Student Research and Creative Inquiry Forum
April 17, 2019
Fisher College of Science and Mathematics

Poster #1
Title: Effect of EGF pathway inhibition on re-epithelialization and regeneration rate in salamanders
Student: Afuh Adeck
Faculty mentor: Renee Dickie (Biology)
Abstract: Salamanders have one of the most extensive regenerative abilities among adult vertebrates. The Epidermal Growth Factor Receptor (EGFR) gene in salamanders is crucial for the maintenance of successful cell growth, cell proliferation and cell survival. The objective of this study is to investigate the effects of the inhibition of EGFR pathways on re-epithelialization and regeneration of amputated salamander tails. We hypothesize that the Inhibition of EGFR pathways will lead to lower rates of re-epithelialization, diminishing regeneration. Salamanders were pre-treated in either 10nM inhibitor or control solution. Amputated tails were stained with Methylene Blue to assess re-epithelialization. Preliminary results suggest that the time required for re-epithelialization is longer in animals treated with the inhibitor than in the controls (~2 vs. 1.4 hours). This data implies that the inhibition of EGFR pathways plays an important role in hindering rapid wound healing. This suggests that upregulating EGFR pathway activity could potentially lead to improved wound healing therapies.

Poster #2
Title: Structural Characterization of Methicillin-Sensitive Staphylococcus aureus TIR Protein
Student: Ahmed Al Khafaji
Faculty mentor: Dr. Michelle Snyder (Biology)

Abstract: One of the most important defensive mechanisms is performed by the innate immune system. The non-specific response becomes extremely critical when we are exposed to new pathogens. The innate immune cells express pattern recognition receptors (PRRs) which possess the ability to recognize pathogen associated molecular patterns (PAMPs) commonly found on invading pathogens such as bacteria and viruses. Many of the PRRs are categorized as Toll-like Receptors (TLRs). TLRs bind PAMPs to their extracellular leucine rich repeat regions. The TLRs' intracellular portion, Toll/interleukin-1 receptor (TIR), starts a signaling cascade resulting in the release of cytokines, which regulate the immune response to the foreign pathogens. Various species of bacteria also express TIR domain-containing proteins, and some of the bacterial TIRs have been found to block mammalian TIR signaling. One of those species is methicillin-sensitive Staphylococcus Aureus (MSSA). So far, we have identified/optimized conditions for expression and purification of the full-length TIR protein, expressed and isolated the protein of interest, set up grids for Cryo EM for characterization, and we also will be setting up crystal conditions with next purification. This characterization could potentially lead to the development of drugs that can help mitigate the virulent effects of this TIR protein.

Poster #3
Title: Plant Collection in the NE U.S Urban Corridor: the MAM Project and it's Role in Understanding Change in Plant Communities
Students: Mya Bass, Abigail Gaffar, Milan Patterson,
Faculty mentor: David Hearn (Biological Sciences)

Abstract: Plant sciences are essential for human life. Within the past decade, the National Science Foundation (NSF) – supported initiatives that have made hundreds of millions of digital plant images and collection data available online for a global audience. The NSF-funded Mid- Atlantic Megalopolis Project is digitizing nearly one million plant specimens from the mid-Northeastern US whose collections date as far back as the early 1800s. The project includes thirteen institutions, including Towson University. At Towson University, we are imaging and transcribing collection data from nearly 55,000 plant specimens. Each specimen is labeled with the origin of collection, date of collection, species name and description of plant. Here, we present the protocol to standardize the digitization efforts across these institutions, and we report on the status of this effort and its applications to research. These images and data can be utilized to investigate phenotypical differences in species by location and urbanization's impact on the environment, they can help understand the impacts of climate change, and they can help to understand biological invasions. The information collected during this project will help better understand urban ecology and such efforts may make it possible to predict and diminish impacts of climate change.

Poster #4
Title: Investigating Human Cytomegalovirus G-Protein Coupled Receptor Homologue US27's Role in Autophagy
Students: Soumia Bekka, Jessica Caple
Faculty mentor: Barry Margulies (Department of Biological Sciences)

Abstract: Human cytomegalovirus (HCMV) infections are characterized by deafness, blindness and sometimes death. HCMV has a seroprevalence ranging from 50-70% in the United States.
However, seroprevalence of HCMV can reach almost 100% in lower socioeconomic areas. Previous research completed in the TU Herpes Virus Lab examined the binding partners of the
HCMV G protein coupled encoded by US27. This research successfully identified gamma-aminobutyric acid receptor-associated protein (GABARAP) as a host protein that binds
specifically to pUS27. GABARAP plays an integral role in the autophagy pathway and is critical for successful autophagy. We hypothesize that the aforementioned binding interactions between pUS27 and GABARAP inhibit autophagy after an HCMV infection. To address this idea, a recovery assay will be performed. siRNA interference will be used to downregulate host
autophagy proteins LC3 and Atg12p. Then wild-type HCMV and a pUS27 knock out strain of HCMV will be allowed to infect these inhibited cells; we will determine the relative effect of
pUS27's contribution to infection by comparing GFP expression, a surrogate for virus replication.
Understanding the role pUS27 in autophagy during HCMV infections may confirm pUS27's potential as a target in developing new antiviral interventions.

Poster #5
Title: DEVELOPMENT OF A MITOCHONDRIAL DNA ASSAY FOR SNP SCREENING USING PCR HIGH-RESOLUTION MELT CURVES
Student: Allison Bender
Faculty mentor: Kelly M. Elkins (Chemistry)

Abstract: The objective of this study was to develop a mitochondrial DNA (mtDNA) assay for single nucleotide polymorphism (SNP) screening using polymerase chain reaction (PCR) coupled with high-resolution melt (HRM) analysis. This method is less costly and time consuming than previous methods, such as post-PCR capillary and gel electrophoreses. Mitochondrial DNA (mtDNA) is found on a small, circular chromosome within the mitochondria, and is less likely to degrade when compared to nuclear DNA due to its smaller size. This is ideal for rapid screening where nuclear DNA is too degraded, such as cold cases, natural disaster cases, and instances involving only teeth or bone remains. Three SNPs (73, 7028, and 16519) of high frequency have been optimized to show differentiation in PCR HRM using a GC tag on one primer of each set. Further development will occur by centrifuging DNA standards with a microcon prior to PCR to isolate the mtDNA from the nuclear DNA, and eliminate any interference due to similarities between chromosomes in the nuclear DNA and sections of the mtDNA.

Poster #6
Title: Investigating the Sequence Flexibility of Small Proteins in the Escherichia coli CydABX Cytochrome Oxidase Complex
Students: John Biondo, John Biondo, Bradley Stansbury
Faculty mentor: Dr. Matthew Hemm (Biology)

Abstract: The small protein (SP), CydX, is a member of a cytochrome bd oxidase protein complex, and is important for bacteria under stress and low oxygen conditions. Although CydX is essential for the operation of the oxidase complex and the amino acid sequence is conserved across many species, we have found that the protein is highly resilient to mutations. Previous work in the lab has shown that every amino acid in the protein can be mutated while retaining complex functionality. Because of this phenotypic resilience to mutations, we are testing if CydX can be replaced by other small proteins of similar size and conformation. If these proteins cannot functionally replace CydX, we are also performing selection screens for mutant versions of the new small protein that can function as CydX in the complex. By characterizing the mutability of CydX through removal and replacement by another SP, our lab may be able to shed light on how small proteins evolve and interact with other complexes.

Poster #7
Title: Analysis of potential short open reading frames in Escherichia coli
Students: Maxwell Blount, Su Song, Elsa Tlapechco, Aissata Diallo, Jack Pierce, Kathleen Mulville, Steven Oktavianus, John Biondo, Tamara Persad
Faculty mentor: Cheryl Warren (Biology)

Abstract: Previous work in multiple organisms has shown that very small proteins (<75 amino acids) have important cellular functions. Small proteins, however, are difficult to isolate and characterize. The E. coli genome contains many short open reading frames (sORFs) that may encode small proteins, but not many of them are expressed. In order to identify new small proteins, our lab is testing sORFs for expression through bioinformatic analysis, recombinant tagging, and biochemical methods. Potential sORFs were analyzed using bioinformatic tools such as NCBI conserved domain, NCBI microbial blasts, and ClustalW to test for likelihood of expression. To test for expression of the predicted small proteins, an SPA epitope tag was introduced into E. coli cells and recombined before the stop codon of each sORF. Correct integration is being confirmed by flanking primer PCR and DNA sequencing. Western blot assays will be performed on cell lysates at stationary and exponential phases to determine whether the short proteins are expressed. Further identification of novel small proteins will not only help in understanding cellular mechanisms, but these tests will help increase the accuracy of future sORF prediction.

Poster #8
Title: The Effect of Anti-angiogenesis on Tissue Regeneration
Student: Luke Bollinger
Faculty mentor: Renee Dickie (Biological Sciences)

Abstract: Vatalanib, a small molecule that works to prevent the formation of new blood vessels, is used in this experiment to track blood vessel formation in developing tissue of axolotl salamanders. This species of salamanders is known for its remarkable capability to regenerate severed limbs or tails, making them the ideal organism to test for regenerative abilities in the absence of angiogenesis. It is unclear whether or not decreased angiogenesis has an effect on the proliferative or maturation phase or tissue outgrowth. Here we show the relationship between lack of vascularization and tissue outgrowth in terms of rate and quality of the regenerated tail. This study demonstrates the low need of vascularization in early tissue growth. This gives a better understanding of the role of blood vessel formation on tissue renewal, especially in a major regenerative species.

Poster #9
Title: Statistical Analysis of Donor Data for Baltimore Humane Society
Student: Kristian Brown
Faculty mentor: Alexei Kolesnikov (Mathematics)

Abstract: The Baltimore Humane Society is interested in increasing the total amount in donations they receive each year. Research involving their current donor database and donation totals is being conducted to help them achieve this goal. Part of this research includes conducting a statistical analysis to calculate and assign a numerical “value” to the organization's fundraising campaign. A t-test and a linear regression model is used to determine the relationship between the timing of fundraising events and the organizations monthly donation totals. This analysis allows the organization to see which fundraising initiatives bring in the most donations. It also shows how the increase in donations as a result of fundraising events impact the months following the event.

Poster #10
Title: Molecular Characterization of Enterococci Sources in the Anne Arundel County Region
Student: Jason Burkholder
Faculty mentor: Vanessa Beauchamp (Biological Science)

Abstract: Enterococci have been historically characterized as non-harmful, but over the past decade the emergence of hospital-associated enterococcus infections carrying antibiotic resistances, and the movement of similar strains into the community have increased significantly. A reliable and cost-effective method to identify the species of origin for enterococci-contaminated local rivers and tributaries is essential in preventing contamination and decreasing the risk to human health. In this study, human, canine, and bird fecal DNA samples were analyzed with primer sets previously designed to amplify targets specific to enterococcal species with the goal of identifying the specific fecal source.

Poster #11
Title: An Examination of Aerobic Fitness Changes Following Exercise Training in Adults With and Without Sleep Apnea
Student: Callie Cromer
Faculty mentor: Dr. Dobroseilski (Kinesiology)

Abstract: An Examination of Aerobic Fitness Changes Following Exercise Training in Adults With and Without Sleep Apnea

Obstructive sleep apnea (OSA) has numerous detrimental effects on cardiometabolic function that may negatively impact aerobic fitness capacity. PURPOSE: Examine the effects of exercise training on maximum oxygen uptake (VO2max) in those with and without OSA. METHODS: Participants underwent overnight polysomnography (PSG) to determine the presence and severity of OSA, as defined by apnea-hypopnea index (AHI). VO2max was assessed on a treadmill before and upon completion of a 6 week (3 sessions/wk; 1 hr/session) exercise training program. RESULTS: Forty six (BMI: 33.3+4.2 kg/m2; 24 men: 22 women) adults completed the study. At baseline, adults with no or mild OSA (-OSA) were younger than adults with moderate to severe OSA (+OSA) (-OSA: 49+ 8 years vs. +OSA: 54+9 years, p=0.04), yet no differences in BMI or VO2max were observed. The change in VO2max following exercise training did not differ according to OSA status (-OSA: 2.2+3.9 ml/kg/min vs. +OSA: 2.6+3.9 ml/kg/min, p=0.7) CONCLUSION: These data suggest that exercise induced improvements in aerobic fitness capacity are not attenuated in adults who suffer from moderate to severe OSA.

Poster #12
Title: What Do Crickets Smell?: Do Dead Odors from Conspecifics Elicit Attraction or Rejection?
Students: Tsion Demissie, Tsion Demissie, Milka Teklemichael, Heaven Woldemariam
Faculty mentor: Dr.Vonnie Shields (Biological Sciences Department)
Abstract: Olfaction is a necessary component of animal physiology. Many animals use their sense of smell for oviposition, mating, and finding food. The insect's olfactory system is an important model in neuroscience for addressing how animals detect, encode, and process olfactory stimuli. Most insects have long paired multi-segmented antennae which allow them to detect odorants through various types of sensory organs. The house cricket, Acheta domesticus, is an omnivorous scavenger. Cricket antennae are important mechanosensory and chemosensory organs used to detect touch, smell, and taste information. The house cricket can contaminate foods with their feces. This raises concerns about foodborne illnesses associated with microbial pathogens creating health concerns. The aim of this study was to determine if odors collected from dead crickets elicited positive or negative anemotaxis using a Y-tube bioassay. We hypothesized that odors collected from dead crickets would elicit significant positive anemotaxis and may signal the presence of food. We further hypothesized that male and female crickets tested with dead cricket odors from 24h, 48h, 72h, and 168h would display significant differences in positive anemotaxis. The overall goal of this study will be useful in suggesting possible odorant lures to trap these insects and prevent food contamination.

Poster #13
Title: Does the Reappearance of a Dorsal Fin in the Black Ghost Knifefish (Apteronotus albifrons) Affect Swimming Kinematics?
Student: Mary Eisinger
Faculty mentor: Christopher Oufiero (Biological Sciences)

Abstract: Apteronotus albifrons, or the black ghost knife fish, is known for its ribbon-like motion of the anal fin during swimming. While these fish possess an elongated anal fin for locomotion, they completely lack a dorsal fin. However, due to inbreeding or relaxed selection, a mutant strain of A. albifrons exhibits an elongated dorsal fin. The presence of the dorsal fin mutation allows for the opportunity to study the effects of the dorsal fin on gymnotiform swimming. This dorsal fin is unique because it does not function like a normal fin; the fish can not control the fin. After using μCT scans to display the internal morphology of the dorsal fin, the results showed that the mutant knifefish regained both the individual fin rays and fin ray supports as seen in the fully functional anal fin. The objective of this project was to determine the effect of the presence of a dorsal fin on swimming. Could the dorsal fin possibly create an advantage in the swimming ability of the knife fish? It was hypothesized that this mutation would not affect normal swimming. Therefore, I compared the routine swimming kinematics between A. albifrons with and without a dorsal fin.

Poster #14
Title: Effect of Climate Change on Spring Ephemeral Flowering
Student: Derick Ekekwe, David Hearn
Faculty mentor: Larry Wimmers (Biology)

Abstract: Global climate change has increased global temperatures by an average of 0.8 degrees centigrade in the past 140 years. This change has been correlated to numerous biological indices including the northern range expansion of many plants an animals. We are investigating whether or not warming is correlated to earlier flowering. This is important due to the interactions among pollinators and flowering plants. Plants and their pollinators are co-evolved. If plants flower earlier, the pollinators may not be active yet affecting both pollination and the ability of the pollinators to obtain food. To test this hypothesis we are identifying flowering dates of spring ephemerals over the past century. Flowering dates are determined by the date of collection of herbaria samples with flowers recorded in the iDigBio database. We chose spring ephemerals because they have a very short flowering period. Thus, their collection date is a good estimate of their first flowering date for any given year.

Poster #15
Title: Development of An Anti-Herpetic, Contraceptive Ring
Students: Amanda Evans, Jennifer Suon jsuon2@students.towson.edu
Faculty mentor: Barry Margulies (Biological Sciences)

Abstract: Herpes simplex virus 1 and 2 (HSV-1, HSV-2) can cause primary and recurrent outbreaks of genital and oral lesions. To treat genital outbreaks, we have developed a matrix-based, intravaginal ring capable of releasing therapeutic amounts of antiherpetic drug for a 30-day period. Our rings are composed of poly (ethylene co-vinyl acetate) (EVA) and the anti-herpetic drug acyclovir (ACV). Through previous in vitro trials, our rings showed effective prophylaxis and consistent therapeutic release of drug over a 30-day period. We are now testing two modified versions of our rings: a triple antiherpetic drug version and a contraceptive plus antiherpetic version. Triple drug combination therapy with ACV and two antiherpetic other drugs (cidofovir and amenamivir) can reduce the chance of viral resistance to treatment. And although a contraceptive intravaginal ring is on the market today, it has only that single activity; we are incorporating a synthetic progesterone, levonorgestrel, into our current ACV-containing rings to act as the contraceptive component. Eventually, we would like to incorporate more antiviral drugs to prevent a wider range of diseases.

Poster #16
Title: Associated Absorbers and Galaxies in the Sloan Digital Sky Survey
Student: Elizabeth Fletcher
Faculty mentor: Dr. Jennifer Scott (Department of Physics, Astronomy & Geosciences)

Abstract: We present the results of 44 low redshift quasars ($0.06 < z < 0.85$) observed with the Cosmic Origins Spectrograph on the Hubble Space Telescope that lie within the footprint of the Sloan Digital Sky Survey. We use photometric data of galaxies from the SDSS DR12 to match galaxies with absorption systems of a similar redshift. Within this data set of quasars, we focused upon associated absorbers. An associated absorber is loosely defined as an absorption system with a velocity separation of less than 5,000 km/s of its background quasar. We will compare the COS sample of possible associated absorber-galaxy pairs to the known anticorrelation between absorber equivalent width and galaxy impact parameter. We will investigate trends with quasar luminosity in this sample and in a control sample of possible non-associated absorber-galaxy pairs in order to examine the galaxy proximity effect.

Poster #17
Title: A Dietary Study of a Maryland Population of Northern Map Turtles (Graptemys geographica) Upriver of the Conowingo Hydroelectric Dam
Student: Matthew Gacheny
Faculty mentor: Dr. Richard Seigel (Biological Sciences)

Abstract: The Northern Map Turtle is a freshwater turtle species that inhabits rivers and lakes in North America. It is a Maryland state endangered species with multiple threats to populations across its range. The species mainly consumes snails and clams and has been shown to consume invasive mollusks as well.
This work characterizes what these turtles are preying upon directly upriver of the Conowingo Hydroelectric Dam, giving needed insight into the little understood feeding ecology of this species, as well as the poorly understood effect of hydrologic alteration on local biota. This characterization is compared to another dietary analysis of the same species downriver of the dam. Turtles were captured and held overnight in plastic bins in the Port Deposit Tomes Gas House Visitor Center and Northern Map Turtle Research Center for dietary material collection. Turtles were then released at site of capture. Dietary items were sorted and analyzed for relative importance of dietary items. Principle diet items were the invasive Zebra Mussel and Japanese/Chinese Mystery Snail, with colonial animals being a notable diet item as well. This contrasts with the previous downstream analysis, implicating an effect on the feeding ecology of these turtles due to the dam.

Poster #18
Title: Development of HPLC-UV and UPLC-MS Methods for Simultaneous Quantification of Multiple Anti-Herpetic Drugs
Student: Nicholas Giannasca
Faculty mentor: Barry Margulies (Biology)

Abstract: Microbial resistance to anti-microbial therapies such as antibiotics or anti-viral drugs has become a large concern in biomedical research. Microbes that develop resistance to widely-used treatments can cause serious untreatable morbidity and mortality in humans. Combination drug therapy has been shown to reduce the overall chance of microbial mutation that leads to multi-drug resistance when compared to single-drug treatments. Three readily available anti-herpetic drugs acyclovir (ACV), cidofovir (CDV), and amenamevir (AMV) are being investigated in combination therapy against primary infections caused by herpes simplex virus-1 (HSV-1) and HSV-2 and outbreaks caused by latent infections associated with these viruses. To quantify these drugs in solutions such as plasma or water, a high-performance liquid chromatography and UV spectrophotometry (HPLC-UV) method of analysis was developed. The method was then adapted for more specific analysis and quantification of the drugs via ultra-performance liquid chromatography and mass spectrometry (UPLC-MS). The outlined method can confidently quantify all three drugs in solution alongside an internal standard, ganciclovir (GCV), that can be used to account for lost drug during sample preparation techniques. These methods allow for the quantification of unknown amounts of drug in solution which can be applied when developing therapeutic dosages and controlled-release technologies.

Poster #19
Title: Female Ordination in the Catholic Church
Student: Kaitlyn Griffin
Faculty mentor: Kate Wilkinson (Women and Gender Studies)

Abstract: Since the earliest days of the organized Catholic Church, women have been prevented from attaining the same religious roles as men, even though they were as equally instrumental in the formation of the new religion both during Jesus' ministry and after his death. Over the past 100 years there have been increased efforts by specific churches and international organizations to convince the Vatican to change this rule and allow the priesthood to be open to anyone who feels a calling. The leaders of the Catholic Church have consistently said no and have released a number of letters explaining their reasoning. Their explanations are weak, however, and based off flawed interpretation of ancient evidence. Through using the same sources they use, I will give responses to their arguments and show both how female priests is allowed within the central tenants of the religion and how it would benefit the church.

Poster #20
Title: Single-Molecule Investigations of Molecular Partitioning into Poly (ethylene Oxide) Films
Student: Priyansh Gujarati Gujarati
Faculty mentor: Tran-Ba, Khanh-Hoa (Chemistry)

Abstract: Molecular partitioning has been commonly studied in the past using conventional methods including the shake-flask method and liquid chromatography. These techniques work well when the molecules (analyte) exhibit a significant solubility in both phases but will fail when the analyte's solubility in one of the phases is very low (< 0.01). Here, we propose to studypartitioning using single-molecule tracking (SMT), that can be used to measure extremely small
partition coefficients (P < 10 -8) using home-built widefield fluorescence microscope in our lab.
Our method is based on monitoring the partitioning of analyte molecules; sulfurrhodamine
B dye (SRB). Concentration of dye in ethanol (C EtOH) ~ 100 nM. Partitioning from an ethanolic
buffer solution into a condensed phase (polyethylene oxide, PEO) will be investigated.
The partition coefficient will be measured by tracking the number of SRB present in PEO,
calculating its local concentration (C PEO) and determine the local partition coefficient using logP
= log[C PEO /C EtOH]. We will study the impact of the polymer swelling on the partitioning behavior
of SRB by varying the water or chloroform or THF (good solvents for PEO) content in a series
of ethanolic solutions.

Poster #21
Title: Absorption Characteristics of Ions in the Circumgalactic Medium
Student: Colin Hamill
Faculty mentor: Jennifer Scott (Physics, Astronomy, and Geosciences)
Abstract: We extend the results of a study of 44 low redshift quasars ($0.06 < z < 0.85$) observed by the Cosmic Origins Spectrograph on the Hubble Space Telescope that lie within the Sloan Digital Sky Survey. We have used galaxy photometric data from SDSS Data Release 12, along with the known anticorrelation between Lyman alpha absorption equivalent width and galaxy impact parameter for absorber-galaxy pairs, to identify the most probable galaxy matches to absorbers in the spectroscopic dataset. We compare our results to confirmed galaxy absorbers from the published literature and to the equivalent width – impact relationships for a variety of ions in the circumgalactic medium. We explore modifications to our matching algorithm to improve its accuracy.

Poster #22
Title: Get Outta My Swamp! Shrek Helps Students Master Optimization
Students: Gabriella Harris, Rachel Schmitz, rschmi9@students.towson.edu
Faculty mentor: Dr. Gail Kaplan (Mathematics)

Abstract: Using our knowledge of AP Calculus and Inquiry-based learning, we created and implemented an engaging, Shrek-themed lesson on the topic of optimization. This is an engaging, Shrek-themed, student-centered activity about interpreting minima and maxima. This project has been successfully implemented in high school and college-level calculus courses.

Poster #23
Title: A Data Pipeline for the Minor Planet Center
Student: Saneyda Hernandez
Faculty mentor: Dr. Scott (PAGS)

Abstract: We present a software pipeline for automatic preparation of image data for submission to the International Astronomical Union's Minor Planet Center. The pipeline draws upon existing software tools, and will allow users to characterize digital images to the astrometric and photometric standards of the MPC. The pipeline is part of a larger project aiming to broaden user input to the MPC by providing efficient, automated, web-based user support for a wide range of observational data.

Poster #25
Title: Synthesis and Optical Properties of Gold Nanoparticles using Anthracenethiol Ligand
Student: Brianna Hutson
Faculty mentor: Dr. Mary Sajini Devadas (Chemistry)

Abstract: The unique optoelectronic properties of gold nanoparticles have been researched and utilized in technological applications such as sensory probes, therapeutic agents, drug delivery in biological and medical applications, electronic conductors and catalysis. The optical and electronic properties of gold nanoparticles are adjustable by changing the size, shape, surface chemistry, or aggregation state which make them difficult to study. The goal of my research project is to synthesize gold (Au) nanoparticles using a modified anthracenethiol ligand. The anthracene core is very conjugated, hence the ligand is highly fluorescent and absorbs in the visible region. Anthracenethiol, also known as C20H18S or 5-(anthracen-9-yl)pen-4-yne-1-thiol has more potential for biological imaging when attached to the Au nanoparticle. This modification of the nanoparticle surface with this ligand will allow me to see how the optical properties of the gold would change due to electron transfer reactions between the fluorophore and the metal atom. The nanoparticles were synthesized using this ligand directly and tested with UV Spectroscopy and fluorescence spectroscopy. The details of the synthesis and characterization will be presented below.

Poster #26
Title: Piecewise Harmonic Finite Elements on Clough-Tocher Splits
Student: Ashley Imus
Faculty mentor: Tatyana Sorokina (Mathematics)

Abstract: We study continuous piecewise harmonic polynomials (splines) in two variables defined over the so-called Clough-Tocher split of a triangle. The Clough-Tocher split is obtained by choosing an interior point in the triangle (usually the barycenter), and coning off to the three vertices of the original triangle. The continuous piecewise harmonic splines of fixed polynomial degree form linear spaces. We prove dimension results for quadratic, cubic, and quartic splines. We also show how to construct Bernstein-Bezier bases for these spaces.

Poster #27
Title: Increasing Solution Viscosity in Dynamic Light Scattering to Lower the Detection Limit for the Determination of Nanoparticle Size
Student: Hristo Ivanov
Faculty mentor: Jeffrey Simpson (Physics Astronomy and Geology Sciences)

Abstract: We report on the development of homebuilt Dynamic Light Scattering (DLS) instrumentation to measure the size of monodisperse (MD), spherical nanoparticles (NPs) of gold. HeNe and Ar-ion lasers constitute the excitation sources for the scattering experiment, while an avalanche photodiode detects the scattered light, and an autocorrelation card analyzes the resulting signal to provide a measurement of the translational diffusion coefficient, which allows for the determination of NP diameter. We characterized our instrumentation using commercially-produced gold NPs with diameters ranging from 50nm to 200nm in aqueous solution. Given the strong temperature-dependence of the solution viscosity, periodic ambient temperature measurements were used to produce dynamic values for viscosity and minimize uncertainty in the determination of NP size. Increasing the liquid viscosity slows down the Brownian motion of the NPs and affords measurement of smaller-sized particles that otherwise diffuse too fast for detection. Currently we are suspending NPs in higher viscosity solutions in an effort to lower our size detection floor from approximately 50nm to 10nm.

Poster #28
Title: The Role of gipA In the Bacterial Resistance against Phagocytosis by Extra – Intestinal Escherichia coli
Students: De'Sha Johnson, Marta G. Perez-Vazquez
Faculty mentor: Michelle Snyder (Biology)

Abstract: Crohn's disease (CD) is a chronic inflammatory bowel disease (IBD) associated with interactions between human gut microbes and the immune system. In a normal gut, the immune system samples the microbiome and modulates responses to identified pathogens. In the gut of CD patients, bacteria can survive, colonize the lamina propria, and cause inflammation. Dictyostelium discoideum is a genetically tractable, cost-effective model for characterization of host-bacterial interactions. Genomic analysis by large-scale BLAST score ratio (LS-BSR) identified a gene (gipA) present in several D. discoideum grazing-resistant E. coli strains. We hypothesize that gipA confers resistance to phagocytosis by D. discoideum. The goals of this study are to manipulate gipA expression in E. coli strains and characterize interactions between D. discoideum and E. coli strains. We have successfully created a vector for overexpression of gipA and have transformed it into a laboratory strain that does not express gipA. In addition, we have created a vector for knockout of the gipA gene and are using it to delete the gipA gene from the genome of a uropathogenic E. coli strain. We expect high phagocytic resistance in strains expressing gipA, and low resistance in strains deleted for gipA.

Poster #29
Title: Implications of Toll-Like Receptor Sequence Diversity and Differentiation on the Management of Neotoma magister (Allegheny woodrat) Populations
Students: Connor Kean, Ryan Beasley
Faculty mentor: Jacqueline Doyle, Ph.D. (Department of Biological Sciences)

Abstract: Over the last century Neotoma magister populations have decreased to the point of extirpation, most sharply in the northern range of the species. Currently the final extant New Jersey population faces local extinction because of low population size and documented low genetic variability. To evaluate the current management of the population, genes from the Toll-like receptor (TLR) gene family were sequenced in both the New Jersey population and in a Pennsylvania population that is currently donating individuals for translocations. The TLR family of genes provides valuable information due to its importance in the immune response pathway and due to its ability to enable the assessment of genetic differentiation and variability between and within the respective populations. The research proceeded by amplifying and sequencing the TLR 3, TLR 5, and TLR7 genes in ~10 Pennsylvania individuals and ~10 New Jersey individuals. Subsequently, the individual sequences were analyzed for the presence of intrapopulation variability and interpopulation differentiation. The completed analysis resulted in meaningful conclusions on the impact and viability of using translocations to help initiate genetic rescue in struggling Allegheny woodrat populations.

Poster #30
Title: Total Synthesis of Cladosin B
Student: Justin Kim
Faculty mentor: Dr. Keith Reber (Chemistry)

Abstract: A convergent total synthesis of the natural product cladosin B, isolated from the deep-sea- derived fungus Cladosporium sphaerospermum, has been developed. Metabolites containing the tetramic acid core exhibit a wide range of biological activities, such as antitumor and anti-HIV effects. However, only a limited quantify of cladosin B has been extracted, making it an ideal target for total synthesis. Our synthetic route began from commercially available methyl (S)-3- hydroxybutanoate, producing cladosin B over eight steps. Key transformations include Narasaka- Prasad reduction of a -hydroxyketone to prepare the 1,3-syn-diol present in the side chain and a 4-(dimethylamino)pyridine (DMAP) catalyzed rearrangement to form the acyltetramic acid core. Samples of cladosin B and its synthetic analogs will be submitted to Eli Lily's Open Innovation Drug Discovery (OIDD) program for further biological testing.

Poster #31
Title: Furin Gene Expression Systematically Reviewed via Quantitative Polymerase Chain Reaction
Student: Olivia Konen
Faculty mentor: Dr. John Weldon (Department of Biological Sciences)

Abstract: Furin is a membrane-bound serine protease that is expressed in vertebrates. It is known to process a wide variety of endogenous proprotein substrates in the secretory pathway, but also plays a role in pathogenic infections. One target of furin is Pseudomonas exotoxin A (PE), a protein toxin secreted by Pseudomonas aeruginosa. PE has been re-engineered to create a class of cancer therapeutics called recombinant immunotoxins (RITs), which are fusion proteins combining antibodies and toxins to create a selective cell-killing agent. The presence of furin has been shown to influence the cytotoxicity of RITs that are created from PE. We investigated the mRNA expression levels of furin in genetically engineered variants of the HEK293 cell line, including wild-type, furin knock-out, and furin knock-out/knock-in. Total RNA was isolated from each variant and used in reverse transcriptase quantitative PCR to assess relative furin expression. Expression was significantly higher ($P < 0.05$) in the knock-out/knock-in line compared to the wild-type. Our results will help to establish the activity-dependent role of furin in the intoxication pathway of PE-based RITs, and support the development of a more effective RIT to treat cancers.

Poster #32
Title: Magnesium diboride-based hyperbolic metamaterial superconductors
Student: Will Korzi
Faculty mentor: Dr. Vera Smolyaninova (PAGS)

Abstract: Superconductivity is a very useful property as materials which are superconducting have zero electrical resistance when they are cooled below their critical temperature (T¬c). Though the issue is that usually these critical temperatures are very low and require expensive cooling methods to achieve. It has been shown that fabricating hyperbolic metamaterials of alternating nanolayers of superconductor and dielectric can create samples with higher critical temperatures. This method has been tested previously with aluminum-based hyperbolic metamaterials, where the Tc was tripled. Continuing with these findings, we applied this method to magnesium diboride, which has significantly higher Tc than in aluminum. We have performed polarization reflectometry measurements on magnesium diboride/magnesium oxide to determine whether the dielectric functions of the samples has hyperbolic character and correlate these properties with Tc. Co-authors include: Grace Yong, Bryan Augstein,
Vera Smolyaninova
(Towson University); Wenura K. Witanage, Fei Qin, Kanishka Wijesekara, Narendra Acharya, Xiaoxing Xi (Temple University); Anne-Marie Valente-Feliciano
(Thomas Jefferson National Accelerator Facility); Michael Osofsky,
Joseph Prestigiacomo, Kate Burgess (Naval Research Laboratory); Igor Smolyaninov (Saltenna LLC and University of Maryland). This work is supported by GARPA DSO Award No: W911NF-17-1-0348.

Poster #33
Title: CHEMICAL IDENTIFICATION OF COCOA GEOGRAPHIC ORIGIN USING UPLC-MS
Student: Gabrielle Lembo
Faculty mentor: Dr. Shannon Stitzel (Chemistry)

Abstract: Cocoa and the production of its products is a global industry and the need for a method to chemically discriminate geographical origin is becoming more and more important for quality control and the traceability of fair-trade practices in the industry. Since each region where cocoa is gown can contain several variations in soil composition, fermentation process and roasting conditions, the differences in chemical signatures can be used to classify beans by their country of origin. Many studies have employed GC-MS, ICP-MS, and HPLC to quantify to detect the presence of certain compounds in cocoa samples. However, little has been done to group and classify different qualities of a cocoa sample to determine its origin.
Use of the LC-MS provides an opportunity to use chemical signatures to not only identify country of origin in cocoa samples but potentially differences in genetic strains and classification of some of the compounds that contribute to taste, aroma, and other desirable attributes.
This project describes the cocoa sample preparation and conditions for UPLC/ESI-TOFMS used to obtain unique chemical signatures from cocoa liquor samples along with the discriminate analysis used to identify chemical fingerprints for cocoa beans based on one of five countries of origin.

Poster #34
Title: Developing Long-Acting Implants for Breast Cancer Prevention
Student: Chloe Lissauer
Faculty mentor: Dr. Barry Margulies (Biology)

Abstract: This project is focused on the development of long-lasting devices that prevent estrogen-dependent breast cancers via the incorporation of anti-estrogen therapeutic drugs. Anti-estrogen therapeutic drugs are divided into selective estrogen receptor modulators (SERMs) and selective estrogen receptor degraders (SERMs). Raloxifene, a SERM clinically administered for breast cancer prevention, is our drug of interest. Our goals are to improve drug delivery and patient compliance while limiting the amount of associated side effects. Drug-infused silicone devices and standards for raloxifene have been created so that high performance liquid chromatography (HPLC) can be performed for quantification and analysis of overall drug release from our release experiments. The current experiment focuses on determining if the raloxifene released from the devices is actively interacting with estrogen and inhibiting the proliferation of breast cancer cells. Through this method of drug administration, it is possible that side-effects of raloxifene can be limited in patients. The method is based on local treatment, meaning that the drug directly interacts with the breast and will not be degraded from traveling systemically. The method is long-lasting, with the potential to last in the body for 5-7 years, ultimately eliminating poor patient compliance and increasing the prevention of estrogen-dependent breast cancers.

Poster #35
Title: Diphthamide-deficient Elongation Factor 2 in HeLa Cells
Student: Elliot Lowe
Faculty mentor: John Weldon (Biological Sciences)

Abstract: Elongation Factor 2 (EF2) is a translation elongation factor which is essential to the process of protein synthesis. Elongation Factor 2 contains a unique post-translationally modified histidine called Diphthamide which is found in both Eukarya and Archaea and is a target of several bacterial toxins. To understand the role that diphthamide plays in translation better, I propose to test a library of EF2 mutants in which the diphthamide histidine residue is substituted with every common amino acid. A gene expression library of these EF2 mutants will be transfected into HeLa cells and cultured for several passages. We hypothesize that HeLa cells will be viable when expressing mutant EF2, yet not resistant to diphthamide-targeted toxins because the cells still contain endogenous copies of wild-type EF2. The frequency of mutants in the transfected HeLa cells will be assessed by high-throughput sequencing and compared to the frequency observed in the original library to determine the overall fitness effect of each mutation. The end goal of this project is to understand which amino acids are best able to replace diphthamide in EF2.

Poster #36
Title: Investigating the Survival of HSV-2 on Various Fomites
Student: Ricardo Mack
Faculty mentor: Barry Margulies (Biology)

Abstract: Herpes simplex virus-2 (HSV-2) is a member of the alpha-herpesvirus family allowing it to affect a wide range of host. HSV-2 affects 11% of the global population. HSV-2 is commonly associated with sores in the genital region, however, it can also cause oral lesions. With such a vast number of people being infected by the virus, everyday objects are often contaminated with the virus. The objective of this project is to determine how long HSV-2 can be viable on objects contaminated with the virus (known as fomites). Through our methods, we hope to develop a clear understanding of the timeline of herpes survival on these objects. After contaminating the plastic cup fomites, we collect samples over a 24-hr period, then use plaque assays to determine viral titers at those time points. Checking viral titer through a time course will give us an important look at how the quantity of live virus on the plastic cup is decreasing over time.

Poster #37
Title: Sports Analytics for Towson University's Men's Basketball Team
Student: Derek Margulies
Faculty mentor: Christopher Cornwell (Mathematics)

Abstract: The overall goal of this project is to improve Towson University's Men's Basketball team's chances of winning games based on statistical analysis of game data. The basketball team has requested our research group to identify which parameters in a game most
affect the outcome and to identify optimal lineup combinations. To approach the ultimate task, I am focusing on play-by-play data extraction and analysis. From play-by-play analysis, I plan to identify which parameters influence a game's outcome and determine whether different parameters affect a game's outcome when grouped together. The conversion from raw play-by-play data to a suitable data form will help both the coaching staff on the basketball team and fellow research team members to interact with the data more easily. Preliminary work has been completed for this project from June 2018 through August 2018.

Poster #38
Title: Characterizing storm event concentration-discharge relationships in urban watersheds using high-frequency data
Student: Melinda Marsh
Faculty mentor: Dr. Joel Moore (Department of Physics, Astronomy & Geosciences)
Abstract: Significant amounts of ions and nutrients can be mobilized in watersheds during storm events. Studying the relationship between solute concentration and stream discharge (C-Q) can offer insight into solute mobilization and transport in watersheds, in part, by highlighting the relative contributions of surface runoff, soil water, and groundwater. More C-Q studies have been performed on forested and agricultural watersheds than urban watersheds despite urban land cover being one of the fastest growing land types. We examined storm event C-Q relationships for two urban watersheds in the Baltimore, MD region: West Branch Herring Run (HERR) and Plumtree Run (PTR). C-Q relationships were evaluated based on rotational direction and slope for specific conductance (SC) and concentrations of dissolved chemical species using a combination of high-frequency sensor data and discrete sampling. Clockwise rotational patterns were observed at HERR while PTR predominantly exhibited anticlockwise patterns, which implies that solute transport occurs more rapidly at HERR and may be attributable to differences in stormwater drainage infrastructure and/or basin morphology. SC and solutes generally exhibited flushing patterns (i.e., an initial concentration rise) during smaller magnitude winter storm events ($Q < 1.42$ cubic meters per sec) in both watersheds; dilution patterns were observed during larger magnitude events.

Poster #39. Title: Bayesian Photometric Redshift (BPZ) and Galaxies in the Quasar Field HE2347-4342
Student: Meaghan McDonald
Faculty mentor: Dr. Jennifer Scott (Department of Physics, Astronomy and Geosciences)

Abstract: Spectroscopic redshifts are generally ideal when determining distances to objects in the furthest parts of the Universe. However, spectroscopic redshifts can be difficult to obtain, so photometric redshifts are often used in their place. The Bayesian Photometric Redshift (BPZ) allows for the estimation of photometric redshifts using Bayesian inference and priors. In this study, we use BPZ to calculate photometric redshifts from multiband imaging of the quasar field HE2347-4342. As a result, we are able to correlate galaxies near the quasar line of sight with fluctuations in the ratio of neutral hydrogen (HI) to that of singly-ionized helium (HeII) measured from spectroscopy in the near UV and far UV respectively.

Poster #40
Title: Speciation of Copper in Bioretention Soils Receiving Runoff from a Copper Roof
Student: Emily McGovern
Faculty mentor: Dr. Ryan Casey (Chemistry)

Abstract: Inquiries have been raised about the soil retention of copper (Cu) from storm water runoff of a copper roof and the effect this copper has on the organisms living in the soil environment. Two bioretention planter boxes sectioned into nine regions ranging from 21cm to 34.5 cm in depth were sieved and further divided into top, middle, and bottom soil depth sections. Copper concentration was analyzed in each soil section using two different methods, soil digestion and sequential extraction. Soil digestion resulted in a range of 14 to 1329 mg Cu per kg of dry soil. Sequential extraction yielded similar results to the soil digestion with the highest copper concentration in organic material and lowest copper concentration in the exchangeables fraction. Because copper found in exchangeables is potentially more bioavailable and more toxic to organisms in the soil, it is ideal for the copper concentration to be low. It is possible that over time through soil aging the copper precipitates or becomes incorporated into more stable and less bioavailable forms such as carbonates, iron and manganese oxides, and organic material that may be less toxic for organisms in the soil environment.

Poster #41
Title: The Mystery Behind the Small Protein CydX
Student: Lauren Miles
Faculty mentor: Matthew Hemm (Biology)

Abstract: Little is known about small proteins, as research up until now has focused more on the function of larger proteins. Our lab is focused on studying whether small proteins play a role in the function of larger protein complexes in Escherichia coli. Past research has shown that a small transmembrane protein, CydX, is essential for the function of the CydAB cytochrome bd oxidase complex. CydDC, a transmembrane complex, is also known to be required in the function of CydAB, as it acts as a glutathione transporter. We hypothesize that CydX is able to interact with both the CydAB and the CydDC protein complexes. To test this hypothesis, we are first tagging the CydC protein with a hexahistidine epitome tag. The small protein CydX has been tagged with a Sequence Peptide Affinity (SPA) epitome tag. Western blotting will be used to check for the presence of the hexahistidine epitome tag on the CydC protein complex. The next step is purifying CydC-His on a nickel column and testing for the presence of CydX-SPA. Observance of copurification would be evidence that CydX does indeed interact with the CydDC complex, and further research will go towards investigating the role of CydX in CydDC function.

Poster #42
Title: Larval Onthophagus taurus Gut Microbiome Includes Cellulose-Degrading Taxa
Student: Alison Moss
Faculty mentor: Dr. Anne Estes (Biological Sciences)

Abstract: The dung beetle Onthophagus taurus feeds on cattle waste. Adults sieve and consume the liquid portion of the dung, while larvae chew on the fibrous solids. Cattle dung is a challenging food source: low in accessible nutrients and high in cellulose. We hypothesize that bacteria isolated from the gut of larval O. taurus exhibit metabolic abilities, including cellulose degradation, which allow the larvae to subsist on cow dung.

BioLog Gen III phenotypic plates were used to identify and characterize bacterial isolates cultured from 3rd instar larval O. taurus gut homogenate. Isolates were previously ID'd using 16S rRNA, lepA, and gyrB phylotyping. Biochemical tests resolved inconsistencies between the phenotypic and molecular ID's. Cellulose-degrading ability of all isolates was determined using cellulose-Congo red agar plates.

Gen III identification displayed greater concordance with lepA/gyrB than 16S rRNA phylotyping. For all isolates, biochemical tests reinforced the Gen III ID. Phenotypic identification revealed the presence of six taxa. Four taxa, Bacillus thuringiensis, Brevibacterium sanguinis, Solibacillus silvestris, and Sphingobacterium thalpophilum, were positive for cellulose degradation. Further metabolic characterization of these isolates will help to elucidate the role of microbes in facilitating dung beetle digestion.

Poster #43
Title: The Effect of Large Mammal Herbivores on Plant Diversity
Students: Taylor Naglieri, Veronica Tayviah
Faculty mentor: Dr. Harald Beck (Biology)

Abstract: Various plots throughout trails of Cocha Cashu, a research site in Peru, were selected to test the effects of Tayassuidae (peccaries) on fern and sapling growth. The experiment was conducted from 2005-2009. Data was collected annually at each site. Each trail had seven plots: each plot was either opened or closed and either ferns or saplings were removed. Two plots (one open, one closed) had both ferns and saplings removed in year one. The amount of saplings, ferns, and palms that grew in the two enclosures where ferns and saplings were removed in year one will be counted in order to test whether or not there was more diversity in the enclosed plots compared to the open ones. It is predicted that more diversity will be found in the enclosed plots that are protected from herbivores

Poster #44
Title: Investigating "Teach-to-Learn" Strategy in an Introductory Biology Course
Student: Matthew Nebiyou
Faculty mentor: Dr. Cynthia Ghent (Biological Sciences)

Abstract: This study investigated the benefits of "teach-to-learn", where students were asked to explain biological concepts. The semester was divided into three units (three different topics) and each student was required to explain two of the topics. For each topic, two of the three groups of students were instructed to record themselves delivering a fifteen minute presentation. These presentations were due for feedback one week prior to the unit exams on which their knowledge of each topic were directly tested in the final essay section of the exam. Results were mixed. Essay scores of the first exam material were statistically significantly higher for both experimental groups and not in the control group. We found no such difference in the corresponding feedback scores or in the third exam. There are two major categories of limitations: researcher based and student based. Researcher-based limitations were lack of clarity in instructions to students, structure of feedback form as well as missing data from second exam. Student-based limitations include noncompliance, technical issues and misunderstanding of instructions. A complicating factor is students' overestimation of their own understanding of the material.

Poster #45
Title: Bromination and Chlorination Kinetics of Dichloroacetamide Herbicide Safeners
Student: Mark Niedzwiecki
Faculty mentor: John D. Sivey (Chemistry)

Abstract: Herbicide safener compounds are a largely uninvestigated group of compounds in terms of their environmental fate. Dichloroacetamide safeners are a class of safener that are commonly used on corn and cereal grains. This project focuses on three dichloroacetamide safeners: benoxacor, dichlormid, and furilazole. All three of these compounds have been detected in natural water systems and pose the risk of being processed by our water treatment plants. These compounds exhibit multiple locations at which further halogenation can occur. This project aims to quantify the rate of chlorination and bromination of benoxacor, dichlormid, and furilazole under simulated drinking water treatment conditions, and examine the effect that different variables have on the chlorination and bromination kinetics. Time course reactors will be performed under chlorinating and brominating conditions to characterize the kinetics of these reactions. Solution conditions will be manipulated, specifically, concentration of chloride, concentration of bromide, pH of the system, and total free available chlorine, in order to examine the effect on the chlorination and bromination kinetics. Pseudo-first-order rate constants will be derived from these time course experiments as a quantitative measure of the reaction kinetics.

Poster #46
Title: Identifying New Small Protein Complexes in Escherichia coli
Student: Tamara Persad
Faculty mentor: Dr. Matthew Hemm (Biology ; Cell and Molecular)

Abstract: One challenge faced in proteomics is the identification of proteins containing ~75 amino acids or less. These small proteins are difficult to identify and characterize because of limitations in both bioinformatics analysis and biochemical detection techniques. Small proteins have been characterized as a part of high-molecular-weight complexes such as our lab's discovery that the Cydx protein is found in the CydAB cytochrome bd oxidase complex. Recent work in the lab has identified 36 new small proteins with varying genomic and biochemical characteristics such as amino acid sequence length, genome location, and direction. We hypothesize that a number of our newly identified small proteins could possibly bind to protein complexes. Bioinformatic characterization and genomic locations were used to select 15 candidates for testing. Using NativePAGE Bis-Tris gels and immunoblot assays, we are analyzing the small proteins for a presence in high-molecular-weight protein complexes. Through this analysis our lab may be able to identify functions for these challenging yet fascinating proteins

Project #47
Title: Clarification of Human Cytomegalovirus (HCMV) pUS27 Molecular Interactions
Student: Kiam Preston
Faculty mentor: Dr. Margulies (Biology)

Abstract: The herpesvirus human cytomegalovirus (HCMV) has a seroprevalence of 60-100% worldwide and came to the forefront of science during the 1980s AIDS epidemic. As a herpesvirus, HCMV may remain latent until it has an opportunity to actively replicate in its lytic phase, potentially causing life-threatening disease. The risk for HCMV related illnesses is an issue for cancer patients, neonates, and other immunocompromised individuals. A G-protein coupled receptor encoded in HCMV's genome and probably enhances the virus' ability to evade the host's immune system is pUS27. Our goal was to characterize the potential interaction between pUS27 and GABARAP, a host autophagy protein. We performed GSTpull down assays and bimolecular fluorescence complementation (BiFC), the latter of which was analyzed via confocal fluorescence microscopy and flow cytometry. Our findings showed that pUS27 binds GABARAP at the LC3 interacting region (LIR) and the GABARAP interacting motif (GIM) of pUS27. Furthermore, critical residues of GABARAP (K24, Y25 & D54), utilized for GABARAP interactions with other proteins in the autophagy pathway, are also important. Our data may be clinically significant if we are able to find a new antiviral compound that disrupts this interaction, providing a point for clinical intervention. Currently, we are reconfirming our findings.

Project #48
Title: Investigating the Relationship between Furin Cleavage and Cytotoxicity in a Recombinant Immunotoxin Based on Pseudomonas Exotoxin A
Student: Danielle Reifer
Faculty mentor: Dr. John E. Weldon (Biological Sciences)

Abstract: Recombinant immunotoxins (RITs) are anti-cancer therapeutic proteins that combine an antibody and a protein toxin. RITs based on the bacterial toxin Pseudomonas exotoxin A (PE) are activated by furin, a protease ubiquitously expressed in vertebrate cells. The furin cleavage site in PE, however, is a very poor substrate compared to other targets of furin. Because the furin cleavage site of PE is so poor, it has been proposed that altering the site to enhance cleavage would increase the cytotoxicity of RITs. Previous research has shown that furin site mutations can modestly enhance RIT activity, but no correlation exists between cleavage efficiency and activity across the full site. Interestingly, the correlation becomes significant if only mutations in the N-terminal region of the cleavage site are considered. To investigate this relationship further, DNA constructs for three different forms of an anti-transferrin receptor PE-based RIT are in preparation: one with mutations on the N-terminal region of the cleavage site, one with mutations on the C-terminal region, and one with mutations over the entire cleavage site. Each RIT will be expressed, refolded, purified by column chromatography, and evaluated in cytotoxicity assays against HEK293 cells to determine how they impact cytotoxicity.

Project #49
Title: Effect of High-Polyphenol Sorghum Extracts on Epigenetic Regulation in Colon Cancer
Student: Kelsey Reynolds
Faculty mentor: Dr. Tsuji (Biology)

Abstract: Polyphenols are secondary plant metabolites found in commonly consumed food items. One such food that is becoming popular again is Sorghum bicolor, a cereal grain that contains varying concentrations of polyphenols. Individual polyphenols have been implicated in the regulation of epigenetic modifying enzymes such as DNA-methyltransferases. The goal of this study is to assess the impact of high-polyphenol sorghum extracts on the expression of DNA methyltransferases. Human colon cancer cells (HT29, HCT116) were incubated with 1.25 mg extract per mL medium for up to 48h. RNA was extracted and reverse-transcribed to cDNA. mRNA expression was quantified using qPCR, normalized to GAPDH, and analyzed.
Exposure of human colon cancer cells to high-polyphenol sorghum extracts compared to solvent control did not appear to affect mRNA expression of DNA methyltransferases 1, 3a, and 3b after 48h. We are currently investigating shorter-term effects of sorghum extracts on expression of genes involved in epigenetic regulation, and will additionally assess protein expression and enzymatic activity. This will allow us to better determine the effects of sorghum varieties on epigenetic regulation and its potential impact on colon cancer. Financial support is provided by Towson University (PT), and the USDA (DS).

Poster #50
Title: Method Development of Improved Separation and Sensitivity of Neurotransmitters using UPLC-MS
Student: Kate Riccardino
Faculty mentor: Kathryn Nesbitt (Chemistry)

Abstract: Neurotransmitters are involved in brain function, disease, and disorders. Dopamine (DA), Glutamate (Glu), and Gamma-Aminobutyric Acid (GABA) are specifically of interest in ADHD, making it imperative to have method development that allows analysis of multiple neurotransmitters at once. UPLC-MS provides the ability to develop a method to separate these neurotransmitters from each other and sort independently based on mass differences. To improve separation and sensitivity, we utilized a derivatization method. Benzoyl chloride (BzCl) is an acid chloride that can react with functional groups such as primary/secondary amines and phenols. BzCl reacts with DA, Glu, and GABA resulting in decreased polarity, thus improving separation of these compounds on a C18 column.13C-BzCl was introduced, thus creating a 13C-BzCl labelled internal standard for each compound. A sample of 50 μM DA, 100 μM Glu, 100 μM GABA, and internal standard was analyzed by UPLC-MS. Each neurotransmitter was separated from the other, generating a symmetrical peak shape. The internal standard verified the separation, as individual fragments matched the retention time of each neurotransmitter in the sample. Our preliminary findings demonstrate that BzCl and 13C-BzCl allow for the accurate detection and separation of multiple neurotransmitters simultaneously.

Project #51
Title: Comparing the bromination and chlorination kinetics of the herbicide dimethenamid in natural and in synthetic waters
Student: Marella Schammel
Faculty mentor: Dr. John Sivey (Chemistry)

Abstract: Chlorine used to disinfect drinking water can react with bromide and natural organic matter present in water sources, forming toxic disinfection by-products (DBPs). Previous studies examining the kinetics of DBP formation were conducted in synthetic waters and typically only considered the most abundant halogenating agents. This study considers often overlooked halogenating agents. Halogenation rates of dimethenamid were quantified in four natural waters of varying salinity. Experimental rates were compared to those predicted using rate constants reported previously with the goal of determining how solution conditions influence the level of agreement between predicted and experimental halogenation rates. Batch reactors were used to determine experimental rates in each of the four natural waters. Experiments performed in the absence of added dimethenamid displayed consumption of free bromine with half-lives ranging from 3–8 hours. To increase the accuracy of comparisons between experimental and predicted rates, free halogen consumption was considered when calculating predicted halogenation rates of dimethenamid. Reaction rates calculated for synthetic waters overpredicted those observed in all examined natural waters by up to a factor of 5. These findings indicate that rate constants measured in synthetic waters may not afford reliable estimates of halogenation rates of organic compounds in natural waters.

Project #52
Title: The Presence and Prevalence of Antibiotic Resistance Genes in the Microbiome of Wild Caught Onthophagus taurus.
Student: Sarah Smith
Faculty mentor: Dr. Anne Estes (Biology)

Abstract: My project screens bacterial isolates from dung beetle guts for resistance to several antibiotics commonly used on cattle farms. In this lab, isolates from Onthophagus taurus were tested to identify levels of antibiotic resistance. Cattle may receive antibiotics to cure or prevent disease or in low doses as growth promoters. If antibiotic-tainted dung is eaten by the dung beetle, the dung beetle gut microbiome population structure may be altered and may harbor antibiotic-resistant strains. I used the Kirby-Bauer method to test for antimicrobic sensitivity on four bacterial isolates with the following five antibiotics: ampicillin, ciprofloxacin, neomycin, tetracycline, and streptomycin. Each of these antibiotics has a distinct mode of action for inhibiting bacterial growth. We found that all tested isolates have resistance to some form of antibiotic.

Project #53
Title: Development of An Anti-Herpetic, Contraceptive Ring
Students: Jennifer Suon, Amanda Evans aevans38@students.towson.edu
Faculty mentor: Barry J. Margulies (Biology)

Abstract: Herpes simplex virus 1 and 2 (HSV-1, HSV-2) can cause primary and recurrent outbreaks of genital and oral lesions. To treat genital outbreaks, we have developed a matrix-based, intravaginal ring capable of releasing therapeutic amounts of antiherpetic drug for a 30-day period. Our rings are composed of poly (ethylene co-vinyl acetate) (EVA) and the anti-herpetic drug acyclovir (ACV). Through previous in vitro trials, our rings showed effective prophylaxis and consistent therapeutic release of drug over a 30-day period. We are now testing two modified versions of our rings: a triple antiherpetic drug version and a contraceptive plus antiherpetic version. Triple drug combination therapy with ACV and two antiherpetic other drugs (cidofovir and amenamivir) can reduce the chance of viral resistance to treatment. And although a contraceptive intravaginal ring is on the market today, it has only that single activity; we are incorporating a synthetic progesterone, levonorgestrel, into our current ACV-containing rings to act as the contraceptive component. Eventually, we would like to incorporate more antiviral drugs to prevent a wider range of diseases

Project #**54**
Title: An Analysis of Meanings for Function Composition Supported By Written Curricula
Student: Rachael Talbert
Faculty mentor: Kristin Frank (Mathematics)

Abstract: Researchers continue to document students' difficulty understanding function composition and the implications these difficulties have on students' understanding of the chain rule. In these reports, researchers focus on students' ability to first recognize the need to compose two functions and then correctly perform the mechanics of the two-step process. However, these studies do not attend to the meanings the student has for the products of their actions; the composite function. We conducted a three-part study to explore students' meanings for the composite function. In the first part of the study, presented in this poster, we investigated the meanings for function composition supported by homework problems in Algebra II (n=2), Precalculus (n=3), and Calculus textbooks (n=3). In particular, we looked at the opportunities textbooks provided for students for students to think about the composite function. We coded each problem in three categories: notation, representation type, and the understanding of function composition supported by the problem. In this poster we share our findings including patterns amongst grade-level textbooks as well as how textbooks build the idea of function composition from Algebra II to Calculus.

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Porject #55
Title: The Effect of Large Mammal Herbivores on Plant Diversity
Student: Veronica Tayviah
Faculty mentor: Harald Beck (Biological Sciences)

Abstract: Various plots throughout trails of Cocha Cashu, a research site in Peru, were selected to test the effects of Tayassuidae (peccaries) on fern and sapling growth. The experiment was conducted from 2005-2009. Data was collected annually at each site. Each trail had seven plots: each plot was either opened or closed and either ferns or saplings were removed. Two plots (one open, one closed) had both ferns and saplings removed in year one. The amount of saplings, ferns, and palms that grew in the two enclosures where ferns and saplings were removed in year one will be counted in order to test whether or not there was more diversity in the enclosed plots compared to the open ones. It is predicted that more diversity will be found in the enclosed plots that are protected from herbivores.

Project #56
Title: Improved HPLC Method for Rapid Analysis of Neurochemicals
Student: Jacob Theismann
Faculty mentor: Dr. Kathryn Nesbitt (Chemistry)

Abstract: Disorders that affect the brain such as depression can cause severe emotional stress and even suicide yet are poorly understood. Dopamine is an important neurotransmitter in the brain that is often associated with mood disorders. As a result of the blood-brain barrier, the chemical environment of the brain is not well represented in the blood stream, in comparison to other organs. To better monitor neurochemical dynamics such as dopamine, microdialysis is often used to sample the chemical environment of the brain which can then analyzed by variety of detectors. Ultra High-Performance Liquid chromatography (UPLC) coupled with mass spectrometry allows for co-quantification of many neurochemicals in a single sample. To reach sensitivities relevant to physiological processes, derivatization can be performed using benzoyl chloride. In this poster we will show a method for shortening the run time of derivatized neurochemicals on the instrument and increasing the throughput. To improve the run, we adjusted the sample's solvent and the liquid chromatography parameters. Previously, dopamine eluted in 8 minutes whereas in the method presented here, dopamine elutes in less than 1.5 minutes. Reducing the instrument run time saves the researcher time and allows for quicker analysis.

Project #57
Title: Effect of Lattice Mismatch Strain in Oxygen Deficient Strontium Titanate Films
Students: Francis Walz, Francis Walz, Joseph Cartelli, Anton Wiggins, Rajeswari Kolagani
Faculty mentor: Rajeswari Kolagani (Physics)

Abstract: My research project is an investigation of the structure and electronic properties of oxygen deficient epitaxial thin films of STO grown by Pulsed Laser Deposition. SrTiO3 (STO) is a quantum paraelectric material which exhibits electronic phenomena that are interesting for technological applications which include its use in semiconductor devices, and as a photocatalytic material. Varying the oxygen content in STO affects the crystal structure and electronic properties which are important for such applications. In oxygen deficient STO (SrTiO3-y), the valence of the titanium ion and the average ionic sizes are different from those of the stoichiometric form (SrTiO3), leading to structural and electronic changes. The initial phase of the project is focused on optimizing the film growth parameters to induce the maximum level of oxygen deficiency sustainable perovskite phase. We have also subjected the thin film to post-deposition thermal treatments in various gas ambients. Some post deposition thermal treatments are also designed to incorporate Fluorine into the films, which may replace oxygen vacancies or displace existing oxygen atoms. I will present our x-ray diffraction results that reveal the effects of varying growth conditions and post-deposition thermal treatments on the crystal structure of the oxygen deficient STO epitaxial thin films.

Project #58
Title: Analyzing the Donation History Data for the Baltimore Humane Society
Student: Jennifer Weiler
Faculty mentor: Alexei Kolesnikov (Mathematics Department)

Abstract: This project was performed by a team of undergraduate students of Towson University's Applied Mathematics Laboratory. The primary goal of the project was to identify ways for the BHS to increase the donation revenue by analyzing the donation history data. My portion of the project was accomplished by cross-referencing the location of the donors with the U.S Census American Community Survey financial data and by providing estimates of the financial parameters for each of the donors. This task was performed in Python by computing the distances of each donor's geocoded address to the two nearest county subdivisions' centroids using the haversine formula. Weighted averages for each of the financial estimates affiliated with these centroids were added to each Maryland donor's profile. With the additional data of the financial estimates of each Maryland donor, regression tree analysis was used to predict whether a Maryland donor is a possible high-contributing donor. A possible high-contributing donor is a Maryland individual who is predicted to have an average annual donation amount greater than or equal to $500, but whose average donation amounts the last five years were below $500.

Project #59
Title: Identification and characterization of small proteins in the human pathogen Streptococcus pneumoniae
Student: Yishak Woldetsadik
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Abstract: Small intergenic proteins are ~15-50 amino acids in size and are encoded by predicted short open reading frames (sORFs) between known genes. Small proteins are important for stress response in E. coli and B. subtilis; however, the Streptococcus pneumoniae (Spn) genome has yet been studied for small protein synthesis. This project aims to identify and characterize small proteins to understand their role in this human pathogen.

We first screened the Spn genome and identified sORFs with <90 base sequences containing a start and stop codon. Using an E.coli ribosome binding site (RBS) consensus sequence, we examined the sequences for an RBS approximately 8-10 nucleotides upstream of the start codon. Thirty candidate sORFs were examined further for predicted transmembrane domains, export signals, and homology in other Streptococci. From these analyses, we chose 5 putative sORFs. To determine if the sORFs encode small proteins, we created DNA constructs containing an SPA tag and a chloramphenicol resistance gene before the stop codon of the sORF. The DNA constructs were used to transform Spn cells to incorporate the tagged DNA in their genome. We will then use western blot analysis to observe small protein synthesis under a variety of stress conditions.

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