BIOLOGY

ELANA YOUSSEF
Faculty advisor: Meghan Davis (Johns Hopkins)
Survival of Staphylococci on BBL™ Culturettes
Staphylococcus aureus, including methicillin-resistant *S. aureus* (MRSA), are bacteria that were previously found in hospital settings. Recently, these bacteria have spread to the community, where transmission is more difficult to control. In an effort to improve our understanding of transmission of MRSA and related bacteria in the community, a study is being performed to understand patterns of household transmission among people, their pets, and their home environments. Because pets may carry veterinary staphylococci in addition to *S. aureus,* and because these coagulase-positive bacteria are leading causes of skin disease in pets, veterinary staphylococci also are relevant to understanding household staphylococci transmission. In the main study, pets were sampled using BBL™ culturette swabs, and then swabs were transported to the laboratory, sometimes resulting in a delay of several days before initiation of culture. Little is known about survival of these bacteria after collection over time. In this sub-project, we examined the culture method's limit of detection on these swabs and the impact on survival for delays of up to a week before initiation of culture for three strains of staphylococci: *Staphylococcus aureus, Staphylococcus (pseud)intermedius, and Staphylococcus schleiferi*. While *Staphylococcus aureus* initially has the most sensitive limit of detection, eventually all three strains experienced similar survival characteristics. In conclusion, little attrition over time was found for the bacteria, indicating that if swabs are cultured within a week, results likely will not be influenced by bacterial survival characteristics in transport.

CHEMISTRY

DAVID GARCIA
Faculty Advisor: Petros Karakousis (Johns Hopkins)
Isothermal Amplification of Mycobacterium tuberculosis DNA
Tuberculosis (TB) still remains one of the most deadly infectious diseases in the world. Reports indicate that yearly there are around 9 million cases related to TB and 1.7 million deaths. Therefore, there is an urgent need for the development of novel assays to rapidly and accurately detect TB and prevent further transmission in the community. These diagnostic methods must be cost effective and easy to use so that they can be implemented in high burden resource-limited settings to reduce the TB burden. In this study, two isothermal amplification techniques (loop-mediated isothermal amplification [LAMP] and thermophilic helicase dependent isothermal amplification [tHDA]) were used to detect Mycobacterium tuberculosis DNA as part of the development of a DNA-based urine test. Urine has been chosen as the body fluid sampled because of its relatively easy accessibility's in clinical settings and its potential utility in cases of extrapulmonary and disseminated disease.

COMMUNICATION DISORDERS & DEAFNESS

LIA PAZUELO
Faculty Advisor: Mahchid Namazi
The Utility of iPad Apps in the Treatment of Social Communication Deficits in Children with Autism
Speech-Language Pathologists are an integral part of the interdisciplinary team working with children with autism whose core deficit is in social communication. New technologies such as the iPad are revolutionizing visual communication tools for children with autism. One of the goals of the iPad's apps is to teach various social communication skills. There are currently hundreds of special education apps that are being used by parents and professionals for children with special needs. Currently however there are no efficacy studies that have systematically investigated the effectiveness of the iPad apps for improving social communication skills in children with autism. The goal of the current project was to study the effects of using three iPad apps as a means of improving social communication skills in two children with autism following an 8-week intervention program. Pre and post-intervention data of the children's use of the targeted social communication skills was collected in two different, 10 minute, conversations as they interacted with an adult and during a game with a peer. The frequency of communicative initiations, eye contact, and number of turns was tabulated; in addition a Pragmatics Profile was competed. An increase in socially appropriate verbal communication was observed including: initiation, asking questions and request for help and clarifications. The Pragmatics Profile also indicated an increase in the proper use of strategies for getting attention, appropriate use of sense of humor and less use of repetitive information. This exploratory study suggests that these iPad's apps: "Face-cards C with iGaze" (version 2.0), "Look in my eyes", and "Stories 2 learn" implemented by a skilled clinician can improve social skills in children with Autism if used in a structured, meaningful and guided way. The results of the study, clinical implications, as well as the role of the SLP in working with children with autism will be discussed.

CRIMINAL JUSTICE

ANGELINA OKWUEGO
Faculty Advisor: Constance Hassett-Walker
Education Regarding Rural Kenyan Girls
I intend to investigate the question,"What are the protective factors that adolescent young women in rural Kenya adopt to ensure their continued education?" Goods and resources in Kenya are limited, particularly with regard to women and girls. With more than 50% of the population in Kenya being women, illiteracy among the nation's females is higher than it is among the males. Girls and women in Kenya are underrepresented in schools and professional careers, and more vulnerable to being infected with diseases. I plan to travel to Kenya during the summer of 2013 as part of the Kenyan Book Project under the direction of Roxie James, Biology Deparment,College of Natural and and Applied Sciences.I will conduct a series of interviews with students, teachers, adminstrators and parents on their views on girls' education.The interviews will be taped and transcribed. The transcriptions will be uploaded into Atlas Ti qualitative analysis software and code. Then, I will summarize my results to answer my research

question regarding protective measures adopted by rural Kenyan girls to remain in school. The proposed study will help make specific suggestions to a rural school, the population of which is about half young women and girls, regarding the perils that female students face in continuing their education, and how the school can help the girls remain in school.

EARTH SCIENCE

MICHAEL RIZZO, NICOLE PETERSON
Faculty Advisor: Paul J. Croft
Cloud Observations and Morphology Physical and Operational Storm Environmental Chase Clues
Based on severe thunderstorm chasing experiences cloud structures and morphology in the pre-storm environment was understood to be directly related to the existence, breakdown, and elimination of boundary layer capping. Operational observations and model output were used to diagnose cap existence and behavior during each chase day in order to plan chases for the day. Radar and satellite imagery was collected to link the progress of convective initiation and cap evolution for each chase day. Ground-based cloud photographs obtained during chases reflected many atmospheric processes as expected according to basic principles of physical meteorology; and were compared with forecasts from operational data and model output. These images suggest specific cloud types, layering, and other characteristics that may assist storm chasing by providing additional observational clues of severe weather outbreaks as related to cap evolution. The results of this preliminary study are intended to assist storm chasers in observing visible evidence of changes in boundary layer capping on space and time scales not otherwise available except through in situ cloud observations.

EDUCATIONAL LEADERSHIP

NATASHIA BAXTER, KELLY WILLIAMS
Faculty Advisors: Kathe Callahan and Leila Sadeghi
Critical Issues In Urban Education
Critical issues confronting urban public schools are multi faceted. Beyond social, economic and political factors, urban districts are faced with state and federal requirements that increase the administrative burden of urban educators. New legislation that transforms the teacher evaluation and tenure process is in the first phase of implementation. Urban districts are required to adopt rigorous teacher evaluation programs that have been approved by the New Jersey Department of Education. In addition, the new teacher evaluation requirements include more robust and targeted professional development opportunities for teachers in need of improvement. The student panelists are practicing administrators in three of New Jersey's largest urban school districts. They will present key findings and recommendations based on their academic research and professional experience as it relates to the benefits and challenges associated with state and federal requirements on urban school districts.

HISTORY

ENRICO BASSO
Faculty Advisor: Christopher Bellitto
The Thirty Years War
The study examines whether or not the Catholic Church was justified in their attacks on the Protestants during the 16th and 17th century in Europe.

This research was part of a course made possible through a grant to Christopher Bellitto from the "Enduring Questions" pilot course grant program of the National Endowment for the Humanities.

ERIN McGREEVY
Faculty Advisor: Christopher Bellitto
The Irish Republican Army
Just war research is valuable because it leads to a better understanding of conflicts, such as the struggle for Irish independence. By looking at this conflict through the lens of just war theory, insight can be gained into the root causes and ultimate goals from the perspective of all parties involved, in this case the Irish revolutionaries and the British government. This project analyzes the history of the Irish Republican Army and looks at their mission from a just war perspective. Using just war theory, their motives and war tactics are examined to determine if their methods and purpose were justified and if they invoked just war theory in the process. Was this a struggle for liberation after centuries of British colonial rule or was it simply terrorism? This project attempts to uncover the answer to that question and others surrounding the Irish Republican Army.

This research was part of a course made possible through a grant to Christopher Bellitto from the "Enduring Questions" pilot course grant program of the National Endowment for the Humanities.

ABIGAIL PETRITSCH
Faculty Advisor: Christopher Bellitto
The Trials of Joan of Arc
Joan of Arc is an important and fascinating figure of history. Yet, were her actions just? Using the traditional requirements for a just war and Joan's own words via her trial transcripts, this question will be examined and explained. Ultimately, by looking at the three trials of Joan of Arc, it seems that Joan did in fact meet the criteria for a just war.

This research was part of a course made possible through a grant to Christopher Bellitto from the "Enduring Questions" pilot course grant program of the National Endowment for the Humanities.

HOLOCAUST AND GENOCIDE STUDIES

ROBERT VENEZIA, MARGUERITE ROMANO, HOLLY BEIN
Faculty Advisor: Dennis Klein
Forgotten Conditions of Genocide

For the casual observer, genocide constitutes destruction of entire groups of people. Students of the subject look more deeply into genocide's conditions and preconditions to offer clarity and explanation. By focusing on the Holocaust era as a case study, three degree candidates in Kean's Master of Arts in Holocaust and Genocide Studies are identifying the circumstances that abetted systematic killing: the power of mass suggestion and persuasion; the initial targeting of the most vulnerable; and the deterrent threat of reprisal. In Weimar Germany before the Nazis ascent to power, popular film production disseminated an influential "stab-in-the back" theory that blamed Communists and Jews for the surprising German defeat in World War I. The secret Nazi "T-4" program – aka the "euthanasia" extermination program – represented the first time that the Nazi regime turned to mass murder. Claiming to purify the "master race" by eliminating those they saw as unfit for life and the life of the nation, the program killed the handicapped and those who were mentally challenged, becoming a significant early stage in the extermination of Europe's Jews. During World War II, the Nazis destroyed the village of Lidice in Nazi-occupied Czechoslovakia as a measure of swift reprisal, known as "Operation Anthropoid," for the underground's assassination of Nazi SS officer Reinhard Heydrich. Once the Nazis announced their destruction of Lidice, the village briefly became a byword for Nazi atrocities.

INDUSTRIAL DESIGN

RAYMOND PROTASIEWICZ
Faculty Advisor**:** Matt Johnson
Lasure
The question was: Can I remotely measure lengths via trigonometric functions utilizing input from two laser range finders and a digital angle finder by combining them into a functionable hand held measuring device? Tape measures and rangefinders have their limitations and there is a hole in the market for a device which offers the efficiency and versatility of both devices. Prototypes, sketch models, CAD models, and extensive research was used to determine the validity of such a product. Prototypes proved the math was sound and that the current technology could produce accurate measurments. I was able to create an ergonomic and potentially functional industrial design for this new hand held measuring device.

MATHEMATICS

ANASTASIIA DEKANTIOS
Faculty Advisor: Wolde Woubneh
Assessment of Global Warming through the Analysis of Glacier Melting Rates over the Past Century
Global warming is an urgent but controversial issue facing humanity. On one hand we have a need for a clean environment and on the other hand restrictions on carbon emissions may cause loss of jobs. One cannot deny the fact that average temperature raises cause ice caps and glaciers around the world to melt. Problems arising with the ice melting include but are not limited to the raise of the sea level, extinction of the Polar Regions species and release of methane that was trapped under the ice for centuries. This study is intended to assess the issue of global warming through analyzing the data on the

ice melting over the years and building a model to predict future meltdown. As a part of this study some creative ideas and solutions to this problem will be offered.

CAROLINA LONDONO
Faculty Advisor: Mahmoud Affouf
Reducing the U.S. Debt-to-GDP Ratio
The current national debt-to-GDP ratio has proved unsustainable in meeting the goal of a healthy U.S. economy. This research investigates how the U.S. debt-to-GDP ratio can be minimized to a percentage that represents a healthy economy and the length of time it will take to reach this goal. This study contributes to mathematical science by providing statistical data and formulating models that can be replicated to predict certain outcomes in real life situations. Discrete math models will be utilized to calculate the time (in years) it may take to reach this goal, and how the U.S. can maximize and/or minimize certain factors in GDP. The research aims to demonstrate how factors change in GDP, and how this will enable the U.S. to reach the equilibrium for a healthy debt-to-GDP ratio. (The research has not been completed)

BRETT SCHWARZENBEK
Faculty Advisor: Wolde Woubneh
A Data Analysis of the Variables that Affect Occurrences of Global Terrorism
Could demographic data be used to predict occurrences of terrorism? My research will attempt to answer just that question by presenting a statistical model based on a broad spectrum of variables. Data, unique to each country, such as population, religion, government, etc. will be used as independent variables for my analysis. Using the Global Terrorism Database (GTD), I will be analyzing data since 1991 pertaining to region, nationality, and type of attack. Pre- and Post-9/11 occurrences of terrorism will also be analyzed.

NJ CENTER FOR SCIENCE, TECHNOLOGY, & MATHEMATICS

SAMANTHA MAHMOUD, QUINTIN FERRARIS, JACQUELYN CALI
Faculty Advisor: Dil Ramanathan
Speed vs Sensitivity: Does HRMS (High Resolution Mass Spectrometry) Detect as Efficiently as UHPLC (Ultra High Pressure Liquid Chromatography) Delivers?
Advances in High Performance Liquid Chromatography (HPLC) have been made to improve productivity and analysis speed with Ultra High Performance Liquid Chromatography (UHPLC). These advancements increase speed, sensitivity and resolution of the chromatographic separation with the higher LC pump pressure and reduced particle size and packing material of column to achieve narrower chromatographic peaks. This LC system was developed with the enhancement of UV/VIS photodiode array detectors with an increase in data acquisition rate. Resulting UHPLC chromatograms contained peak widths of about 3-5 seconds and a total separation time 1/10th of HPLC. Though an efficient and cost effective tool, these detectors are not sufficient enough to fully characterize unknowns, metabolites and impurities encountered during drug discovery and development. UV/VIS/Diode array detectors require reference

standards to identify peaks of interest. Unambiguous identification of metabolites and impurities can occur due to co-eluting peaks as well as endogenous impurities that may be present in the sample matrix. Mass spectrometry (MS) as a detector is the most precise and accurate solution to resolve this unambiguity in LC analysis. MS detectors detect based on the mass-to-charge ratio of the analyte of interest present in the sample, therefore the masses of interest can be analyzed simply by knowing the mass of interest and unknowns and metabolites can be identified using the elemental compositions predicted by the mass measurement. Recent advancements in MS detectors have increased mass resolution and allow identification of analytes with +/-5 ppm mass accuracy. But can these MS detectors detect as fast as the UHPLC can separate? This research will try to answer this question by performing a series of studies to compare different parameters in HRMS such as scan rate and resolution to optimize detection to ensure accurate quantitation and unknown characterization.

KATHLEEN McGEE
Faculty Advisor: William Eaton
Linking Soil Faunal and Fungal Community Structures with Carbon and Nitrogen Cycle Dynamics as Indicators of Ecosystem Condition in Three Habitats in the Northern Zone of Costa Rica
Development of secondary forests has recently been used as a remediation strategy in the Northern Zone of Costa Rica, following 40 years of extensive deforestation and conversion of primary forests into grasslands. However, the effects of such land uses on both soil ecosystem biomass development and the critical soil biota associated with it is unknown. For this project, we examined the levels of carbon and nitrogen biomass development, the efficiency of carbon utilization, and Next Generation DNA sequencing-based composition and structure of the fungal and invertebrate communities in soils from an old growth primary forest in Costa Rica, and adjacent grasslands and secondary forests that originally were part of this forest. The primary forest soils showed greater rates of carbon and nitrogen biomass development and efficiency of carbon use, greater abundance of the more specialized invertebrate groups Collembola, Orbitada, and Coleoptera critical to organic carbon processing, and fungal groups associated with decay of wood and complex organic carbon compounds while the grasslands showed the lowest levels of these metrics. It appears that prior land use strategies in this region altered the functionality of these soils, with regenerating secondary forests showing a more clear trajectory towards recovery of soil biotic and abiotic components than found in older grasslands.

ELDHO RAJU, CHINMAYI PARIKH
Faculty Advisor: Dil Ramanathan
Evaluation of Centroid and Profile Mode Data Collection Method for High-resolution Accurate Mass Spectrometry (HRMS) Based Integrated Qualitative and Quantitative Bioanalysis
Recently an analytical conflict has come about in the mass spectrometry community regarding the data acquisition modes obtained through high resolution mass spectrometry (HRMS). Many scientists acquire HRMS data in centroid mode instead of profile mode to maintain simplicity, and to conserve file size. This research investigates the effectiveness of centroid mode verses profile mode in data acquisition. Four pharmaceuticals and their metabolites were used to observe the effectiveness of centroid verses profile mode data acquisition using HRMS instrumentation, LTQ Orbitrap Discovery. This

research also investigates mass resolving power, mass accuracy, and mass extraction window (MEW) to obtain accurate m/z measurement in both centroid and profile data acquisition modes. Some post data acquisition parameters were also investigated such as smoothening algorithms. A mass resolving power of 15 K FWHM was optimized for m/z measurements with sufficient mass accuracy in HRMS studies. An optimal MEW with a mass tolerance of 10 ppm and gaussian peak smoothening algorithm with 7 data points, were also found sufficient for the accurate quantitation of an analyte of interest in the extracted ion chromatogram. The application of internal calibration enhanced the mass accuracy in all data acquisition modes and cimetidine was found to be a good lock mass compound. Centroid data found to show better signal response, which cannot be further improved by manual processing which is preferred in industrial research. These conclusions can help scientists obtain accurate HRMS data necessary for both qualitative and quantitative bioanalysis.

NURSING

COURTNEY DI BONA, MICHELE E. CANFIELD, MAUREEN MAHLER
Faculty Advisor: Kathleen Neville
The Effect of Nurse Leaders on Nurses' Perceptions of Patient Rounding
Hourly rounds (intentionally checking on patients at regular intervals) have re-emerged as standard practice among nurses in acute care settings, and there is the need to identify nurses' perceptions regarding this increasingly mandated practice. The research question is**:** In nurses practicing in an acute care hospital, which is more effective in improving nurses' perceptions of patient rounding, working the day shift with nurse leaders supporting rounding versus working evening and night shifts without nurse leaders? No research was identified exploring the differences in nurses' perceptions of rounding between day shift, evening shift and night shift. This study is a replication study of a pilot study using the newly developed tool, Nurses' Perceptions of Patient Rounding Scale (NPPRS) (Neville, 2010). This correlational descriptive study was conducted by distributing the NPPRS, a 42 question 5-point Likert scale with responses ranging from strongly agree to strongly disagree and 2 open-ended questions. The questionnaires were completed through a convenience sample of anonymous volunteer Registered Nurses from five units at Raritan Bay Medical Center in Perth Amboy and Old Bridge, New Jersey. The data derived from this evidence based research will be used to advance the state of the art knowledge on the nurses' perceptions of rounding to improve nursing satisfaction with the care they provide and the quality of patient care.