergraduate Education.
(Top)

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

Eric Sluder, Nicole Whewell, Stephen Moore, Xuanzhu Zhu
E.F. Charles LaBerge, Professor of the Practice, Department of Computer Science and Electrical Engineering; Fow-Sen Choa, Professor, Department of Computer Science and Electrical Engineering; Kaleb McDowell, Branch Chief, Translational Neuroscience at Army Research Laboratory
Where: UC Ballroom
When: 10:00 - 12:00 p.m.

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

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

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

Ke Tang
Brigid Starkey, Lecturer, Department of Political Science
Where: Engineering 023
When: 10:15 a.m.

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

This work was funded through an Undergraduate Research Award from the UMBC Office of Undergraduate Education.
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Regular Gig: Understanding the Benefits of Open Mic Performance

Jennie S. Williams
Michelle Stefano, Folklorist in Residence, Department of American Studies
Where: UC 312
When: 10:45 a.m.

An open mic night is a scheduled, often weekly, activity at a nightspot where musicians, poets, comedians and storytellers come in, sign up on a list, and perform without a formal booking. This research identifies the communal properties of the musical open mic night events in the Baltimore area and applies them to the greater theoretical discourse concerning understandings of "community." This research required my regular attendance at three distinct open mic night venues in order to become familiar with the regular attendees, and to understand the benefits of producing and participating in open mic nights. In-depth qualitative research methods were used, which included the collection of 11-15 semi-structured recorded interviews, as well as participant observation and detailed field notes. The interviews were conducted with performers, emcees, and the venue business owners, and focused on questions of their individual experiences and reasons for attending, or hosting, their respective open mic nights. The result of this research addresses the commonly valued foundation of creativity and artistic expression that open mic nights can provide and support for the greater Baltimore network of amateur and professional musicians and poets.

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