

MONTCLAIR STATE UNIVERSITY

Third Annual Student Research Symposium

April 30, 2009

University Conference Center

Presented by

MSU Chapter of Sigma XI

College of Science and Mathematics

and

College of Humanities and Social Sciences

Message from the Deans

Discovery and original scholarship should be a critical part of any educational program. It is clear that students who seek new knowledge through active research attain and retain a deeper understanding and appreciation of their discipline. To that end, the College of Science and Mathematics and the College of Humanities and Social Sciences at Montclair State University are proud of our many students who are presenting their original work at our Third Annual Student Research Symposium.

Students' original scholarship forms the foundation of this important event and their research, in turn, reflects the dedication and enthusiasm of our outstanding faculty. We offer hearty congratulations to the many students who have chosen to pursue this sometimes unpredictable path of original research. Research is never conducted in a vacuum, and it is becoming more common for teams of scholars from diverse disciplines to seek answers together to questions that have not been asked before. This discovery "moment" can be a hallmark of the many years spent in college. The presentations and posters displayed today, in a large sense, represent that moment. We again offer sincere congratulations to all student participants and their faculty mentors for a job very well done.

The success of this event reflects the work of many, but special notes of appreciation must go to Diana Thomas, Jinan Jaber, Barbara Feldman, Mary Lou West, Susan Brunda, AJ Kelton and Milos Topic.

Robert Prezant, Dean

College of Science and Mathematics

Claire Taub, Interim Dean

College of Humanities and Social Sciences

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Schedule

4:00 PM – 4:15 PM	CSAM and CHSS Opening Remarks
4:15 PM – 6:30 PM	CSAM and CHSS Oral Presentations
4:15 PM – 4:45 PM	CHSS Poster Session
5:30 PM – 6:30 PM	CSAM Poster Session
6:30PM – 7:00 PM	CHSS Poster Session
6:30 PM – 7:00 PM	CSAM Closing Remarks and Award Recognition
7:00 PM – 7:15 PM	CHSS Closing Remarks and Award Recognition

ORAL PRESENTATIONS

Session I 4:15 PM-6:30 PM UN– Conference Room

Moderator: Avram B. Segall

4:15-4:30	Presenter: James Doughty; Advisor: Elizabeth Emery Title: Coming Out of the Boudoir: Gays in the Francophonie
4:30-4:45	Presenter: Matt O'Connor; Advisor: Timothy Renner Title: Gaius Marius Archetype of an Emperor
4:45-5:00	Presenter: Dorothy Kenney; Advisor: Marilyn Tayler and Avram B. Segall Title: District of Columbia v. Heller and the Second Amendment "Right to Bear Arms"
5:15-5:30	Presenter: Michael Stehlik; Advisor: Avram B. Segall and Marilyn Tayler Title: Hawthorne's Literary Perspective on Puritan Values and Its Applicability to Law
5:30-5:45	Presenter: Laura Marchini; Advisor: Avram B. Segall and Marilyn Tayler Title: Battered Woman Syndrome and Self-Defense: A Defense of Justification

- 5:45-6:00 **Presenter:** Salman Ahmad; **Advisor:** Marilyn Tayler and Avram B. Segall
Title: The Legal and Political Implications of Electronic Surveillance
- 6:00-6:15 **Presenter:** Nicole Maciejunes; **Advisor:** Avram B. Segall and Marilyn Tayler
Title: Conscription: the Ebb and Flow
- 6:15-6:30 **Presenter:** Alireza Abedin; **Advisor:** Avram B. Segall and Marilyn Tayler
Title: Recognition of the Right to Physician-Assisted Suicide is a Protection of Individual Civil Liberties

Session II 4:15 PM-6:30 PM UN– Conference Room

Moderator: Baojun Song

- 4:15-4:30 **Presenter:** Carlos Campoverde; **Advisor:** Diana Thomas
Title: A Mathematical Model for Weight Change
- 4:30-4:45 **Presenter:** Alexandra Perj; **Advisor:** Diana Thomas
Title: Predicting Weight Change Using a Differential Equation
- 4:45-5:00 **Presenter:** Kim Rude; **Advisor:** Baojun Song
Title: Patch Models and Applications on the Spread of Avian Influenza
- 5:00-5:15 **Presenter:** Cihan Karabulut; **Advisor:** Aihua Li
Title: Generalized Fermat Equation
- 5:15-5:30 **Presenter:** Samuel Petrocelli; **Advisor:** Jing Peng
Title: Autonomous Vehicle Overview
- 5:30-5:45 **Presenter:** Marie McCrary; **Advisor:** Lora Billings
Title: Stochastic Particle Escape in a Double-Well Potential
- 5:45-6:00 **Presenter:** David Burger; **Advisor:** Lora Billings
Title: Migration and Mixing between Populations in Disease Models
- 6:00-6:15 **Presenter:** Michael Mancuso; **Advisor:** Youngna Choi
Title: The US Subprime Mortgage Debacle: How it Started and Provoked the Current Financial Crisis

Session III 4:15 PM-5:15 PM UN– 3046

Moderator: Lee Lee

- 4:15-4:30 **Presenter:** Shontelle Berfet; **Advisor:** Lee H. Lee
Title: Study of the Effect of Cupric Chloride and Zinc Chloride on the Growth of Cyanobacteria *Synechococcus* sp. IU 625
- 4:30-4:45 **Presenter:** Tomasz Kurcon; **Advisor:** Nina Goodey
Title: Relationship Between Catalysis and Conformational Motion in Indole-3-glycerol Phosphate Synthase from *Sulfolobus solfataricus*
- 4:45-5:00 **Presenter:** Barbara Soares; **Advisor:** John J. Gaynor
Title: Sequencing the Natterjack Mitochondrial Genome
- 5:00-5:15 **Presenter:** Winder Perez; **Advisor:** Lee H. Lee
Title: Study On the Mechanisms of Mercury Tolerance in Cyanobacterium *Synechococcus* sp. IU 625

Session IV 4:15 PM-5:15 PM UN– 2042

Moderator: Carlos Molina

- 4:15-4:30 **Presenter:** Robert Cuellari; **Advisor:** Shifeng Hou
Title: Chemical Modification of Graphene
- 4:30-4:45 **Presenter:** Sailaja Sankabathula; **Advisor:** John Siekierka
Title: A Leishmania Protein Kinase (LmxMPK1) as a Potential Drug Target for the Treatment of Leishmania Infection
- 4:45-5:00 **Presenter:** Jairo Sierra; **Advisor:** Lisa Hazard
Title: Hormonal Control of Ion Secretion by the Nasal Salt Gland of the Desert Lizard *Uromastix dispar*
- 5:00-5:15 **Presenter:** Craig Queenan; **Advisors:** Carlos Molina and Johannes Schelvis
Title: Binding of ICER to Its Own Promoter as a Mode of Cooperative Regulation

Session V 4:15 PM-5:15 PM UN– 2042

Moderator: Marc Kasner

- 4:15-4:30 **Presenter:** Gregory R. Ames; **Advisor:** Marc Kasner
Title: A Computational Study of the Electronic and Steric Contributions to the Relative Stabilities of Axial and Equatorial Substituents on 6-Membered Rings (Part 1: The Problem and the Method)

4:30-4:45 **Presenter:** Andrew K. Mauro; **Advisor:** Marc Kasner
Title: A Computational Study of the Electronic and Steric Contributions to the Relative Stabilities of Axial and Equatorial Substituents on 6-Membered Rings (Part 2: The Relative Energies)

4:45-5:00 **Presenter:** Marc N. Muniz; **Advisor:** Marc Kasner
Title: A Computational Study of the Electronic and Steric Contributions to the Relative Stabilities of Axial and Equatorial Substituents on 6-Membered Rings (Part 3: The Molecular Geometries)

5:00-5:15 **Presenter:** Pravin Punamiya; **Advisor:** Dibyendu Sarkar
Title: Enhancing lead Phytoextraction capability of a lead-accumulating grass with arbuscular mycorrhizal fungi

Session V 4:15 PM-5:30 PM UN- 2006

Moderator: Sandra Passchier

4:15-4:30 **Presenter:** Krutika Patel; **Advisor:** Shifeng Hou
Title: The Fabrication of Graphene – Poly(diallyldimethylammonium chloride) Multilayer on Silane Modified Glass Surface

4:30-4:45 **Presenter:** Candice Falk; **Advisor:** Sandra Passchier
Title: Particle Size Results of The Andrill Southern Mcurdo Sound Project

4:45-5:00 **Presenter:** Daniel Hauptvogel; **Advisor:** Sandra Passchier
Title: Heavy Mineral Analysis of Sediment Cores, Southern McMurdo Sound, Antarctica

5:00-5:15 **Presenter:** Michael Hardy; **Advisor:** Dibyendu Sarkar
Title: Retention of Heavy Metals from Acidic Sulfur-Rich Waste Water by Water Treatment Residuals: A Reconaissance Study

5:15-5:30 **Presenter:** Padmini Das; **Advisor:** Dibyendu Sarkar
Title: Urea Catalyzed Uptake and Biotransformation of 2, 4, 6-trinitrotoluene (TNT) by Vetiver grass (*Vetiveria zizanioides* L.) from Millhopper Soil

Oral Presentation Abstracts **CHSS (Alphabetically by Presenter)**

Title: Recognition of the right to physician-assisted suicide is a protection of individual civil liberties

Presenter: Alireza Abedin

Advisor: Avram B. Segall and Marilyn Tayler

Abstract: The topic of physician-assisted suicide (PAS) is currently the subject of heated debate involving many fundamental issues including its legality, political implications, morality, and possible impingement of medical ethics. States such as Oregon and Washington have passed initiatives declaring that terminally-ill individuals should be granted the right to end their suffering, with the assistance of a physician, under strict guidelines and restrictions. The stance taken by such states runs contrary to the traditionally held outlook of the United States Supreme Court emphasized by rulings in cases such as *Washington v. Glucksberg* and *Vacco v. Quill*. The court's rulings in these cases held that the practice should be banned, further implicating the justices' opinions that the Constitution does not protect the right to die. The lack of accord on this issue in the realms of politics and law indicates that an interdisciplinary approach on the topic of PAS is vital in order to attain a more comprehensive understanding of the topic and also to develop new interdisciplinary insights in addressing the issues that arise when debating PAS.

For the purpose of this research, the issue of PAS will be viewed through the disciplinary lenses of law and political science, the intention being to integrate the insights attained from these two disciplines, resulting in a new and more comprehensive approach to the subject matter. Each discipline has its own distinct perspectives, insights, assumptions, theories, and concepts with regards to PAS. Yet, most societal issues, due to their complex nature, are rarely ever sufficiently addressed using a single disciplinary approach. The lack of consensus and decisiveness regarding PAS is evidence of this claim. Thus far, legal and political institutions, by themselves, have yet to come to a resolution regarding this matter.

Title: The Legal and Political Implications of Electronic Surveillance

Presenter: Salman Ahmad

Advisor: Marilyn Tayler and Avram B. Segall

Abstract: This research examines the practice of electronic surveillance in the United States and tests the hypothesis that the increase in monitoring exchanges of electronic information as a result of the implementation of the United and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism Act of 2001 (USA Patriot Act of 2001) has curtailed individual liberties. The law enforcement practice of performing electronic surveillance in the confines of the Fourth Amendment requires an interdisciplinary approach to examine the political motivations and the legality of such motivations because no single disciplinary perspective can adequately address this issue. The research first examines an individual's Fourth Amendment expectation of privacy first through three major political events of the Palmer Raids, Watergate Scandal, and the War on Terror, then Supreme Court cases such as *Katz v. United States*, and finally the demands of law enforcement agencies. The research attempts to find a correlation between these political and legal events in an attempt to explain how the USA Patriot Act of 2001 has effected Fourth Amendment protections on privacy. This research concludes that the standards for issuing warrants and having probable cause have decreased, an individual's expectation of privacy has also decreased; however, the need for electronic surveillance grows due to the increase in electronic crime, particularly on the internet.

Title: Coming Out of the Boudoir: Gays in the Francophonie

Presenter: James Doughty

Advisor: Elizabeth Emery

Abstract: The purpose of this research was to study three things in the Francophonie, or French speaking world: the status of gay rights, whether any cross-cultural connections between the regions studied in these rights existed, and the influence of religion in the regions studied. Though the Francophonie consists of countries all over the world, the three regions studied and compared were: France, Canada and North Africa. The choice to limit the Francophonie was the author's due to two major factors: the availability of information regarding the subject as well as the overwhelmingly large influence these regions have on the Francophonie itself. The research itself was a combination of primary and secondary sources either depicting the historical events of the gay rights movements in these regions from a first person point of view, or in the case of religion and homosexuality, particularly in the Islamic context, secondary sources which were studies of translated texts, were used. The status of gays in Canada

and France are relatively positive with a few more strides to be made versus North Africa where, from a Western point of view, there are still strides to be made. Furthermore, the cross cultural connections were not surprising, with Canada and France sharing a common history in regards to the gay rights movement versus North Africa having its own path. Finally, religion's influence varies amongst the West and North Africa, with France and Canada having little religious influence and North Africa having a significant influence.

Title: District of Columbia v. Heller and the Second Amendment "Right to Bear Arms"

Presenter: Dorothy Kenney

Advisor: Marilyn Tayler and Avram B. Segall

Abstract: The purpose of this study is to analyze and determine if the United States Supreme Court has laid the foundation to uphold an individual's Second Amendment "right to bear arms" under state law. The Second Amendment has been an issue of political and legal debate. The ambiguity regarding the Amendment's intent and application explains the Supreme Court's previous reluctance to take up the issue as it applies to state laws. This past term, for the first time in the nation's history, in the case of District of Columbia v. Heller, the Court held, by a one vote margin, that the Second Amendment protects an individual's right, unrelated to military service, to keep and bear arms. This research is presented to focus not only on the legal aspect of this important landmark decision, but to also understand the larger political scope surrounding the Second Amendment. This will, in turn, make the connection of legal decisions to the overall role that the Supreme Court plays in defining political values, resolving political conflict, and reinforcing the political process. Research presented here will show that through the doctrine of selective incorporation and concepts of federalism the future of gun regulation, policy and the overall interpretation of the Second Amendment will change the landscape of law and politics. The overall issue is: whether a country's people or their government actually has the legitimate authority to rule.

Title: Conscription: the Ebb and Flow

Presenter: Nicole Maciejunes

Advisor: Avram B. Segall and Marilyn Tayler

Abstract: The United States of America has a democratic system that allows its citizens control the government and through it; the policies that govern our everyday lives. Military policy is one area of the law that sees the most frequent changes. Looking at both the history and legal foundations of conscription combined with the sentiments concerning the practice at the time, a pattern is revealed. After breaking free from England, Americans were afraid of a strong federal military so they did not want the newly founded government to have the power to compel men to serve. The Civil War required too many troops for volunteers alone so the government was forced to conscript. This practice was not favored by the public so after the War it was eliminated. When World War I called for mass amounts of troops, America again turned to conscription to fill its needs. This War marked a shift in public opinion towards conscription that was fully realized at the end of World War II. Americans were proud of their military victory and no longer viewed conscription in a negative way. For the first time a peace time draft was kept in place. The people's view of conscription shifted once again between the Korean War and the Vietnam War to a negative practice. By integrating the pattern of success in war and the pattern of public opinion, a conclusion can be drawn concerning their connection. When America is successful in war we are not afraid to conscript.

Title: Battered Woman Syndrome and Self-Defense: A Defense of Justification

Presenter: Laura Marchini

Advisor: Avram B. Segall and Marilyn Tayler

Abstract: Battered Woman Syndrome is a psychological disorder found in people living in abusive relationships. These victims of domestic violence sometimes use force to kill their batterers. Many victims are then charged with homicide. Battered Woman Syndrome has been increasingly used as evidence to bolster the victim's claim of self defense. This admission attempts to assist the jury in its determination of the guilt or innocence of the victim. It is hypothesized that, over the past two decades, Battered Woman Syndrome has become increasingly accepted as a justification for self-defense in homicide cases. An interdisciplinary methodology encompassing both the disciplinary research methods of psychology and law is necessary because of the broad scope of the topic. By examining the problem from each discipline's perspective, the paper highlights the common ground between the law of self-defense and the psychology of Battered Woman Syndrome. The research findings conclude that Battered Woman Syndrome is a valid justification for self-defense in homicide cases and has proved to be an invaluable resource for victims of domestic violence everywhere.

Title: Gaius Marius Archetype of an Emperor

Presenter: Matt O'Connor

Advisor: Timothy Renner

Abstract: The purpose of this study is to show the effect that Gaius Marius had on Roman history in transitioning the Roman Republic into the Empire. While many scholars argue that the collapse of the Republic and the formation of the Empire occurred late in the first century BC under the regimes of Julius Caesar and Octavian, critical steps were taken in this direction much earlier. Many of the stages of this process were initiated by the actions of Gaius Marius or influenced by them. Marius is credited with a reformation of the army that involved standardizing the way it was recruited and how arms and rank were assigned. Abolishing the property and wealth qualifications for the army had a tremendous effect on the continually widening gap between the rich and the poor, since men who had lost any source of income now had a full time job for the rest of their lives with a pension. Marius also defeated a major invasion of barbarians that threatened Romans at this time and was named the third founder of Rome. Further, Marius held the supreme command in Rome, the consulship, for seven terms, this feat was never to be matched, not even by many of the emperors. Marius had such a loyal following among his troops and the people that it is easy to see why he was able to gain this unprecedented power. Ultimately, he shifted the allegiance from the state to an individual and became drunk with power, a practice that many of the politicians following him would mimic, including his nephew Julius Caesar. This research utilizes primary sources, especially Roman historians including Sallust, Plutarch and Appian, and responds to modern commentaries by the authors of the Cambridge Ancient History and by Roman history scholars Phillip Kildahl and T.J. Luce. This research shows that Gaius Marius played a critical role in the development of the Roman state and should not be ignored as one of the key reasons for the transition from the Republic to the Empire.

Title: Hawthorne's Literary Perspective on Puritan Values and Its Applicability to Law.

Presenter: Michael Stehlik

Advisor: Avram B. Segall and Marilyn Tayler

Abstract: Hawthorne's Literary Perspective on Puritan Values and Its Applicability to Law. The purpose of this research is to discover whether Puritan values in Nathaniel Hawthorne's literary work shape his view of law in the nineteenth century. The goal is to show that the role of Puritan values in Hawthorne's literary work is to provide a paradigm for his view of nineteenth-century law. This has been done by analyzing Hawthorne's works and life experiences for evidence of Puritan values and the law influencing his decisions and his overall view of the world. That has led to the exploration of Hawthorne's views on religion and morality through his comparison of them to his perceptions of nature and the legal system. Upon examining these topics, it becomes evident that Hawthorne's literary work was certainly influenced by the law during his lifetime and is exemplified through his use of Puritan values in his literature.

CSAM (Alphabetically by Presenter)

Title: A Computational Study of the Electronic and Steric Contributions to the Relative Stabilities of Axial and Equatorial Substituents on 6-Membered Rings (Part 1: The Problem and the Method)

Presenter: Gregory R. Ames; **Co-authors:** Andrew K. Mauro and Marc N. Muniz

Advisor: Marc Kasner

Abstract: Due to steric interactions, the equatorial conformer of substituted cyclohexanes is energetically more stable than the axial. It has been observed that the presence of a heteroatom in the ring and the electronegativity of the ring substituent can stabilize the axial conformer more than the equatorial conformer. This effect is termed the anomeric effect. The electronic contributions stem from the fact that orbitals of non-bonded electrons lie parallel to adjacent anti-bonding orbitals.

In the exo-anomeric effect (Figure 1a), donation of electron density from the exocyclic oxygen into the anti-bonding orbital between the ring oxygen and the carbon to which the exocyclic substituent is attached will result in a broadening of the O-H bond angle and a lengthening of the C-O bond. Thus, analysis of bond angles and bond lengths allows for quantization of the magnitude of the exo-anomeric effect and its contribution to the stability of the axial conformer. Figure 1b illustrates an example of the endo-anomeric effect in which electron density is donated from the oxygen in the ring to the anti-bonding orbital of the exocyclic C-O bond. The endo-anomeric effect results in a lengthening of the exocyclic bond and a broadening of the ring angles.

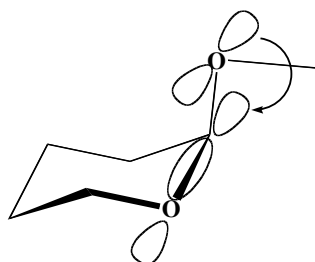


Figure 1a: The Exo-anomeric Effect

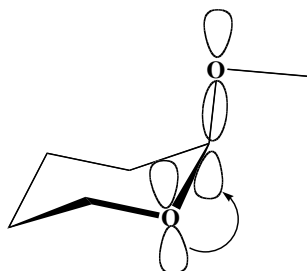


Figure 1b: The Endo-anomeric Effect

By systematic variation of the ring atom X and the exocyclic substituent R (Figure 2), the relative contributions of the exo- and endo-anomeric effects can be evaluated.

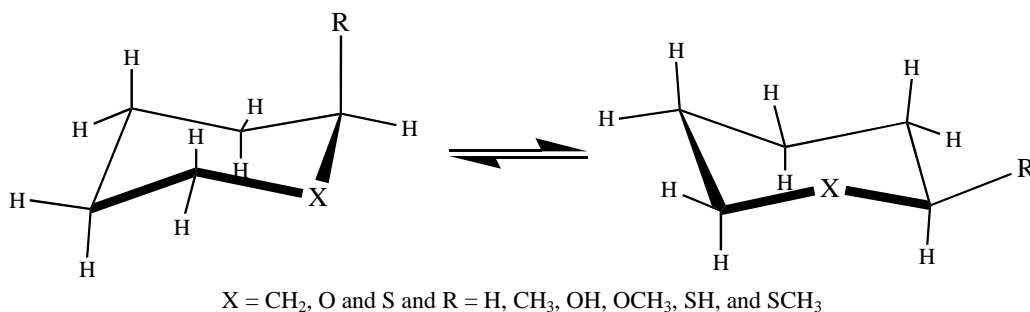


Figure 2: The Compounds in this Study

Additionally, by changing the R = OCH₃ group to OCH₂F, OCHF₂ and OCF₃ some measure of the effect of the exocyclic substituent's electronegativity on the endo-anomeric effect can be evaluated.

Conformational searches were carried using Spartan to determine the most stable axial and equatorial rotamers and then HF/6-311G++(d,p)//HF/6-311G++(d,p), B3LYP/6-311G++(d,p)//B3LYP/6-311G++(d,p) geometry optimizations and frequency calculations were done using Gaussian. In addition, single point energy calculations (MP2/6-311G++(d,p)//HF/6-311G++(d,p) and MP2/6-311G++(d,p)//B3LYP/6-311G++(d,p) were done to check the validity of the relative energies. The results for these calculations were thermally corrected to give relative conformational free energies (DG at 298.15 K). The degree of electronic interactions can be evaluated by measurements of various bond length and bond angles. The degree of steric interaction can be evaluated by comparisons with cyclohexane and examination of the non-bonded distances.

Title: Study of the Effect of Cupric Chloride and Zinc Chloride on the Growth of Cyanobacteria *Synechococcus* sp. IU 625

Presenters: Lizchelle Urena and Shontelle Berfet

Advisor: Lee H. Lee

Abstract: The cyanobacteria, *Synechococcus* sp. IU 625, were used for this experiment because it is a good indicator for water contamination especially for heavy metal substances. In this experiment, the effect of different concentrations of cupric chloride (0, 5, 10 and 15 mg/L) and zinc chloride (0, 10, 25 and 50 mg/L) on the growth of cyanobacteria *S. IU 625* were studied. Growth was monitored by direct count using hemocytometer. Turbidity study was studied using a spectrophotometer at wavelength 750 nm. The content of Cu and Zn in the cells and in the media in different cultures was analyzed by using ICP (Inductively Coupled Plasma) spectrometer. In the cultures containing Cu with different concentrations, the growth was all very similar. The higher concentrations of CuCl₂ (25 and 50 mg/L) were also used in this study. The growth was only slightly decreased. The results from the metal content study indicated that there was very high content (87-100%) of copper stays outside of the cells throughout the growth period. This study suggested that the cells have low permeability to copper and may be this is the reason why the cells have high tolerance for copper. In the cultures containing zinc, 10 mg/L grew better than the control. 25 mg/L of ZnCl₂ slightly inhibited the growth. Concentration of 50 mg/L, completely inhibit the growth of the cells and it is bactericidal concentration. The results from ICP study indicated that at 10 mg/L, 100% Zn was in the

medium, at 25mg/L, the content of Zn inside the cells and outside the medium were similar. The concentration of 50 mg/L, at day3, 75% of Zn got into the cell. Day 8 and 17, the amount of Zn inside and outside was similar. This study suggested that cyanobacteria use different mechanisms for different metal tolerance.

Title: Migration and Mixing between Populations in Disease Models

Presenter: David Burger

Advisor: Lora Billings

Abstract: In the field of epidemiology, models depend on how a population can be broken down into groups of people that carry similar traits that are important to the disease. These break downs occur at both the intra-population level as well as the inter-population level. Modeling how these groups interact is fundamental to capturing how a disease spreads in and between populations. We will only concern ourselves with the interactions that lead to differences in disease behavior. Within a single population, this would be the interactions between susceptibles and infectives. Between populations, this becomes the migration of susceptibles or infectives from one population into the susceptible or infective class of the other population. We study how migration and other mixing effects in an SIR model can induce an epidemic or how these can be controlled to curb an oncoming outbreak. In particular, we will consider single populations and two population models with a forcing on the contact rate. We use this to look for behavioral changes in the overall disease dynamics for different given initial conditions.

Title: A Mathematical Model of Weight Change with Adaptation

Presenter: Carlos Campoverde; **Co-author:** Alexandra Peri

Advisor: Diana Thomas

Abstract: Obesity has become a great concern in today's society because of the illnesses that are directly resulting from the extra weight. Therefore, understanding how the body adapts to weight change is very important. Recent studies have shown that changes in weight affect the body by producing adaptations to the entire energy outflow. Our research developed a differential equation model which was derived from the first law of thermodynamics. This model incorporated three central adjustments, resting metabolic rate (RMR), non-exercise activity thermogenesis (NEAT), and dietary induced thermogenesis. This model was then produced to model weight changes corresponding to changes in intake. From this development, a substantial study was done to validate the accuracy of this model. Twenty two cases of overfeeding for 8 weeks were thoroughly studied. Twelve of these subjects were females and ten were males and 10 were obese. Ages ranged from twenty seven years old to fifty five. The model correlated well to individual data.

Title: Chemical Modification of Graphene

Presenter: Robert Cuellari; **Co-authors:** Shifeng Hou, Najeeb Hakimi and Matthew L.Gorring

Advisor: Shifeng Hou

Abstract: Graphene is a novel nanomaterial that composed of single atom thick conjugated carbon bonds in a honeycomb arrangement. Since first discovered in 2004, graphene has shown various unique properties, including superior mechanical strength and low density and high heat conductance. Many potential applications are based its unique mechanical and electrical properties: graphene-polymer composites, electronic devices, precursors for loading catalysts, targeted drug delivery, next generation molecular sensors and biosensors. In our strategy, graphene oxide was synthesized from graphite powder through a modified Hummers method and graphene oxide was then reduced to graphene by use of LiALH₄ and NaBH₄. A detailed chemical modification processes were performed on graphene oxide and reduced graphene. Several functional groups were synthesized on graphene. The FT-IR, X-Ray diffraction, TEM, SEM and UV-spectroscopy techniques were used to characterize graphite, graphene oxide, reduced, and chemically modified reduced graphene, respectively. In addition, we have further characterized the solubility and chemical reactivity of amine and hydroxyl substituted graphenes and their compatibility with a series of polymer matrixes. Our results demonstrate the feasibility of combining conventional organic synthesis techniques with techniques for the modification of nano-particles. The optimization of this chemical modification technique will develop a systematic approach for chemical modification of graphene and seek potentials applications in nano-materials science and bio-nanotechnology. One of these methods has yielded a highly dispersed graphene oxide. This novel high-dispersion graphene oxide has unique electrical conductivity due to its high surface area to mass ratio which could lead to practical applications in capacitors with high storage of energy.

Title: Urea Catalyzed Uptake and Biotransformation of 2, 4, 6-trinitrotoluene (TNT) by Vetiver grass (*Vetiveria zizanioides* L.) from Millhopper Soil

Presenter: Padmini Das; **Co-authors:** Pravin Punamiya, Dibyendu Sarkar, Rupali Datta and Konstantinos C. Makris

Advisor: Dibyendu Sarkar

Abstract: Migration of 2, 4, 6-trinitrotoluene (TNT) from TNT-impacted military sites can cause serious soil and groundwater contamination. TNT is a group C human carcinogen and a potential mutatoxin. Presence of high levels of TNT can prohibit residential and other uses of closed military sites unless effective remedial measures are taken. Current remediation technologies for TNT contaminated soils are expensive, and phytoremediation is a cost-effective and environmentally friendly alternative. One of the major challenges in developing an effective phytoremediation system for TNT contaminated soil and water is limited plant uptake of TNT resulting from the low solubility of TNT. The effectiveness of a common agrochemical urea as a chaotropic agent in increasing TNT extractability and uptake in plant-hydroponic systems has been already documented, but little is known about its performance in the highly-complex soil solution. The primary objectives of the present greenhouse study were to i) fully characterize the TNT uptake and biotransformation by vetiver grass from a low organic matter containing soil, ii) evaluate the catalyzing effectiveness of urea as a chaotropic agent in enhancing TNT uptake by vetiver grass. One sandy soil was contaminated with 100 mg Kg⁻¹ TNT along with four rates of urea (0, 125, 350, 1000 mg kg⁻¹). Plants were allowed to grow in TNT contaminated soil for 22 days. Urea concentrations were chosen to mimic the agronomic fertilizer nitrogen application rates (125 to 350 mg kg⁻¹) used for agricultural crops. 1000 mg kg⁻¹ urea was chosen to comply with the previous hydroponic TNT-vetiver experiment. The vetiver grass reduced soil TNT concentrations (73%) in absence of urea, compared to the TNT amended-no plant controls (21%). Urea significantly enhanced (p<0.0001) the Vetiver-TNT uptake from soil. Within the limits of agronomic fertilizer nitrogen application rate, 125 mg kg⁻¹ was optimum for urea catalysis of TNT uptake by vetiver grass (82% removal of TNT). However, increasing the urea rate to 1000 mg kg⁻¹, increased the TNT disappearance rate (91% removal of TNT). The observed first order TNT disappearance rates from soil at all sampling intervals were significantly correlated with different urea application rates. Significant TNT translocation from root to shoot was observed. Major TNT metabolites, such as 2-ADNT, 4-ADNT and 1,3,5-TNB were detected in shoot tissues, suggesting TNT phytodegradation by vetiver grass. Under conditions of similar initial TNT concentration, vetiver grass was deemed to be much superior in TNT uptake to the other plant species so far used for removing TNT from soils.

Title: PARTICLE SIZE RESULTS OF THE ANDRILL SOUTHERN McMurdo SOUND PROJECT

Presenter: Candice Falk

Advisor: Sandra Passchier

Abstract: The ANDRILL Southern McMurdo Sound (SMS) Project was carried out in December of 2007 by an international interdisciplinary team that recovered the most complete Neogene (23.03-2.59 Ma) stratigraphic record from Antarctica. Analyzing particle size distributions of samples throughout the core can determine environmental conditions of the past, such as the advancement or retreat of glaciers and the rise and fall of sea level. Over 300 samples were taken at approximately 3 m intervals from the 1100 m AND-2A core. Samples were processed and analyzed using a Malvern Instruments Mastersizer 2000 laser diffractometer which has the capability to measure sediments from 0.02 µm to 2000 µm. Statistical measures, such as the mean particle size, percent grain size, and distribution are analyzed to characterize the lithology. The changes in the percentage of clay, silt and sand will give a better understanding of the hydrological processes and climate changes in Antarctica through the Neogene which will help predict future global environmental changes.

Title: Retention of Heavy Metals from Acid Mine Drainage by Water Treatment Residuals: A Reconnaissance Study

Presenter: Michael Hardy; **Co-authors:** Dibyendu Sarkar, Rupali Datta and Necip Guven

Advisor: Dibyendu Sarkar

Abstract: Abandoned mines are a widespread problem in coal mining states of the United States, and pose a serious environmental problem to the entire nation. Remediation of such sites is a major challenge for researchers and regulators. Although surface mining is an important industry that produces valuable materials, it also causes habitat destruction and produces tons of waste material, much of which contains high amounts of heavy metals and sulfide-containing minerals such as pyrite. In the presence of water and oxygen, pyrite (FeS₂) reacts to produce acid mine drainage (AMD)—a heavy-metal-rich sulfuric acid solution that contaminates water resources and damages nearby ecosystems. While there are a wide variety of remediation techniques for AMD, this study evaluates the possibility of using a waste by-product, drinking water treatment residuals, (WTRs), as a sorbent to remove heavy

metals (e.g., copper, lead, and zinc) from AMD. Drinking WTRs can be obtained free of charge from drinking water treatment facilities and have already been shown to have a high capacity for removing other contaminants from water. Two WTR types, Fe- and Al-based, were used in this study to evaluate their potential to remove heavy metals from AMD. Both the Fe- and the Al-WTRs removed ~90– 99% of Cu, Pb, and Zn from standard solutions (maximum initial load was 2500 mg·kg⁻¹ WTR⁻¹ for each). It was also determined that pH did not have any significant effect on adsorption of Cu or Pb between pH 2 to 6 under the conditions of the experiment, but did have a significant effect on removal of Zn. In simulated AMD, the Al-WTR removed ~64– 69% and 88– 91% of the initial loads of Cu and Pb, respectively (initial loads were 500 mg·kg⁻¹ for each), and ~34– 50% of the initial load of zinc (5000 mg·kg⁻¹). Under the same conditions, the Fe-WTR removed ~54– 56%, 84– 88%, and 25– 47% of the initial loads of Cu, Pb, and Zn, respectively. Overall, results demonstrated the ability of both Al- and Fe-WTRs to remove a host of metals from AMD. Further investigation is needed to evaluate the effectiveness WTRs as a remediation technique for abandoned mine sites, under different environmental conditions.

Title: Heavy Mineral Analysis of Sediment Cores, Southern McMurdo Sound, Antarctica

Presenter: Daniel Hauptvogel

Advisor: Sandra Passchier

Abstract: The Antarctic Drilling Program (ANDRILL) recently drilled sediment cores from a sea ice platform in southern McMurdo Sound (SMS) in late 2007. The core site is located just offshore the Transantarctic Mountains along the margin of a half graben, a site of high sedimentation rates. A grain count analysis of heavy minerals from these cores will result in the recent history, from 17 Ma to present, of ice sheet drainage patterns and dynamics. The volume and dynamics of the Antarctic ice sheets through this interval of time are poorly known. Evidence of volcanics in the sediment will constrain the timing of eruptions within the McMurdo Volcanic Group. Results of 15 samples from the first 650 m of core will be presented. To date, 9 samples have been analyzed with 300 counts per grain mount. Initial results show changes in heavy mineral composition which can be determined primarily by quantities and varieties of augite and diopside. There is also evidence to support increased activity of the McMurdo Volcanic Group volcanoes from about 1 Mya. Further research will be done on the remaining samples as well as an SEM analysis in order to form a better interpretation of ice sheet dynamics in this region.

Title: Generalized Fermat Equation

Presenter: Cihan Karabulut

Advisor: Aihua Li

Abstract: An equation of the form: $Ax^p + By^q = Cz^r$, where A, B, C are non-zero integers and p, q, r are positive integers greater than 1, is called a generalized Fermat equation. We seek relatively prime integers x, y, z that fit the equation. Despite its fame little is known about the nature of this equation. I will talk about the brief history of this equation; the known solutions and the research I did with Dr. Aihua Li regarding this equation.

Title: Relationship Between Catalysis and Conformational Motion in Indole-3-glycerol Phosphate Synthase from *Sulfolobus solfataricus*.

Presenter: Tomasz Kurcon

Advisor: Nina Goodey

Abstract: Indole-3-glycerol phosphate synthase from *Sulfolobus solfataricus* (SsIGPS) belongs to a broad family of (α₈)-barrel enzymes. It catalyses the fifth step in tryptophan biosynthesis, converting 1-(o-carboxylphenylamino)-1-deoxyribulose-5-phosphate (CdRP) to indole-3-glycerol phosphate (IGP). The ultimate goal of this project is the mapping of the motions within SsIGPS during catalysis. Changes in the FRET signal resulting from the change in the environment of a pair of probes will be detected by a SX 20 stopped-flow instrument revealing information about the proteins intrinsic motion. Three recombinant proteins were engineered by substituting a single native amino acid by a cysteine residue in two of the three loops near the active site. In this way, three double mutants were created, each containing an amino acid substitution in two of the three chosen positions. Three additional single mutants were created, each containing a cysteine substitution in one of the three loops. Strong absorption of 2-nitro-5-thiobenzoate (TNB-) product of the reaction of cysteine and 5, 5'-dithiobis-(2-nitrobenzoic acid) (DTNB), at 412 nm can be used to determine reactivity of the cysteine in each mutant. SX 20 stopped-flow instrument was used to measure the increase in absorbance observed upon mixing of SsIGPS mutants with DTNB. So far all the single mutants had been labeled with Alexa 555 fluorophore. Tagging the enzymes changed catalytic activities of two mutants, one of which experiences twofold decrease in activity while the other more than fortyfold decrease in activity. Cysteine reactivity of single mutants with DTNB suggests that two mutants have nearly equivalent reaction rates, which are tenfold faster than the remaining third mutant. Such differences

among the rates in the single mutants can be used to selectively label double mutants with two different fluorescent dyes. In near future, fluorescent resonance energy transfer (FRET) will be used to determine conformational motion of SsIGPS mutants upon binding of the substrate CdRP, conversion to IGP, and subsequent dissociation. SX 20 instrument will be used to detect FRET signals generated upon interaction between the two fluorophores resulting from the change in their proximity as the loops move during the reaction.

Title: The US Subprime Mortgage Debacle: How it Started and Provoked the Current Financial Crisis

Presenter: Michael Mancuso

Advisor: Youngna Choi

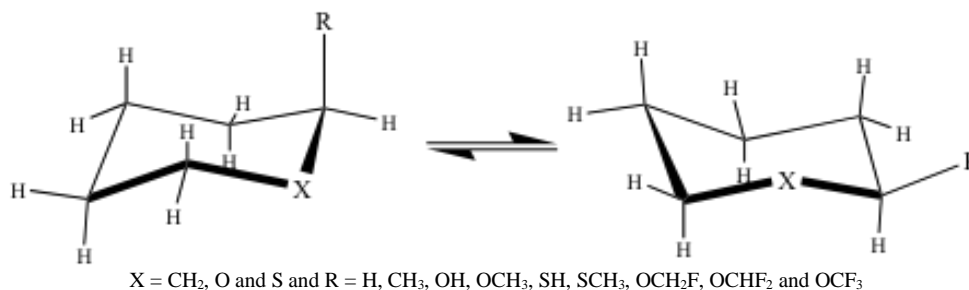
Abstract: The decline of the US real estate market which started in 2006 has become a full scale financial crisis and been hitting all parts of the world. This presentation investigates the source of the crisis, the subprime mortgages in the US real estate market, and tracks down the side effects and damages caused by them, emphasizing how local reckless lending has evolved a global crisis in all sectors of economy.

Title: A Computational Study of the Electronic and Steric Contributions to the Relative Stabilities of Axial and Equatorial Substituents on 6-Membered Rings (Part 2: The Relative Energies)

Presenter: Andrew K. Mauro

Advisor: Marc Kasner

Abstract: In order to evaluate the presence of an anomeric effect, the relative energies of a series of compounds was determined using four computational methods: geometry optimizations and frequency calculations using HF/6-311G++(d,p)//HF/6-311G++(d,p), B3LYP/6-311G++(d,p)//B3LYP/6-311G++(d,p) and single point energy calculations using MP2/6-311G++(d,p)//HF/6-311G++(d,p) and MP2/6-311G++(d,p)//B3LYP/6-311G++(d,p). The existence of an anomeric effect can be determined by looking for trends, exceptions and comparisons in the series of compounds:



The computational methods result in a determination of the minimum energy for the conformation of the molecule selected. This corresponds to the internal energy (E or U) of the compound at 0 K. Before proper evaluation of the relative stability of the compounds can be made, the relative internal energies (DU's) must be converted to relative enthalpies (DH's) at 0K and then to relative free energies (DG's) at 298.15 K.

There are no apparent electronic interactions nor any anomeric effect in the cyclohexane series and all the equatorial conformers are more stable than the axial conformers. Selected members of the tetrahydro-2*H*-pyran (oxane) series show evidence of the anomeric effect by the enhanced stability of the axial conformer relative to the equatorial conformer. The tetrahydro-2*H*-thiopyran (thiane) series is harder to evaluate because the longer C-S (relative to C-O) bond lessens the steric interactions.

Title: Stochastic Particle Escape in a Double-Well Potential

Presenter: Marie McCrary

Advisor: Lora Billings

Abstract: We consider the problem of predicting the trajectory of a particle in a double well potential under stochastic perturbations. By adding background noise to the equations of motion, we can induce the particle to switch between the two stable states. We measure the average time it takes to escape from one basin to the other basin under different types of noise. The escape time of the system under Gaussian white noise is well known, following the theory of Brownian motion. We present theory for predicting the escape time if we add small amplitude Poisson pulses. We also address how the switching rate varies as the potential undergoes different types of bifurcations, such as the saddle node and pitchfork. We find that weak Poisson pulses, as well as varying the

bifurcation parameter, r , can lead to a significant change in the escape rate. We compare analytical results with extensive numerical simulations.

Title: A Computational Study of the Electronic and Steric Contributions to the Relative Stabilities of Axial and Equatorial Substituents on 6-Membered Rings (Part 3: The Molecular Geometries)

Presenter: Marc N. Muniz; **Co-authors:** Gregory R. Ames and Andrew K. Mauro

Advisor: Marc Kasner

Abstract: When the axial conformer is more stable than the equatorial conformer, the interactions that cause the stability are termed the anomeric effect. The equatorial conformer in substituted cyclohexanes is almost always more stable than the axial conformer due to the domination of the steric effects. However, the presence of non-bonding electrons leads to a reversal of this situation and the appearance of an anomeric effect. To a certain degree, some stabilization occurs in substituted cyclohexanes when the atom bonding the R group to the ring has non-bonding electrons but the stabilization of the axial conformer occurs to a greater degree when two atoms with non-bonding electrons are present,

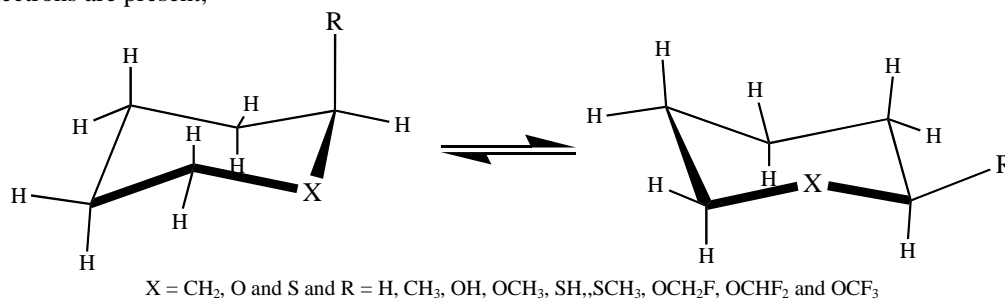


Figure 1: The Compounds in this Study

It has been pointed out that donation of the non-bonding electrons to anti-bonding orbitals will lead to geometric changes in the bond lengths and bond angles near the donating and accepting orbitals. Donation of the non-bonding electrons from an oxygen or sulfur atom can only occur from a non-hybridized p orbital. Thus, when no donation occurs, the bond angles surrounding the O or S will be closer to the sp^3 angles and when some donation does occur, the angles will expand because of the larger sp^2 component. Similarly, donation of electron density into an anti-bonding molecular orbital will decrease the bond order and lengthen the bond.

Analysis of the geometries of the molecules selected in this study showed the most pronounced exo-anomeric effect (donation of electron density into the ring) when X = S and R = OH. When X = O and R = OCH₃ the largest endo-anomeric effect was present. Both compounds had large negative conformational free energies indicating the stabilization of the axial conformer.

Title: The Fabrication of Graphene – Poly(diallyldimethylammonium chloride) Multilayer on Silane Modified Glass Surface

Presenter: Krutika Patel; **Co-authors:** Pratik Shah and Robert Cuellari

Advisor: Shifeng Hou

Abstract: Graphene is a single layer of carbon with honey comb structure. It is newly discovered carbon in two dimensions. Graphene is approaching bright future for electronic technologies and materials science, such as computing and digital displays. Furthermore, the layer-by-layer assembly is process that creates thin film on a substance by combination of electrostatic force between opposite charged macromolecules. The layer-by-layer technique leave us with numerous advantages such as being inexpensive, easy to analyze, control of layer thickness and highly pure compounds are not essential .In this report we have performed layer-by-layer technique to create thin films of grapheme on a silane modified glass surface. The glass slide was treated with silane to generate a negatively charged monolayer surface. This monolayer modified glass was immersed into graphene oxide solution and poly(diallyldimethylammonium chloride) (PDDA) solution alternatively. A multilayer of negatively charged graphene and positively charged PDDA was fabricated on the surface. The fabrication process was monitored by UV spectroscopy and the morphology was characterized by scanning electron microscopy.

Title: Study on the Mechanisms of Mercury Tolerance in Cyanobacterium *Synechococcus* sp. IU 625

Presenter: Winder Perez; **Co-authors:** Lee Lee, Quinn Vega and John J. Gaynor

Advisor: Lee H. Lee

Abstract: *Synechococcus* sp. IU 625 (*Anacystis nidulans*) is a freshwater unicellular cyanobacterium and an obligate photoautotroph that readily harbors plasmids. This organism has been used in many studies to assess the effect of heavy metal toxicity as an environmental pollutant. Cyanobacteria like *Syn. sp. IU 625* have general metal resistance mechanisms. However, tolerance to mercury, the heavy metal with the strongest toxicity, is dependent on mercury resistance determinants (*mer*) that are commonly found in plasmids. Research into the genome of related strain PCC 7942 indicates that *mer* genes may also be located on the genome. The present study addresses the issue of plasmid versus chromosomal mediated mercury tolerance in *Syn. sp. IU 625* and the findings suggest that *mer* determinants are located on both plasmid and genome. In one of the few studies for strain IU 625, Simon isolated 4.7-MDa and 37-MDa plasmids in 1978. The relationship between these plasmids and the 7.6-kb and 46.6-kb plasmids of strain PCC 7942 is unknown. The present study provides preliminary findings into the similarities between the plasmids of these two related species.

Title: Predicting Weight Change Using a Differential Equation

Presenter: Alexandra Peri

Advisor: Diana Thomas

Abstract: With obesity on the rise, weight management has become a priority research topic. The benefits of remaining within a healthy weight range are staggering. Getting to this point however is very difficult. This is because of the complex way in which our bodies regulate weight. Along with voluntary physical activity, basal metabolic rate (BMR) and dietary induced thermogenesis (DIT), non-exercise activity thermogenesis (NEAT) is also a key factor in weight change that has gone unnoticed until recently. This is the amount of energy that is used throughout the day in involuntary movements. Several overfeeding studies have discovered that NEAT increases more than expected resulting in less weight gain. I worked with a mathematical model developed by Thomas, Ciesla, Stevens, Levine, and Martin that has incorporated NEAT. The model is a differential equation that predicts the change in weight over time resulting from a change in caloric intake. The only initial conditions required are baseline height, weight, age and gender. I applied data from an 8 week overfeeding study conducted at Mayo Clinic by James Levine to validate the model. The data set included men and women, as well as healthy and overweight individuals. The model predicted the changes very well. The average difference between the model prediction and actual result was 2.5 kg for weight, 1.1 kg for fat free mass, and 2.3 kg for fat mass. This model very closely predicted what would occur. The predictions were extremely close to what actually occurred. This type of model could eventually be used to determine who gains or loses the most weight along with the amount expended due to NEAT.

Title: Enhancing lead Phytoextraction capability of a lead-accumulating grass with arbuscular mycorrhizal fungi

Presenter: Pravin Punamiya; **Co-authors:** Dibyendu Sarkar, Padmini Das, Rupali Datta and Summer Barber

Advisor: Dibyendu Sarkar

Abstract: Despite several efforts to reduce residential lead (Pb) exposure, Pb contaminated soils are still abundant in the United States, and significant manifestations of Pb toxicity symptoms are reported in recent times. Current technologies used to remediate lead contaminated soils are expensive, and the need to develop a low-cost and environmentally friendly remediation technology is of great necessity. Phytoremediation can be a feasible technology if biomass of lead accumulating plants can be enhanced to improve their Pb extracting capabilities. We inoculated a Pb hyper-accumulating grass (Vetiver grass, *Vetiveria zizanioides*) with an arbuscular mycorrhizal (AM) fungus, *Glomus mosseae*, and allowed plants to grow for 4 weeks with and without vetiver grass colonized by AM fungi. We conducted a hydroponics study (Phase I) in half strength Hoagland solution, and a pot experiment (Phase II) in a sandy soil (Millhopper series Spodosols) with four different levels of Pb (0, 1, 2, and 4 mM) and (0, 400, 800 and 1200 mg Kg⁻¹), respectively. After 4 weeks of growth, plants were harvested and analyzed for total shoot biomass, total root biomass, Pb concentration in root and shoot, chlorophyll activity and low molecular weight thiols (LMWT). The mycorrhizal colonization increased shoot and root dry mass (15% for phase I and 18 % for phase II), and Pb uptake (30-35% for phase I and 40-45% for phase II) at all Pb application rates. Further, plants colonized with AM fungi had higher chlorophyll activity, and lower LMWT produced, suggesting lower stress. Microscopic images and PCR reaction confirmed presence of *G. mosseae* in the roots of inoculated plants. Results from this study suggest that effective phytoremediation of Pb contaminated soils can be achieved with AM fungi

assisted phytoextraction. Keywords: Lead, Phytoextraction, Arbuscular mycorrhizal fungus, *Glomus mosseae*, Vetiver grass.

Title: Binding of ICER to Its Own Promoter as a Mode of Cooperative Regulation

Presenter: Craig Queenan; **Co-authors:** Carlos Molina and Johannes Schelvis

Advisors: Carlos Molina and Johannes Schelvis

Abstract: Inducible cAMP Early Repressor (ICER) is a regulator of cAMP signaling in the cell. ICER can be found in normal cells, but it is not present in tumor cells. The growth of these tumor cells is hampered when ICER protein is artificially reintroduced in these cells. Therefore, it is hypothesized that ICER manipulation could potentially be used as a new therapy for the treatment of cancer. Although much is known about the physiological role of ICER, little is known about the regulation of the gene. In this study, the negative autoregulation of ICER by binding to its own regulatory sequences, is being examined. ICER is an isoform of the cyclic AMP Responsive Element Modulator (CREM), binding to regulatory sequences on the promoter of specific genes. These regulatory DNA sequences are termed cAMP Responsive elements (CRE). The ICER promoter has been shown to contain four of these CRE sites, termed cAMP autoregulatory elements (CARE) 1-4, whereas most other promoters only contain one. Therefore, it was the goal of this research to determine if the multiple CARE sites act independently of each other when binding ICER, or if some form of cooperative regulation occurs between two or more of the CARE sites. Oligonucleotides that represent CARE1, CARE2, and CARE1&2 with fluorescent and quencher molecules attached were obtained to monitor the binding of ICER by using fluorescence resonance energy transfer (FRET). An electromobility shift assay (EMSA) was also performed to verify that the binding effects seen in the FRET analysis were in fact due to ICER binding to the CARE sites constructs. The results show that CARE 1 and CARE2 follow the pattern of independent binding of ICER with binding constants of $0.12 \pm 0.04 \mu\text{M}$ and $0.16 \pm 0.03 \mu\text{M}$, respectively. The construct for CARE1&2 clearly shows the characteristics of cooperative binding, rather than independent, and has a binding constant of $0.59 \pm 0.12 \mu\text{M}$ and a Hill coefficient for cooperativity of $n = 3.6 \pm 1.6$. ICER's binding to the CARE constructs have already provided novel information about its interaction with its promoter and may lead to new information about its role as a tumor suppressor.

Title: Patch Models and Applications on the Spread of Avian Influenza

Presenter: Kim Rude

Advisor: Baojun Song

Abstract: The avian influenza virus (AIV) is an infectious disease that predominantly affects birds. The spread of AIV is of great concern due to economic losses resulting from deaths of poultry and health risks to humans. Though the virus does not often spread to humans, since influenza viruses mutate easily, there is serious concern that the virus could mutate into a strain that is transmitted easily to and among humans. There has been much speculation that migratory waterfowl may play a role in the spread of avian influenza, since they have been shown to carry the disease without having any severe symptoms. Thus, we seek to use mathematical modeling to study the spread of avian influenza and investigate the impact that migratory birds may have. We first construct a discrete model for the spread of avian influenza in which we consider two separate populations of birds as well as a third population that seasonally travels between the first two populations. We estimate parameter values and run simulations in MatLab to observe the changes in the prevalence of AIV in the populations. We compare our results to the data and also observe long term trends in the prevalence of the disease, showing that the model is a 2-cycle. We then do theoretical work on the model to determine under what conditions the periodic solution will hold. Next we work with a continuous SIR model that has three patches. Some birds stay local to each patch, but there are also migratory birds that travel between patches. We find and interpret the basic reproductive number.

Title: A Leishmania Protein Kinase (LmxMPK1) as a Potential Drug Target for the Treatment of Leishmania Infection.

Presenter: Sailaja Sankabathula; **Co-authors:** Nalinai Pather, Katie Gaskill, Pamela Omesiete, Monika Maliborska and Ritu Patel

Advisor: John Siekierka

Abstract: Diseases of the developing world affect millions of people worldwide. The morbidity associated with these diseases in terms of socio-economic impact is enormous and the development of new drugs to treat these infections is urgently needed. Leishmaniasis is a disease caused by protozoan parasites transmitted by the bite of sand flies. Leishmaniasis is second only to malaria in terms of morbidity worldwide. Inhibitors of a human protein kinase, p38 Mitogen-Activated Protein Kinase (p38), have been shown to inhibit the proliferation of another parasite, *Toxoplasma gondii*, the causative agent of toxoplasmosis. *T. gondii* encodes a p38-related kinase (tgmapk-

1) that is inhibited by p38 inhibitors. We hypothesize that parasite p38 homologs play an critical role in the replication of other parasites as well and may be potential drug targets. A sequence homology search showed that both p38 and tgmak-1 share significant homology with a kinase found in *Leishmania mexicana* called LmxMPK1. A deletion mutation in this kinase gene renders the parasite unable to establish disease in a murine model, validating LmxMPK1 as a potential drug target. We have expressed LmxMPK1 in HEK 293T cells and shown, by quantitative SDS-PAGE autoradiography using ³³P-ATP, phosphorylation of the MAP kinase substrate, myelin basic protein. We also show that LmxMPK1 kinase activity is inhibited by the p38 kinase inhibitor, BIRB796. These results support further study of p38 inhibitors as potential anti-leishmania agents.

Title: Hormonal Control of Ion Secretion by the Nasal Salt Gland of the Desert Lizard *Uromastix dispar*.

Presenter: Jairo Sierra

Advisor: Lisa Hazard

Abstract: Desert lizards of the genus *Uromastix* use their salt glands in order to secrete sodium or potassium depending on the cation load that they are given. To examine the regulation of secretion rate and the sodium: potassium ratio, we treated six lizards (*Uromastix dispar*) with sodium chloride, potassium chloride, and spironolactone (an aldosterone inhibitor) in conjunction with potassium chloride. Sodium chloride induced sodium secretion but not in large quantities. Potassium chloride induced large amounts of potassium secretion, and decreased sodium secretion as expected. Spironolactone appeared to have no significant effect on sodium or potassium secretion, though this could be due to small sample size. In future experiments we will be treating the lizards with hormones and other hormone inhibitors, in order to further investigate their effects on the regulation of sodium and potassium secretion.

Title: Sequencing the Natterjack Mitochondrial Genome

Presenters: Barbara Soares, Ali Hoshyari and Maureen Dempsey

Advisors: John J. Gaynor, John K. Koroky and Kirsten J. Monsen

Abstract: DNA was amplified and sequenced to piece together the mitochondrial genome of the Natterjack toad (*Epidalea calamita*). To date, the Natterjack toad's genome is incompletely categorized. The completed genomes of *Bufo japonicus*, *Bufo melanostictus*, and *Bufo gargarizans* were compared and analyzed to determine highly conserved regions that could be used to design primer sequences capable of binding to conserved regions within the Natterjack toad's genome and allowing for successful DNA amplification. Once conserved regions were located, forward and reverse primers were synthesized to amplify DNA extracted from a sampling of Natterjack toads from Castlegregory, Ireland and Roscullen Island, Ireland. Natterjack toad DNA was amplified *via* numerous polymerase chain reactions. Gel electrophoresis and gel imaging were then used to determine the presence of amplified DNA, predict the size of amplified DNA fragments, and indicate primer pairs capable of amplifying natterjack toad DNA. Once fragments were amplified, they were sequenced. Sequencing data was then analyzed and compared to the fully categorized genomes of *Bufo japonicus*, *Bufo melanostictus*, *Bufo gargarizans*, and other organisms to determine what genes had been amplified and where these genes were located in the Natterjack toad's mitochondrial genome.

Poster Presentation Abstracts

CHSS (Alphabetically by Presenter)

Title: The Rights of Crime Victims in Judicial Proceedings – Is Legal Protection Making a Difference?

Presenter: Anila Ali

Advisor: Marilyn Tayler and Avram B. Segall

Abstract: The hypothesis of this research project is, under New Jersey law, the constitutional and statutory rights granted to crime victims in judicial proceedings are not adequately being implemented by courts and prosecutors as required by law. The implementation of the crime victims' rights movement requires analysis through interdisciplinary studies of sociology and the law because neither discipline alone can fully address this issue. This research examines judicial decisions and statutory enactments relevant to the implementation of constitutional rights protecting defendants. These rights will be contrasted to the effort to "balance the scales of justice" for the rights of crime victims. Evidence suggests that it may be an endless conflict that changes and modifies as the crime victims' movement continues to expand. The research will present and explore the Crime Victims' Rights Act of 2004 and New Jersey Crime Victims Bill of Rights Statute, which state victims are entitled to be treated with fairness, compassion and respect by the criminal justice system. These standards appear to place the burden on law

enforcement agencies, even though existing resources are limited. This research concludes that law enforcement officials need to be more conscientious and effective in working to assist victims and witnesses. The legislation should be reviewed annually so that necessary amendments can be made to ensure the continuation of enhanced services to victims of violent crime.

Title: Transfer of Property Rights: Finding the "Public Good" in Eminent Domain

Presenter: Christine Aramini

Advisors: Avram B. Segall and Marilyn Tayler

Abstract: This research tests the hypothesis that current law regarding eminent domain transfers property rights to private enterprise without consideration of "the public good." It is necessary to approach this issue using interdisciplinary methods to develop a full understanding, because this issue cannot be adequately examined through one disciplinary perspective. The method of research employed is to examine the issue of eminent domain through two disciplinary lenses: Law and Political Science with Political Sociology as a sub-discipline. The Takings Clause of the Fifth Amendment of the United States Constitution holds that "[no person shall] be deprived of life liberty, or property; without due process of law, nor shall private property be taken for public use, without just compensation." An individual's right to property is one of the fundamental rights on which this nation was built. Nevertheless, in 2005 the United States Supreme Court found in the case *Kelo v. New London* that "public use," includes private economic development. The Supreme Court case *Kelo v. New London* is used as the primary touchstone case of this research. Since *Kelo v. New London* has broadened the term "public good" this has been used to the advantage of private enterprise. By comparing and contrasting different aspects of cases since the ruling, this research concludes that the "public good" is not being protected and current law allows for the abuse of property rights.

Title: Capital Punishment is cruel and unusual when relating to minors, the mentally ill, and the mentally handicap

Presenter: Elizabeth Badillo

Advisor: Marilyn Tayler and Avram B. Segall

Abstract: Capital punishment is cruel and unusual when relating to minors, the mentally incapacitated, and the mentally ill. There are several controversies on this topic because it questions whether a defendant who committed the crime of murder should be punished by execution. Execution ideally emphasizes the logic of "an eye for an eye," which was the main logic for most the cases tried, back in the day. The evolution of capital punishment has created more defenses that defendants now use to decrease their sentencing or to avoid it all together. The methods that were used in the research to create some understanding of how the capital system works, is law and psychology. Without both elements, the capital punishment system would be a system without ethics, without probability (chance), depending on the argument, and without professional expert opinions given on the witness stand, on behalf of the defendant. The best example of integration of both psychology and law is the insanity defense, which is used in capital cases. Insanity is a legal terminology, but without the assistance of psychologists to evaluate these criminal's mental state, the insanity defense would not be valid. Several researchers have realized that there are other issues at play that makes capital punishment cruel and unusual for people other than minors, and the mentally incapacitated. Factors that shows that the capital punishment system is flawed are the negligent of attorneys, the jurors disregard for paying attention at mitigating factors, psychiatric ethics, judicial ethics, and the most important of them all, that jurors are death-qualified jurors, which means that most of them do not have mercy for criminals, even if they are mentally ill, mentally incapacitated, or even minors.

Title: The Influence of Mary Wollstonecraft on Contemporary Feminist Legal Theory

Presenter: Nicole Dozsa

Advisors: Marilyn Tayler and Arvam B. Segall

Abstract: The research compiled in this paper explores whether the writing of Mary Wollstonecraft has influenced contemporary feminist legal theory. It is necessary to employ the disciplines of law and literature in order to reach an interdisciplinary understanding of how Wollstonecraft's philosophies remain pertinent to feminist legal theorists' work today. The research methodology employed requires examining legislation that has oppressed women, and how feminist legal theorists and authors have reacted to the attitudes of a patriarchal judicial system. In order to gain insight into the causes behind the disparity between genders, it is necessary to examine the foundation the Anglo-American legal system has been founded upon. The discussion will center on how feminist legal theorists and enlightenment writers have combated those concepts, and how they have formulated their own theories and insights about women's rights in society. By analyzing Wollstonecraft's fictional and philosophical writing concerning female agency, and feminist legal theorists' perspectives on female autonomy, one may conclude that Wollstonecraft's theories continue to influence feminist jurisprudence today.

Title: FDA-Approved Medical Products for non-FDA Approved Medical Purposes and the Risk to Public Health

Presenter: Fernando Fernandez

Advisor: Marilyn Tayler and Avram B. Segall

Abstract: The hypothesis of this research project is to analyze that the use of FDA-approved medical products for non- FDA -approved medical purposes presents a risk to public health. This project draws upon updated sources such as recent published articles, journals and books. It also uses case law such as the United State Supreme Court cases of United States vs. Sereno, United States ex rel. Franklin v. Parke-Davis, and Moore v. Regents of the University of California, to exemplify the improper use of the off-label promotion and practice coming from physicians and pharmaceutical companies. The research project will examine the legal and ethical aspect of the off-label prescription practice. The legal aspect involves court cases, the Federal Drug Administration (FDA), and the details of drug approval will be examined to determine the efficacy of this institution. The ethical aspect focuses on medical ethics, and proper physician moral conduct will be examined. It is also necessary to use an interdisciplinary research approach to examine the issue. This interdisciplinary approach helps reach the conclusion that the off-label practice is essential for medical innovation, yet patients rely on physicians and drug manufactures' critical judgment to use off-label practices adequately.

Title: Un Voyage à Paris – Le Métro

Presenter: Mary Hartnett

Advisor: Elizabeth Emery

Abstract: The materials presented depict one day of a ten-day thematic unit for high school French students. The thematic unit, A Trip to Paris, provides students with step-by-step instructions on traveling to France, from obtaining a passport, making flight and hotel reservations, and visiting some of the most important monuments and museums within the city of Paris. Students are provided with a variety of visuals and new vocabulary to enable them to communicate effectively in French during their travels. The thematic unit culminates in an Internet project / webquest in which they choose a Parisian hotel and create a travel brochure to guide hotel guests to the area's restaurants and attractions. Today's presentation focuses on learning how to use the Paris Metro, the city's subway system. The objective of this lesson is to teach the students how to get around the city of Paris via the Metro system.

Title: Are women's divorce rights under Shariah Law more restrictive than under State law in the United States?

Presenter: Laila Kabbash

Advisors: Marilyn Tayler and Avram B. Segall

Abstract: "In the 21st Century, the United States has seen an increase in immigration. The assimilation and/or acculturation of immigrants into American society has brought, particularly in the Muslim community, many complexities regarding religious law, and its interpretation within the commonalities of the civil legal system. The primary focus of this study will be a comparison of the rights of women in divorce proceedings under Shariah Law compared to those of women obtaining a divorce pursuant to state civil law in the United States. A compare and contrast analysis is essential in illustrating the differences between these two systems. US courts face the challenge of interpreting religious law while keeping that law within the legal boundaries of the US legal system. The objective of state statutes is to leave enough room for interpretative language so that the civil law system is able to remain in constant fluid with everyday demands and changes. Shariah is the main body of law which governs Muslim theocracy. It is the legal system by which both public and private life are governed. Within this system law is interpreted through the scripture known as the Quran, along with Prophet Muhammad's commentary of the Quran, known as the Hadith. In this study of Shariah Islamic law and civil law in the United States, the distinct cultural and legal differences that impact the roles of women within these two societies is addressed. It is essential to form an integrated understanding of how US civil law was able to interpret religious law that deal with cultural values governed by the Quran."

Title: Uncle Tom's Cabin as a Challenge to Slave Law

Presenter: Andrea Khan

Advisors: Marilyn Tayler and Avram B. Segall

Abstract: The purpose of this research is to explore the hypothesis that Harriet Beecher Stowe's novel Uncle Tom's Cabin influenced change in the law with regard to slavery in pre- to post- Civil War America. As this issue reaches beyond the scope of a single discipline, adequate exploration requires an interdisciplinary approach. In order to explore this issue, two disciplines have been used: law, particularly slave law, and literature, particularly the nineteenth-century American novel. The manner in which the pre-Civil War American law regarded slavery is

considered, as demonstrated in such touchstone cases as the Dred Scott decision and in legislative acts like the Fugitive Slave Act of 1850. It is found that disagreement over slavery between the Northern and Southern states led to the outbreak of the American Civil War in 1861. The war, which began just eight years after the publication of Uncle Tom's Cabin, is identified as a major factor in the abolition of slavery. Both a scholarly and a critical approach are used in the exploration Stowe's novel to identify why and how the novel may have been written and how it may have served as one of many catalysts of the war. Interdisciplinary research indicates that Uncle Tom's Cabin may have influenced American public attitude toward slavery to such an extent as to have contributed to the eruption of the Civil War, and thus affected the American law regarding slavery.

Title: The Reinforcement of Re-Entry Programs in Prisons to Combat Recidivism

Presenter: Magda Laspina

Advisor: Avram B. Segall and Marilyn Tayler

Abstract: It is hypothesized that recidivism among drug related offenders will continue to increase until an effective program is implemented in prison for their re-entry into society. Re-entry programs are a complex and multifaceted issue that must be viewed not only from the legal perspective, but also from the sociological perspective. "Re-entry" refers to the return to the community of incarcerated individuals from jails and prisons and their reintegration into society. During incarceration prisoners are more vulnerable to adapt to "prisonization" which means they learn norms of the antisocial subculture from other prisoners. Therefore, the longer the offenders stay in prison, without an effective reintegration program the greater the likelihood of reoffending once return home. This research shows the importance to use jail time to rehabilitative and provide the inmates with vocational training so when they are released from prison, they can be productive citizens. To break this cycle of recidivism, the criminal justice system and society need to join forces to avoid sending the same individuals to jail and returning them to the community without rehabilitation.

Title: Immigration Panic

Presenter: Mariana Lopez

Advisor: Marilyn Tayler and Avram B. Segall

Abstract: The immigration panic should consist of not how many immigrants enter the country but who the immigrants are and how they are let in to the country. Only two-thirds of 1.5 million immigrant workers have entered legally in the past ten years, this implies that more than half a million workers enter the country by other means. The United States is a country based upon individual freedoms, personal liberties, and the American dream and implementing a system that brings in immigrants only to work, without providing the possibility of residency, seems to go against these principles. An interdisciplinary approach is essential to solve the problems encountered by illegal aliens due to the fact that no single disciplinary perspective can adequately address this issue. Immigration law serves as the backbone to the issues of undocumented workers unionizing/guest worker programs in order to attain the American dream by dictating policies. Political science provides the outlet for change in through lobbying for immigration reform under public policy principles. A number of powerful interests have joined together in support of the idea that any new immigration legislation should include a guest worker program. A guest worker comes into the country to do work that Americans do not want to do. This does not justify employers treating them any different than they would American employees. By assuring that the identified requisite conditions of a guest worker program are in place, and by designing a program that is responsive to both businesses and workers, a modified guest worker program may be the best option. Undocumented workers are discriminated against and their speaking up leads to their arrest and deportation. New policies are needed, policies that will ensure that those people who come here in hope will not find humiliation and degradation.

Title: Relationship of Empathy and Attitudes towards Animal Rights among Montclair State University Students

Presenter: Michelle Newton

Advisor: Janet Ruane

Abstract: This study seeks to determine the relationship between the capacity for empathy and attitudes towards animal rights. Surveys containing abridged versions of the Animal Attitudes Scale and Multi-Dimensional Emotional Empathy Scale were distributed to a sample of Montclair State University students. A significant positive correlation was found between the capacity for empathy and positive attitudes towards animal rights. Additionally, gender was found to influence both variables, as females yielded greater capacities for empathy and more positive animal rights attitudes than did males. This study also sought to test for the effects of socialization on animal rights attitudes. These findings may be of interest to those who seek to further explore the relationship between humans and non-humans. The use of a convenience sample weakens the study's external validity.

Title: Undocumented Aliens: Barriers to the Pursuit of Higher Education

Presenter: Karen Okida

Advisor: Marilyn Tayler and Avram B. Segall

Abstract: It is hypothesized that the passage of legislation such as the Dream Act is essential for undocumented aliens to share in the advantages of education beyond secondary school. This research project examines higher education through the disciplines of law and sociology. It draws upon case law from Plyler v. Doe and Day v. Bond. The research also includes aspects of Durkheim's study of educational sociology and examines how education relates to social issues. Current immigration policies do not provide undocumented aliens with adequate access to higher education. However, many states have taken their own initiatives in providing these students with in-state tuition rates creating controversy between federal and state government. If the proposed Dream Act were to be passed, it would grant undocumented students rights to financial aid and the opportunity to adjust their immigration status. This research reflects the importance of higher education from a sociological and legal standpoint. It concludes that the United States government must develop a plan to implement a cohesive and accessible method or program for college age undocumented aliens to pursue a higher education.

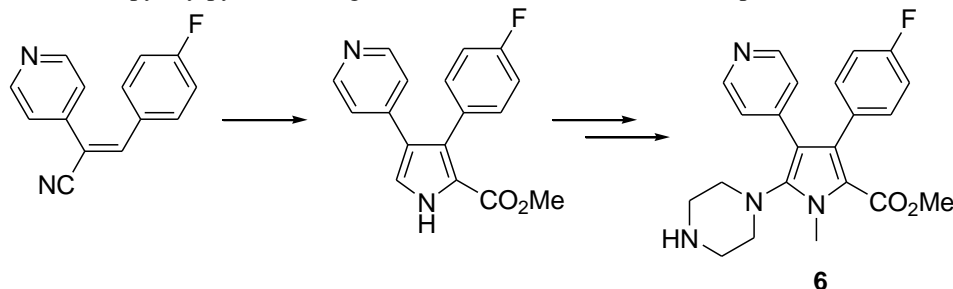
CSAM (Alphabetically by Presenter)

Title: Synthesis and Characterization of Pyridylpyrroles: Inhibitors of p38 MAP Kinase

Presenters: Maryam Alapa, Stephanie Barros, Chris Munson, Michael Spinelli and Dharti Shyani

Advisors: Fina Liotta and John Siekierka

Abstract: Protein kinases are critical enzymes in cellular signal transduction cascades. The protein kinase, p38 mitogen-activated protein kinase (p38 MAPK), plays a role in inflammatory processes by regulating the production and action of inflammatory mediators, e.g. TNF α , IL-1, etc. Several small molecule p38 MAPK inhibitors have been shown to effectively block the production of IL-1, TNF, and other cytokines *in vitro* and *in vivo*, and some have advanced into the clinic for the treatment of diseases such as rheumatoid arthritis (RA), inflammatory bowel disease (IBD) and psoriasis. A novel series of pyridylpyrrole compounds have been described that potently inhibit p38 MAPK-mediated TNF α production *in vitro* and *in vivo*, but fail to inhibit the catalytic activity of active p38 MAPK *in vitro*. Preliminary evidence indicates that these compounds may bind to the unactivated form of p38 MAPK and prevent its activation by upstream kinases. This mode of action is unique and may offer advantages over other structural classes of p38 MAPK inhibitors. The synthesis and characterization of the potent p38 inhibitor **6** is described. The synthesis of pyridylpyrrole **6** was accomplished via an efficient isonitrile cyclization followed by a palladium catalyzed amination reaction. Further modification of compound **6** will lead to pyridylpyrrole analogs, which will be evaluated for their potential as inhibitors of the p38 pathway.



Title: Cloning and expression of parasitic mitogen-activated protein kinase

Presenter: Pablo Apablaza

Advisor: James Dyer

Abstract: Mitogen-activated protein kinases (MAPKs) are involved in a wide variety of processes in many types of cells and in many different organisms. Human MAPKs are known to be responsive to stress stimuli and are involved in apoptosis and cell differentiation. Parasite and plant MAPKs are also involved in stress responses. These MAPKs have been identified in the Apicomplexan parasite *Toxoplasma gondii* and also in the malarial parasite *Plasmodium falciparum*. The purpose of this research is to clone and express these MAPKs in a heterologous expression system so that further biochemical characterization of the protein may be done.

Title: Within twig competition for water in Douglas-fir

Presenter: Krystal Arango; **Co-author:** Kathleen Pormento

Advisor: Dirk Vanderklein

Abstract: It is known that structure is related to function in the hydraulic system. What is unknown is whether the structure of side twigs and terminal twig within a branch create competition for water. Using twig samples from the base of two Douglas fir tree crowns, hydraulic conductance and tension were observed in side twigs and the main tip of several samples. A solution of distilled water and .01 M KCL in a container was pushed through a tube at a set pressure, which was connected to a twig sample. From this, droplets of water were measured from the side and terminal twigs accordingly. This method was utilized to observe the flow rate from each side twig when flow through the tip was closed and alternatively, the flow rate from a tip when all side junctions were sealed. Since leaf area is involved in pulling water through a twig, it was measured to evaluate the possible effects of tension in conjunction with conductance. Diameter measurements were taken at each junction, tip, and bottom of each sample. This was done to assess the relationship for each junction's diameter width and resistance effects. In general, it was shown that 1. conductance between all side twigs (in total) and the tip were variable, which might have been impacted on by embolisms due to winter conditions or blockage within the system and 2. that there appears to be competition of water within a twig.

Title: Study the Effect of Mercury and Cadmium on Cyanobacteria *Synechococcus* sp. IU 625

Presenter: Muhiba Begum; **Co-author:** Maryam Raja

Advisor: Lee H. Lee

Abstract: *Synechococcus* sp. IU 625 is a unicellular cyanobacterium found in fresh water areas. It is a good indicator of contamination because it is simple, sensitive, and ubiquitous organism. Mercury and cadmium are toxic heavy metals, which in high concentrations can inhibit the growth of *Synechococcus* sp. IU 625. For this study, 100 ml of 3M media inoculate with organisms, had different concentrations of HgCl₂ or CdCl₂ added to them. For HgCl₂, concentrations were (0, 0.1, 0.5, and 1.0 mg/L). For CdCl₂, concentrations were (0, 5, 15, and 30 mg/L). The growths of the cells were monitored with spectrophotometer at 750nm for turbidity study and with hemocytometer for direct cell count. The content of Hg in the cells and media was analyzed by using cold vapor technique on Atomic Absorption spectrometer. The content of Cd in the cells and media was analyzed by ICP (Inductively Coupled Plasma) spectrometer. The result of Mercury for 0.1mg/L was the same as the control. At concentrations of 0.5 mg/L and 1.0 mg/L, the growth was severely inhibited and had a long lag phase of 16 days and 21 days respectively. For Cadmium the 5 mg/L, the growth was the same as the control and 15mg/L slightly inhibited the bacteria. At 30 mg/L, it almost completely inhibited the growth of *S. IU625*. The metal content investigation showed that cells were 100 percent permeable to Mercury at all times and all concentrations. However, in Cadmium they were not permeable with low concentrations. The results show that 20-30% gets into the cell and most cadmium stays in the media. After remove the metals from the medium, Cadmium at 30 mg/L was clearly bactericidal and Mercury at 1mg/L was bacteriostatic. This depicts that it's more sensitive to Mercury than to Cadmium. The permeability may be one of the reasons that the cells are able to tolerate the metal contamination.

Title: The impact of defoliation on starch reserves in Japanese barberry

Presenter: Jean-Edson Belcourt; **Co-author:** Tony Cullen

Advisor: Dirk Vanderklein

Abstract: New Jersey is host to a number of non-native invasive plant species that out-compete the native plants for space, sunlight, and soil. One of those plant species, Japanese barberry (*Berberis thunbergii*), has become particularly wide-spread in certain regions of New Jersey. Various theories exist to explain the ability for non-native organisms to become invasive. Until recently, it was thought that Japanese barberry profited from a lack of defoliators, but last year Joan Ehrenfeld of Rutgers University, NJ documented extensive defoliation across a wide geographical distribution in New Jersey. This research is set up to address if Japanese barberry possesses certain properties that help it maintain its invasiveness following defoliation. Our working hypothesis is that Japanese barberry starch reserves will be negatively impacted by defoliation. To study this hypothesis, we defoliated by hand the leaves on new stem growth of large- and small-sized barberry plants by either 50% or 100%. We measured response to defoliation by measuring starch content of leaves, stems and roots harvested at the end of last summer. Our results indicate that, in fact, starch reserved were not affected thus giving the plant an advantage over it's native competitors. Furthermore, we found that larger plants had much more starch, indicating that as the plants get bigger the harder it will be to kill them.

Title: Molecular Cloning of an Avian Ovarian-specific Transgenic Construct

Presenter: Goce Bogdanoski

Advisor: Carlos A. Molina

Abstract: Hyperovulation in domesticated hens is considered as highly desirable genetic trait, a feature that has been explored in multiple studies and remains the focus of many biotech companies. Unlocking the molecular mechanism that controls ovulation may provide basis for development in new reproductive technologies. Previous research done on rodents provided data and identified a single transcription factor, the Inducible cAMP Early Repressor (ICER), found to directly mediate the nuclear response to gonadotropins and trigger hyperovulation. Transgenic mice carrying tissue-specific FSH inducible ICER construct showed two-fold ovulation rate increase following hormonal activation of the cAMP second messenger relay. In this study, we generate a transgenic construct derived from the domesticated hen, *Gallus Gallus*. For this purpose, we amplified the ovarian-specific 3kb promoter sequence of the Inhibin- α subunit gene and the avian homolog of the ICER I γ cDNA. The generated construct was termed FLAG-gg-ICER I γ transgene. The DNA sequencing analysis showed successful amplification of gg-ICER I γ . Following transfection into 293T (Human Kidney Carcinoma cells) our Western Blot analysis identified expression of FLAG-tagged gg-ICER I γ . We are now focusing on subcloning the Inh-a-FLAG-gg-ICER I γ transgenic construct onto an expression vector and perform functional analysis in cell culture. This transgene would utilize a lenti-viral delivery vector and infect fertilized *Gallus Gallus* eggs, to generate transgenic hens. Using a well established signaling pathway, we hypothesize that ICER over-expression in hens ovaries will trigger changes in gene expression that will induce hyperovulation.

Title: Synthesis of Novel Thieno[2,3-d] pyrimidines Bonded to Ionic Liquids

Presenter: Allyson Bress

Advisor: Jack Isidor

Abstract: The goal of this research was to synthesize and characterize a small library of new compounds that consist of an imidazolium chloride substituted at the 4-position of some thieno[2,3-d] pyrimidines. In the past, substituted thieno[2,3-d] pyrimidines, particularly those with aliphatic or aromatic amine substituents at the 4-position, have been the basis for many active drugs. The pyrimidine ring system itself is arguably the most prevalent and widespread feature of drugs in the pharmacopeia. The incorporation of the imidazolium chloride as a substituent at the 4-position on these heterocyclic rings should alter their properties relative to the cases where there is a simple amino group at this position. In particular, the imidazolium salt should increase the polarity of the molecule and affect its solubility and transport properties. The synthesis of seven new compounds is described. Preliminary results of how these compounds responded in kinase inhibition studies is presented.

Title: Ionic Liquids as potential Kinase Inhibitors

Presenter: Allyson Bress

Advisors: Jack Isidor and John Siekierka

Abstract: Ionic liquids are ionic salts that, unlike traditional metal-based salts such as sodium chloride, consist of a resonance stabilized organic cation and a conventional anion such as halide, nitrate, tetrafluoroborate, etc. The goal of this research was to synthesize and characterize a small library of new ionic liquids that consist of an imidazolium chloride substituted at the 4-position of some thieno[2,3-d]pyrimidines that are known to have wide-ranging physiological activity. Recent research has shown ionic liquids to be quite promising not only in green chemistry applications but also in many other areas of chemistry and biochemistry, such as enzyme inhibition, electrochemical applications, and pharmaceutical chemistry. The six newly synthesized compounds were analyzed with LC-MS and NMR spectrophotometry to verify their structures. Of the six compounds, F083 has structural similarity to the known Bcr/Abl kinase inhibitor iminitib (Gleevec). This compound was assayed, therefore, for activity against Abl kinase using two different fluorescence based assays. The compound library was tested for inhibition c-Abl kinase and the serine/threonine p38 mitogen activated protein kinase (p38). None of the compounds were found to inhibit p38 when tested against the positive control RWJ67657. However, when tested against the c-Abl kinase, all compounds showed inhibition with compound F083 being the most potent with an approximate inhibition of 40% at a concentration of 10 micromolar. The results justify further exploration of this compound as a Bcr/Abl kinase inhibitor, including creating a complete dose response curve as well as possible modification of the compound's structure in order to increase potency.

Title: Using Radionuclides to Investigate NJ Rivers for Sources of Excess Fine Grained Sediment

Presenter: Nicole M. Bujalski; **Co-authors:** Jared M. Lopes, Joshua C. Galster, Huan Feng and Kirk Barrett

Advisor: Joshua Galster

Abstract: In 2007 the Environmental Protection Agency declared excess sediment loading as the largest cause of stream impairment in the United States. The turbidity from excess sediment can cause ecological and biological damage as well as affecting recreation and water sources. The source of this sediment loading can be caused by bank erosion or overland runoff, but the difficulty comes in determining the source. Characterizing the sediment using the radionuclides ^{137}Cs and ^{210}Pb may allow the source to be determined. Due to the atmospheric deposition of the radionuclides, it is assumed that sediment coming from surface erosion will have a higher activity than bank erosion. Case studies of urban and rural water sheds were conducted to better understand how these processes occur. The general hypothesis was that urbanized land would cause sediment loading from bank erosion. Vast amounts of impermeable surface will cause an increase in urban runoff. Larger discharges in rivers will cause added stress on the system, often resulting in bank erosion. Rural or agricultural watersheds on the other hand are characterized by frequent tilling and more permeable surfaces. This causes sediment loading from surficial (rill and sheetwash) erosion. When the source can be identified, best management practices can be employed to remediate waterways and for future land use planning.

Title: Molecular Forensics of Passaic River Sediments with an Interest in Biomarkers and Polycyclic Aromatic Hydrocarbons

Presenter: Nicole M. Bujalski

Advisor: Michael A. Kruge

Abstract: The tidal lower Passaic River which extends from the Dundee Dam to the Newark Bay has been heavily contaminated during the 20th c. due to the industrial use and the urbanization of its banks. Two long (5 and 6.7 m) Passaic River sediment cores were analyzed using a molecular forensic approach. The cores were taken near the mouth of the river. A suite of organic molecules was quantified using pyrolysis-gas chromatography/mass spectrometry (Py-GC/MS) to better understand the processes involved in legacy and ongoing contaminant patterns. The 4-vinylguaiacol/indole (VGI) ratio is used to assess terrestrial versus aquatic biomass influx to the system, as well as to trace general sediment transport processes. The data suggests predominant terrestrial plant input in core 9A (VGI > 1) except for the deepest three samples which contain relatively more aquatic organic matter (OM). The top and bottom sediments in Core 7A show a predominance of aquatic biomass, while terrestrial OM is relatively more important mid-core. Petroleum biomarkers including hopane, pristane and phytane indicate significant petroleum product contamination of the sediments, > 30 mg/kg in the middle sediments of both cores. Sewage markers have also been observed (but not quantified) in some samples indicated a fresh, ongoing source of input, most likely a result of combined sewer overflows (CSOs). Polycyclic aromatic hydrocarbons (PAHs) have been found at relatively high concentrations in all samples. Concentrations of benzo(a)pyrene have been found as high as 18 mg/kg. There are very high concentrations of total PAHs (> 40 mg/kg) spiking up to 460 mg/kg. The spike in 7A occurs just above the gravelly layer at the bottom of the core, suggesting that PAHs may have migrated via the porous gravel then upwards into the finer sediment.

Title: Investigation of amino acid residues involved in the sunflower thiolase reaction mechanism

Presenter: Melissa Cadet; **Co-author:** Iris Gomez

Advisor: James Dyer

Abstract: Acetoacetyl CoA thiolase is one of two thiolase activities found in sunflower cotyledons. This thiolase activity is involved in the oxidation of the short-chain substrate acetoacetyl CoA to produce two acetyl CoAs. Crystal structures of thiolase from other organisms have identified conserved cysteines and a histidine present in the active site of the enzyme indicating that these residues probably play a key role in the reaction mechanism. The purpose of this research is to do site-directed mutagenesis of the corresponding cysteine and histidine residues in the sunflower acetoacetyl CoA thiolase

Title: The Soil Beneath the Pines: How variations in soil characteristics affect plant growth in communities dominated by *Pinus strobus*

Presenter: Anthony Cauterucci

Advisor: Greg Pope

Abstract: To obtain an understanding of how soil characteristics can effect pine growth, and how pine growth can affect soil characteristics, soil samples were taken and diameter breast heights were recorded at three sites of similar elevation, topography, and aspect in communities dominated by Eastern White Pine (*Pinus strobus*).

Transects were chosen at Mills Reservation in Montclair, NJ, South Mountain Reservation in West Orange, NJ, and Veteran's Park in Essex Fells, NJ. Soil samples will be tested for macro and micro-nutrient levels, pH, soil moisture content, bulk density, percent organic matter, and particle size. These parameters will be related to biomass on each site. Initial results show that a nitrogen deficiency may be common within all three pine stands, that a surplus in potassium may be present within the stands, and that phosphorus may become a limiting nutrient to pure pine stands over time. It is expected that stands with soils of higher bulk density will have less biomass on site, and that sites with no limiting nutrient, higher moisture content, and more organic matter will have higher biomass levels. This data will provide valuable information in understanding what characteristics of soil are essential to create a thriving ecosystem for sustainable growth of pines in stand communities of north eastern New Jersey. This baseline knowledge will be helpful for reference in restoring at risk ecosystems and by giving an idea of what parameters are present in similar, healthy, communities.

Title: Synthesis of Fluorophoric Bromo-substituted Rhodamine ligands

Presenter: Adrienne Conklin; **Co-author:** Kenneth Yamaguchi (New Jersey City University)

Advisor: Kenneth Yamaguchi

Abstract: Bromo-Substituted Rhodamine derivatives are an optimal starting point for the synthesis of elongated fluorophoric molecules. The synthesis of these rhodamine derivatives elongated with a series of bridges and ligands is currently under investigation and results will be characterized and reported.

Title: Indications of Potential Toxic/Mutagenic Effects of World Trade Center Dust on Cells in vitro

Presenters: Constantino Lambroussis, Barbara Soares, Caitlin Ament, Anise Elie and Lotfi Bassa

Advisor: Ann Marie DiLorenzo

Abstract: Preliminary research conducted on Human Lung Fibroblast Cells exposed to World Trade Center (WTC) Dust at various ppm concentrations and simulated stress environments (via decreased serum levels) indicated that the exposed cells presented with decreased levels of cell proliferation as WTC Dust ppm in test media increased, regardless of serum level present in the media. The particle concentrations of WTC Dust assessed for each serum concentration included 1.25, 2.5, 12.5, 25, 125, and 250 ppm. The serum concentrations used included 10% Fetal Bovine Serum (FBS) as the non-stressed level, followed by 2.5% and 1% FBS as simulated stress environments. The purpose of this ongoing research project is to investigate the extent of cellular damage resulting from World Trade Center Dust exposure to human lung tissues. Assessment for apoptosis (programmed cell death) showed that higher than baseline levels of apoptosis were present in WTC Dust exposed cells in both MRC-5 (male) and WI-38 (female) human lung fibroblast cells. Exposure levels as low as 25 ppm WTC Dust have shown increased levels of apoptosis. Determining if chromosome breakage (micronuclei formation) is occurring is currently planned for future research. If decreased cell proliferation, apoptosis, and chromosome breakage are present following exposure, this provides evidence to support World Trade Center Dust as a possible carcinogenic agent.

Title: The response of Japanese barberry to partial or complete defoliation

Presenter: Tony Cullen; **Co-author:** Jean-Edson Belcourt

Advisor: Dirk Vanderklein

Abstract: New Jersey is host to a number of non-native invasive plant species that out-compete the native plants for space, sunlight, and soil. One of those plant species, Japanese barberry (*Berberis thunbergii*), has become particularly wide-spread in certain regions of New Jersey. Various theories exist to explain the ability for non-native organisms to become invasive. One of these theories states that they have a competitive advantage as a result of a lack of natural predators. Until recently, it was thought that Japanese barberry profited from a lack of defoliators, but last year Joan Ehrenfeld of Rutgers University, NJ documented extensive defoliation across a wide geographical distribution in New Jersey. This research is set up to address if Japanese barberry possesses certain properties that help it maintain its invasiveness following defoliation. This research will assess how Japanese barberry may be affected by partial or total defoliation. Our working hypothesis is that Japanese barberry will be negatively impacted by defoliation. To study this hypothesis, we defoliated by hand the leaves on new stem growth of large- and small-sized barberry plants by either 50% or 100%. We measured response to defoliation by measuring carbon uptake through photosynthesis and carbon allocation to growth. Photosynthesis was measured twice during the summer and growth was assessed on plants harvested at the end of summer. Our results indicate that, in fact, Japanese barberry is not affected in any way by partial or complete defoliation; thus, giving the plant another advantage over its native competitors.

Title: Induction of apoptosis by triptolide: lysosomal activity

Presenter: Deanna De Vore

Advisor: Reginald Halaby

Abstract: Triptolide (TPL) is a diterpenoid derived from the naturally occurring Chinese herb, *Tripterygium wilfordii Hook f.* It has many uses, one of which may be a less toxic alternative to chemotherapy and radiation for oncology patients. The pharmacodynamics of this herb are still not well understood. Our laboratory has previously demonstrated that TPL induces apoptosis in MCF-7, human breast adenocarcinoma cells. This was shown by MTT assay, TUNEL assay, DAPI (4', 6-diamidino-2-phenylindole) staining, and hematoxylin and eosin staining. In this study, we have specifically investigated lysosomal enzyme activity and lysosomal morphology in MCF-7 cells exposed to TPL. MCF-7 cells were treated in the presence or absence of TPL and monitored using a biochemical assay for acid phosphatase, which is a marker enzyme for lysosomes. There was a significant increase in lysosomal enzymatic activity in treated cells after 24 h. Cells were also stained with LysoTracker Green® and counterstained with DAPI. An increase in the number of lysosomes was detected in TPL-treated cells after 24 h. The experimental cells also displayed cell shrinkage and chromatin condensation, hallmarks of apoptosis. These results lend support to the notion that the cell death mediated by triptolide in MCF-7 cells is a lysosomal-mediated death. To decipher the molecular mechanisms by which TPL regulates apoptosis in these cells, we are currently measuring the expression levels of pro- and anti-apoptotic proteins via western blot analysis.

Title: Study the Potential Heterotrophic Growth in Phototrophic Cyanobacteria *Synechococcus* sp. IU 625

Presenters: Livia Dervova and Linda Uwumarogie

Advisor: Lee H. Lee

Abstract: *Synechococcus* sp. IU 625 is an important bacteria commonly used in biology research in several aspects including environmental control, metabolism, and genetics. It is a unicellular photosynthetic cyanobacterium. Its photosynthesis machinery is very similar to that of eukaryotic photosynthesis and is able to photolysis water in the presence of oxygen. In this study, a possible heterotrophic metabolism was carried out using vanillate as an organic source. Two sets of experiments with different concentrations of vanillate (0.0, 0.5 mM, and 1.0 mM) were put into light and dark environments respectively. The growths of the cultures were monitored by spectrophotometer at 750nm for turbidity study, while a hemocytometer was utilized to determine a direct cell count. The degradation of vanillate was monitored using spectrophotometer at 286nm. The results showed that similar growth for the sets grown in the light environment for all concentration of vanillate. From the degradation study, it suggests that in the presence of light, the cells do not use vanillate as their carbon source. Subsequently, the sets that grew under dark conditions exhibited growth rates that were severely inhibited compared with the light sets. The comparison among the dark conditions of variable concentrations of vanillate indicated that although their growth was limited, the higher concentration of vanillate the better growth was observed. From the degradation study, the outcome indicated that the dark cultures used vanillate as their carbon source. The morphology of the cultures showed elongation of the bacteria which contrasted the short rod shape in the control. This study suggests that *Synechococcus* sp. IU 625 may be able to grow in the dark to an extent if there is an external carbon source available. This further suggests that *Synechococcus* sp. IU 625 may contain some genes that can metabolize external carbon source.

Title: Urban Recovery in the City of Passaic

Presenter: Christina Evers

Advisor: Greg Pope

Abstract: Since the rapid decline in industrial activities along the Passaic River over the last 2 decades, many of the cities who were home to these companies have been financially struggling ever since. When the corporation's left, they took the money with them but left behind numerous large factory buildings that still stand today. Many of these abandoned factories are located in Passaic, New Jersey. The buildings are eye sores and a depressing symbol of a past that once was. Much of the surrounding area is run down and ridden with demographic and financial problems. A great start to improving the quality of the area and utilizing what is already there would be to redevelop the abandoned factories. They can be converted into businesses and low income housing. In order to do this, I will be examining other cities who have gone through similar trends, a period of economic success followed by a time frame where the area fell into its own decline. The main focus will be on cities that have climbed out of the financial rut and are now again a place of wealth and prosperity. By studying these trends, as well as the histories of these areas, recommendations for urban recovery can be made.

Title: Optimization of expression and purification of Acetoacetyl CoA Thiolase from Sunflower Cotyledon

Presenter: Iris Gomez; **Co-author:** Melissa Cadet

Advisor: James Dyer

Abstract: Sunflower (*Helianthus annuus L*) cotyledons have two thiolase activities that have been identified previously. Thiolase I (acetoacetyl CoA thiolase) has specificity for the four-carbon acetoacetyl CoA, resulting in the production of two Acetyl CoA molecules. Thiolase II (oxoacyl CoA thiolase) is active towards short, medium and long chain acyl CoAs. The purpose of this research was to optimize the expression and purification of a Thiolase I from an E. coli expression system. The sunflower thiolase was cloned into the pET151 expression vector, and this construct was transformed into BL-21 E. coli that were induced for production of the Thiolase I with 1 mM IPTG. The soluble Thiolase I was purified using Ni-NTA agarose affinity chromatography with a single band appearing on a Coomassie Blue stained SDS-PAGE in the fraction eluted from the column with 100 mM imidazole.

Title: Effects of phosphates and nitrates on water elements in the city of Neptune

Presenters: Keneka Gordon, Barabara Hantzopoulos and Tayyab Malik

Advisors: Kevin Olsen and Ann Marie DiLorenzo

Abstract: Among the many minerals that exist today, phosphate and nitrate were chosen to be experimentally tested due to their common presence in aquatic environments and natural fertilizers. Although united concentrations of these minerals is a great source of nutrition for plants, excess amounts can be damaging to the existence of various organisms. Water quality is also jeopardized if there is too little present. In this study, large containers were used to sample water from a lake in the city of Neptune following a major rain fall. Samples were taken at intervals to assess the pollution factor at onset of the rain storm and specific times after the onset of the storm. Samples are presently being tested for toxicity levels after this event. It will help to identify how much of these elements are present. This study hopes to determine if the rain fall elevated the amount of phosphorous and nitrogen in the body of water. A possible adverse effect could have made conditions worse for the people of Neptune by causing pollution increase. Adverse effects can exist also when the amounts of the minerals were depleted

Title: Wind Energy Potential for the campus of Montclair State University

Presenter: Darryl Green

Advisor: Gregory Pope

Abstract: Is the campus of Montclair State University a good location for small scale wind energy generation? On June 10, 2008, a strong storm moved across northern New Jersey. This storm generated winds of 38 mph with gust of 69 mph at Teterboro, 44 mph winds with gust of 58 mph at Newark, and 14 mph winds with gust of 33 mph at Caldwell. This storm was strong enough to down trees and power lines across the region causing thousands to be without electricity, in some cases for several days. How much energy could the campus of Montclair State University generate from wind? With this in mind, I gathered data from January 1st to Friday April 10th from Caldwell, Newark, and Teterboro airports. Data will continue to be collected until Wednesday, April 15th. Unfortunately, hourly observations are not available. The data are not given in hourly increments but an average of the day's observations (average wind speed, the days maximum wind speed, and the days maximum wind gust). My goal for this phase of the project is to get a rough estimate of potential wind energy generated since January 1st. Keeping in mind that wind generally increases with height, Caldwell 4.61 miles west-northwest of MSU rest at 174 feet, Newark 12 miles south-southeast rest at 10 feet, and Teterboro 7.33 miles east also rest at 10 feet above sea-level. The campus of Montclair State University rest at an elevation of 436 feet above sea-level, that's 262 feet higher than Caldwell and 426 feet higher than Newark and Teterboro. What type of winds would be generated at an elevation well over 400 feet? The second phase of this project is to construct a weather monitoring system on top of Mallory Hall in order to gather data that will indicate the potential amount and consistency of the winds on campus. Hopefully, this project draws support and interest from the campus community considering the University signed a Memorandum of Understanding with the US Environmental Protection Agency agreeing to meet high environmental standards designed to reduce the carbon footprint of the campus. The final goal of this project is to work towards the construction of small scale wind turbines for the campus community.

Title: In vitro inhibition of Sindbis virus replication by Glycyrrhizin

Presenter: Luz Guevara

Advisor: Sandra Adams

Abstract: Alphaviruses, a genus of the *Togaviridae* family, are responsible for a wide spectrum of human and animal diseases ranging from silent asymptomatic infections to fever to encephalitis. Alphaviruses are transmitted via mosquito bites and have a high incidence of disease in Africa, Asia, Australia and Eastern Europe. Previous research had shown that certain medicinal plant compounds present antiviral activity and can be used to treat viral infections. The purpose of this study was to determine if glycyrrhizin, a natural compound found in the *Glycyrrhiza glabra* plant commonly grown in Europe, was able to inhibit the infection of Sindbis virus in Vero cells. Vero cells, treated with glycyrrhizin, were infected with Sindbis virus. Viral media from these experimental cells and from control cells were then used to determine the viral titer by the TCID₅₀ method. Cells were also examined microscopically for morphological differences. The results indicated that there were fewer viral particles released in the experimental plates with the glycyrrhizin treatment, compared with the control plates. Based on the results we conclude that glycyrrhizin is able to inhibit Sindbis virus replication and can therefore, be further investigated for treatment of Alphavirus infections.

Title: The Isolation and Purification of Cyanobacterial *Synechococcus* sp. IU 625 and Cyanophages AS-1 Cultures and their DNA for PCR-based assays

Presenters: Bobak Haghjoo, Omar Mercado and Cerinena Redman

Advisor: Lee H. Lee

Abstract: *Synechococcus* sp. IU 625 (*Anacystis nidulans*) is a unicellular, rod-shaped cyanobacterium. Notably, it is utilized as an indicator species for environmental contamination and produces dense algal blooms in freshwater. Cyanophages possess crucial roles in modulating cyanobacteria populations. In our research lab, both cultures of *Synechococcus* sp. IU 625 and the cyanophages were maintained. Experiments were performed in order to develop the molecular probe for identification of a host and its virus in the polluted environment. A detrimental rise in temperature and humidity in the research lab contaminated all the cultures in the summer of 2008. Thus, several procedures were conducted to isolate pure cultures of *Synechococcus* sp. IU 625 and AS-1. Cultures contaminated with mold were disposed while other cultures contaminated with bacteria were purified with serial dilutions and discontinuous streaking techniques. Cells and cellular debris were eradicated from cyanophage lysates by centrifugation at 5,000 rpm and 9,000 rpm, respectively. The supernatants later underwent filtration with Nalgene filter units in order to obtain the pure cyanophages. DNA extraction from *Synechococcus* sp. IU 625 and cyanophage were carried out. This extraction involved numerous centrifugations, digestion with enzymes, incubations, and deproteinization. After successful DNA extraction, a Nanodrop confirmed the quantity and purity of DNA, and the results exhibited a desired ratio of DNA/protein and proper amount of DNA. The purified DNA of *Synechococcus* sp. IU 625 and cyanophages were diluted and proper concentrations were determined to be used for PCR-based assay.

Title: A Study of Dredging as it Relates to the Hudson River Superfund Site

Presenter: Vanessa Harries

Advisor: Gregory Pope

Abstract: The Hudson River Superfund site spans a length of 197 miles, of which the Environmental Protection Agency has found to be contaminated with polychlorinated biphenyls. PCBs, used in the production at General Electric's manufacturing plants in the last century, have been found to be carcinogenic and thus of probable harm to humans. The preferred method of sediment remediation is dredging, and the EPA and GE have worked together over several years' time to plan the dredging project. The scope and breadth of this project are unprecedented, thus many questions have arisen as to the safety of this project. This paper serves to delineate the proposed dredging project, compare similar dredging and remediation projects, and determine if the project is the optimal solution for the riverbed. This study will include consultation with several professionals that have knowledge of the project, and an understanding of environmental dredging. It will also include in-depth case studies of several other sites that have undergone sediment remediation. Aspects of environmental dredging as it differs from navigational dredging will be researched. Finally, a stringent search for alternative technologies and research for the remediation of PCBs will be conducted. The results anticipated include an alternative approach to the finalized dredging project of the Superfund site.

Title: A Computational Study of the Structure of α -Glucopyranose and β -Glucopyranose in the Gas Phase and in Solvent Systems

Presenters: Mark A. Haverick, Joseph P. Campos and Cameron M. Stewart

Advisor: Marc Kasner

Abstract: Glucopyranose is the principal compound in the metabolic pathway by which heterotrophic organisms receive their carbon atoms and more importantly, their energy. The structure of glucopyranose in solution can be represented by a 6-membered ring containing an oxygen atom, a CH_2OH on the ring adjacent to the oxygen in the ring and several additional OH substituents on the ring (Figure 1a).

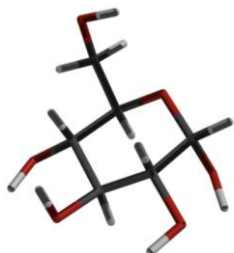


Figure 1a: α -D-Glucopyranose

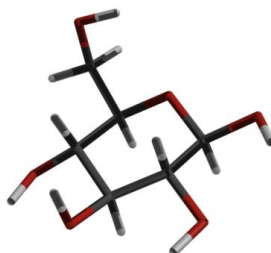


Figure 1b: β -D-Glucopyranose

In the β form, the OH group adjacent to the ring oxygen switches from the axial position (Figure 1a) to the equatorial position (Figure 1b)

Experimental results show that the ratio of α -D-glucopyranose to β -D-glucopyranose is 34% to 66%. However, it should be recognized that the molecules illustrated in Figure 1 are not the only possible structures for the axial (α) and equatorial (β) forms of glucopyranose.

Studies show that both α -D-glucopyranose and β -D-glucopyranose exist in three forms (shown in Figure 2) separated by about a total of 1.5-2.0 kJ (0.4-0.6 kcal). A close examination of Figure 2 shows that there are two other axes of rotation that can have some effect on the relative energy of glucopyranose: the O-C bond on the exocyclic methyl group (Figure 3a) and the O-C bond on at the number 2 ring position (Figure 3b).



Figure 2: gg, gt, and tg Rotamers of α -D-Glucopyranose



Figure 3a



Figure 3b

Additional Rotations Possible in α -D-Glucopyranose

A computational study to determine the potential energy surface as a function of the rotations illustrated in Figure 2 and Figure 3a was carried out at the HF/6-311G++ (d,p) and B3LYP/6-311G++(d,p) levels. Identification of energy minima and the relative energies of the other semi-stable rotamers will allow a better determination of the structural equilibria among the individual forms of α & β D-glucopyranose and the α -D-glucopyranose to β -D-glucopyranose equilibrium. Additionally, computational studies of the solvated system (with both water and methanol) will allow a clearer picture of how the structures of α -D-glucopyranose to β -D-glucopyranose is affected by solvents.

Title: In Vitro Toxicology of Heavy Metals Lead and Cadmium on Cultured Rodent Cells and MRC-5 Lung Cells

Presenters: Anise Elie, Michelle Hernandez and Fahad Rouf

Advisor: Ann Marie DiLorenzo

Abstract: Among the heavy metals that exist today, Cadmium and Lead were chosen to be experimentally tested due to their common presence in everyday life. One of the most deadly metals that currently exists is the pollutant lead. High exposure to the metal in drinking water increases the risk for damaging effects to the nervous, cardiovascular, and kidney systems. Pregnant women, developing fetuses, and children are the most susceptible to the poisonous effects of lead. Although cadmium has many uses, it is a substance of concern in regards to human health as its toxic effects have been associated in several diseases including osteoporosis, cancer, and kidney dysfunctions. Lead and Cadmium are naturally occurring elements and are usually found in combination with other elements. In this study both Chinese Hamster Ovary cells (CHO) and MRC-5 Lung Cells (human male lung cells) were cultured in 2 separate experiments using twenty-four well plates. Ham's F-12 media was used for the CHO cells and MEM media was used for the lung cells. Combinations of lead nitrate, cadmium nitrate, cadmium sulfate, and cadmium chloride were used at 125ppm and 250ppm. Presently, using these chemicals, the re-growth of cells is being measured inside the 1cm x 1cm area where the monolayer of cells have been removed by scraping. It is expected that wound healing will be modified by varying levels of these xenotoxic salts of heavy metals. Quantification of re-growth should show or detail the possible effects of specific chemicals on cellular proliferation.

Title: Characterization of COX3, tRNA-Gly, ND3, tRNA-Arg, ND4L, and ND4 Genes in the Natterjack Toad Mitochondrial Genome

Presenters: Ali Hoshiyari, Maureen Dempsey and Barbara Soares

Advisors: John J. Gaynor, John K. Korkey and Kirsten Monsen

Abstract: The Natterjack toad (*Epidalea calamita*, formerly *Bufo calamita*) is a toad native to northern Europe. This toad, the only toad species native to Ireland, lives in sandy and heathland areas. Due to loss of habitat from human overpopulation, reduction in habitable coasts due to construction of dykes and seawalls, and acidification of aquatic habitat from acid rain and other pollution factors, there has been a significant decrease in the Natterjack toad population. DNA samples of this species have been collected from Castlegregory, Ireland and Roscullen Island, Ireland. In this study, segments of the mitochondrial DNA coding for COX3, tRNA-Gly, ND3, tRNA-Arg, ND4L, and ND4 genes have been sequenced for the first time. This study is ongoing and, once completed, will allow for a better understanding of the phylogenetic relationship of *Epidalea calamita* to other toad species. A completed mitochondrial genome may also allow for a better understanding of genetic differences and similarities among different Natterjack toad populations.

Title: Predicting Drug-target Interactions Using Phylogenetic Trees

Presenter: Sean Hughes

Advisor: Nina Goodey

Abstract: The discovery of medicinal drugs that have the desired pharmacological profiles is critical for human health and survival is time consuming and expensive. Consequently we must also aim for obtaining maximum benefits from those medicinal compounds that have already been identified and found to have favorable properties. To address this need, we propose to develop computational tools for predicting drug-enzyme interactions based on evolutionary relationships between homologous enzymes from different organisms. We plan to use the enzyme dihydrofolate reductase as a model system and predict which existing drugs that have already been found to successfully inhibit this enzyme from one organism can be used to inhibit the same enzyme from another organism. The binding between the drug dihydrofolate reductase pairs will be experimentally evaluated and the mechanism of inhibition analyzed. While these tools will be applicable to other enzyme systems, dihydrofolate reductase is both an important target and a good model system: this enzyme has recently been of interest as a drug target in many

global health issues. Many sequences and crystal structures are available for dihydrofolate reductase and purification is easy due to the commercial availability of affinity chromatography resin specific for this enzyme. The computational approach is based on the hypothesis that similar molecules bind to similar sequences using phylogenetic tree relationships as the measure of similarity.

Title: Progress on New Syntheses of Aromatic Fluoro-Amino Acids

Presenter: Montaser Khalil; **Co-authors:** Drilona Seci and Safa Tamimi

Advisor: David Konas

Abstract: Fluorinated amino acids are essential tools for biological and pharmaceutical chemists. The substitution of fluorine for hydrogen in an amino acid structure can have dramatic and desirable effects on its chemical reactivity. Selective, electrophilic fluorination using so-called "NF" reagents is an important safe and modern way to add fluorine to electron-rich compounds such as aromatics. Because of these two facts, there is a demand for new efficient syntheses of fluoro-amino acids and an interest in developing new applications for "NF" reagents. In this presentation, we will describe our strategies for the synthesis of aromatic fluoro-amino acids using electrophilic "NF" fluorinations, progress on the preparation of fluorination substrates, and our initial fluorination results.

Title: A study of future dentistry needs

Presenter: Oguz Konar

Advisor: Dirk Vanderklein

Abstract: At the beginning of 2009 spring semester, I started working for a dental supply company named Smile Dental Supply whose primary goals are to supply dentists with products they use in their daily dental practice, promote new technologies, and educate them, through seminars, about latest developments and products in dental industry. I was hired by this company as a business-to-business dental sales representative, and given the responsibility of growing the companies business in northern New Jersey in the light of the company goals mentioned above. However as a research student this was a great opportunity for me to do my externship in dental field and utilize my scientific skills to expand my knowledge about dental diseases. The purpose of this research was to find the most important dental disease that will make the greatest impact on patients in the next 25 years. I did a survey and asked this question to all the doctors that I had visited during my research and received a surprising overall result. Most of the dentists believe that gum disease will keep its place as the most important dental disease in the next 25 years.

Title: Effects of road deicers on survival and behavior of larval and adult wood frogs

Presenter: Kristen Kwasek

Advisor: Lisa Hazard

Abstract: Use of road deicers (primarily NaCl) in the northeastern U.S. has increased dramatically over the last century. Salts applied to roads can travel considerable distances from the site of application, and may contaminate local watersheds to levels above 100 mM. Amphibians that breed in vernal pools early in the spring, when salt levels could still be high, may be especially vulnerable to increased salinities. We integrated responses of larval and adult wood frogs (*Lithobates sylvaticus*) to increased salinity to determine whether adult frogs would be able to detect and avoid salinities that would be detrimental to them or to their offspring. Tadpoles were raised in groups at concentrations ranging from 0-200 mM NaCl. No tadpoles at higher concentrations survived to metamorphosis. At low salinity, tadpoles had slightly higher mortality and lower growth and development rates than control animals. Adult frogs were mildly dehydrated to induce thirst, then placed in a shallow dish of water ranging from 0-500 mM NaCl. Location (in or out of the dish) and behavior (moving, standing, sitting, or water absorption response) were recorded during a 10-minute trial. In contrast to arid-adapted anuran species, the wood frogs showed no aversion to salt, remaining in even 500 mM NaCl for the full 10 minutes. Mass loss during the 10-minute trials increased with increasing salinity. The results have important ecological implications. Tadpoles showed sublethal effects even at relatively low concentrations and high mortality at higher concentrations, but adult wood frogs may not be capable of evaluating the salinity of potential breeding sites, leaving this species potentially vulnerable to increased mortality or subtler sublethal effects due to road salt runoff.

Title: Indications of Potential Toxic/Mutagenic Effects of World Trade Center Dust on Cells *in vitro*
Presenters: Constantino Lambroussis, Barbara Soares, Caitlin Ament, Anise Elie and Lotfi Bassa
Advisor: Ann Marie Dilorenzo
Abstract: Preliminary research conducted on Human Lung Fibroblast Cells exposed to World Trade Center (WTC) Dust at various ppm concentrations and simulated stress environments (via decreased serum levels) indicated that the exposed cells presented with decreased levels of cell proliferation as WTC Dust ppm in test media increased, regardless of serum level present in the media. The particle concentrations of WTC Dust assessed for each serum concentration included 1.25, 2.5, 12.5, 25, 125, and 250 ppm. The serum concentrations used included 10% Fetal Bovine Serum (FBS) as the non-stressed level, followed by 2.5% and 1% FBS as simulated stress environments. The purpose of this ongoing research project is to investigate the extent of cellular damage resulting from World Trade Center Dust exposure to human lung tissues. Assessment for apoptosis (programmed cell death) showed that higher than baseline levels of apoptosis were present in WTC Dust exposed cells in both MRC-5 (male) and WI-38 (female) human lung fibroblast cells. Exposure levels as low as 25 ppm WTC Dust have shown increased levels of apoptosis. Determining if chromosome breakage (micronuclei formation) is occurring is currently planned for future research. If decreased cell proliferation, apoptosis, and chromosome breakage are present following exposure, this provides evidence to support World Trade Center Dust as a possible carcinogenic agent.

Title: The Effect of Temperature on Infectivity of Coliphage T4r
Presenter: Kristen Larson; **Co-author:** Mazahbin Tibbi
Advisors: Sandra Adams and Dirk Vanderklein
Abstract: The efficiency of the bacteria phage, T4r, to infect *E. coli* was tested in this experiment by placing it under various temperature conditions. The hypothesis was that greatest level of infectivity would occur at the coolest temperature. The size and amount of plaques is the measure of viral infectivity.

Title: Effect of pH Level on T4r Coliphage
Presenters: Jeanne Lehmann, Raymond Lugtu de Dios and Wardha Khawaja
Advisor: Sandra Adams
Abstract: The purpose of the experiment is to determine the effect, if any, of a change in pH of the viral media on the ability of a T4r coliphage to infect a culture of *Escherichia coli*. The experiment involves a comparison of the viral titer as measured by plaque assay of the following 1) a plate containing 0.25 mL of an *E. coli* B broth and the serial dilutions of T4r coliphage; 2) a plate containing 0.25 mL of *E. coli* B broth and diluted T4r coliphage with an altered pH level; and 3) a control plate containing 0.25 mL of *E. coli* B broth, with an altered pH level equivalent to the experimental sample. The pH level was monitored and adjusted accordingly to ensure a viable environment for the *E. coli* B colony. Therefore, pH levels in this experiment were limited in acidity to a pH of 3.0.

Title: Analysis of RET signal transduction and downregulation in transfected VERO Cells
Presenter: Shani Maslovski
Advisor: Quinn Vega
Abstract: The Ret proto-oncogene encodes a transmembrane receptor tyrosine kinase which plays key role in neural differentiation and survival as well as development of the enteric nervous system and kidneys. RET is activated through interaction with members of the ligand-binding co-receptors GFRA 1-4 and its corresponding neurotrophic factors consisting of glial derived neurotrophic factor (GDNF), neurturin (NTN), artemin (ART) and persephin (PSP) forming a heterodimer structure. Upon activation, Ret undergoes autophosphorylation at select tyrosine residues in the intercellular catalytic domain creating docking sites for proteins involved in signal transduction. Mutations of the ret gene have been associated with several cancers such as MEN2A and MEN2B as well as the developmental disorder Hirschsprung's Disease. In order to analyze the effect of RET mutations on signal transduction and down-regulation, VERO cells were transfected with mutant forms of RET and the affect of RET mutations on protein degradation was analyzed using cyclohexamide treatment and Western blot analysis. Experimental results suggest that MEN2A and MEN2B have unique degradation pathways. Moreover, an interaction of co-receptor GFRA-1 with RET was analyzed using Molecular Biology techniques. Preliminary data suggest that upon activation and signal transduction, RET protein is degraded while the levels of GFRA-1 remain unchanged. Future experiments will be performed to confirm these changes and to study the effect of RET mutations on protein down-regulation and association with the co-receptor GFRA-1.

Title: Protein acrobatics: the relationship between motion and catalysis in dihydrofolate reductase from *Bacillus stearothermophilus*

Presenter: Andrew Mauro

Advisor: Nina Goodey

Abstract: Most enzymes have defined three-dimensional structures but are not rigid, rather they flex to change conformation and local shape. The study of protein conformational motion is critical for the field of drug design. The motions that take place upon the binding of a compound to a protein must be considered for a realistic representation of protein structure that is a useful computational starting point in the design of biologically active pharmaceutical compounds. It is not trivial to capture these motions because enzymes are too small to be viewed via optical microscopy and consequently it is necessary to apply novel methods to determine the extent, direction, and rates of these motions. The careful correlation of the motion of dihydrofolate reductase from *Bacillus stearothermophilus* (BsDHFR) with catalysis will be achieved by means of fluorescent probes and stopped-flow instrumentation. So far, the protein was obtained from transformed BL-21 cells using published methods (Kim et al., 2005). The protein's purity was verified by SDS-PAGE electrophoresis. Preliminary kinetic studies were performed using a stopped-flow instrument in order to determine the activity of BsDHFR at different temperatures. Next, the purified wild type protein will be labeled with the environmentally sensitive fluorescent probe PymPO via a maleimide reaction at a single naturally occurring cysteine residue. Several mutants of BsDHFR will be created that have the same probe attached at different positions in the protein structure. These extra probes will provide insight into the movement of the whole enzyme since motion at different areas of the protein can be studied. We will determine the changes in the probe fluorescence to determine the rates of motion during catalysis and binding in the protein. The observed rates of conformational motion will be correlated with kinetic rates. The results will provide insights into the conformational motion of this enzyme during catalysis. Kim et al. (2005) Structure and Hydride Transfer Mechanism of a Moderate Thermophilic Dihydrofolate Reductase from *Bacillus stearothermophilus* and Comparison to Its Mesophilic and Hyperthermophilic Homologues, *Biochemistry* 2005, 44. 11428-11439.

Title: The Geometry and Motion of a Nematode Sperm Cell.

Presenter: Kaitlyn Murphy

Advisor: Diana Verzi (San Diego State University)

Abstract: The movement of *Ascaris suum* sperm cells is caused by protrusive, adhesive and contractile forces that act inside the cell. A discrete, 2-D geometric model of the forward motion and turning of the cell is modeled in our research paper. The general assumption used is that the internal pH level of the lamellipod is responsible for motility. The main focus of this model is the protrusion of the front boundary of the cell, although contractile and adhesive forces are present in the model. This model only considers MSP bundles because they appear to be responsible for protrusion, and they make up the framework for the shape of the lamellipod.

Title: Study of Phycocyanin Gene in Cyanobacterium *Synechococcus* sp. IU 625.

Presenters: Aline Oliveira, Arti Rana and Lina Halawani

Advisor: Lee H. Lee

Abstract: Cyanobacterium *Synechococcus* sp. IU 625 is a unicellular photosynthetic prokaryote. It is a major causative agent of algal blooms in the environment. It possesses a light-harvesting complex containing pigments such as chlorophyll and phycocyanin to absorb light at different wavelengths. Phycocyanin is a unique blue pigment that gives cyanobacteria its blue-green color. This gene is a good candidate for PCR-based assay to detect cyanobacteria. In this study, a set of primers (17 forward and reverse primers) have been designed from the phycocyanin gene using the genome information obtained from a very close related strain *Synechococcus elongatus* sp. PCC 7942. The designed primers have been used to prime Syn. Sp. IU 625 purified DNA. PCR products have been analyzed by using agarose gel electrophoresis. The fragments obtained from different priming sets have been sequenced using Genewiz sequencing facility and then assembled using CodonCode Aligner. The phycocyanin gene was completely sequenced and mapped. The sequences were then sent to GenBank for BlastN and BlastP sequence similarity searches. *Synechococcus* sp. IU 625 phycocyanin α and β subunits were identified. Results showed that phycocyanin α subunit is identical and β subunits are loosely related to the subunits in *Synechococcus elongatus* sp. PCC 7942 and *Synechococcus elongatus* sp. PCC 6301. The results suggest that the phycocyanin gene is highly conserved among *Synechococcus* species

Title: Synthesis and Characterization of a Potent p38 Inhibitor- RWJ67657

Presenter: Nalinai Pather; **Co-author:** Sailaja Sankabathula

Advisors: John Siekierka, Fina Liotta and Ronald Goldberg

Abstract: The protein kinase, p38 mitogen activated protein (MAP) kinase (p38) is an important cellular signaling protein involved in a number of cellular functions including cell proliferation, cell death (apoptosis) and regulation of inflammatory response as in Rheumatoid Arthritis. Our laboratory is studying the role of p38 in HIV and parasitic infection. A number of intracellular parasites such as malaria, toxoplasma and Leishmania have homologous kinases to p38 which play an important role in the infectious cycle of these pathogens. We have been studying the kinases of these pathogens with the goal of generating low molecular weight inhibitors to be used as potential therapeutic agents. Here we report on the synthesis of the potent p38 inhibitor RWJ67657 and its inactive regioisomer. To assess the potency of these two inhibitors synthesized at Montclair State University, two high throughput fluorescent based assays were developed. One directly measures the phosphorylation of a peptide the other measures the production of ADP as a consequence of the conversion of ATP to ADP during the kinase reaction. We compared the activity of these two compounds to three other commercially available known p38 inhibitors. We determined that RWJ67657 has an IC₅₀ of 6.5 nM and 20 nM in the two assays, comparable to the commercially available known inhibitors. The regioisomer was inactive (IC₅₀ >10 μM). RWJ67657 will serve as a very useful pharmacological probe for our studies on the role of p38 in HIV disease and the function of p38 homologs in parasitic infections.

Title: Fingerprinting DNA Damage

Presenter: Franklin Paulino; **Co-author:** Johannes Schelvis

Advisor: Johannes Schelvis

Abstract: Recently skin cancer has become more prevalent due to a variety of environmental factors such as the depletion of the ozone layer. Ultraviolet radiation from the sun can cause DNA damage that leads to the formation of cancerous cells. Specifically, ultraviolet radiation catalyzes the dimerization of adjacent pyrimidine bases resulting in a dimer that inhibits DNA from functioning properly. In our experiments, we have utilized DNA strands of varying lengths and damaged them using ultraviolet light. High pressure liquid chromatography (HPLC) was used to purify the damaged DNA that contained the dimers for analysis, which was performed using Raman spectroscopy. Raman spectroscopy is a spectroscopic technique that measures the frequencies of molecular vibrations, which are unique for a given molecule. The undamaged DNA and the damaged DNA with the dimers produce their own characteristic Raman spectra that can be used to establish a "fingerprint" of these dimers in damaged DNA. This "fingerprint" will be used in future experiments to ascertain the presence of these dimers in DNA with the potential of developing a new method for the detection of these potentially dangerous DNA lesions.

Title: Autonomous Vehicle Overview

Presenters: Samuel Petrocelli

Advisor: Jing Peng

Abstract: The autonomous vehicle will have the ability to drive from one position to another on a GPS map. The system will have entered in many positions describing point to point directions and GPS will verify where the vehicle is located in respect to the next desired longitudinal and latitudinal position. A path programming system will choose the best (smoothest and shortest) path to travel from position to position. There will be two laser scanners produced by SICK that will be mounted on the vehicle to collect spatial information from the surrounding environment. Standard practice is to leave the units stationary. Instead we will turn the units vertically and oscillate them such that their internal vertical scan now has an external horizontal motion. This will allow us to view the front of the vehicle fully whether the vehicle is moved or stopped. We now have a periodically upgrading 3 dimensional view of the front of the vehicle. This data can then be analyzed to determine what is and is not an obstacle. In the event of a confirmed obstacle the path programming system can override the GPS path and adjust around the obstacle.

Title: The Sub-Prime Mortgage Crisis

Presenters: Diego Pinillos and Priyank Bhatt

Advisor: Youngna Choi

Abstract: In our "Sub-Prime Mortgage Crisis" poster, we show the reasons that drove our country to the current crisis. We do this by analyzing things such as interests and the amount of Sub-Prime mortgages given by financial institutions previous to the crisis. We also analyze its impact in the current financial market.

Title: The effect of goose feces on ground water

Presenter: Priyanka Purohit; **Co-author:** Dominick Ritacco

Advisor: Dirk Vanderklein

Abstract: There is a growing interest in the impact non-migrating geese are having on our public parks. One potential effect is the impact of their feces which is high in phosphates and nitrates. The effects of nitrate and phosphate on ground water are of interest because of their potential effects on algal growth and water quality. In this experiment we studied the effect of goose poop on ground water by simulating average feces deposition on small grass plots. The experiment consisted of twelve plots of grass in perforated pots to be able to catch soil water flow-through. Our treatments consisted of feces or no feces and mowing or no mowing with three replicates per treatment combination. Our expectations for this experiment were that we would see minor changes in the amount of nitrate and phosphate in the simulated ground water for the plots that had goose feces added to them. We also hypothesized that the mowing of the grass would yield a higher concentration of both phosphate and nitrate in the simulated ground water. We tested the simulated ground water with separate nitrate and phosphate tests every four to six weeks, collected and recorded the amount of nitrate and phosphate levels in the simulated ground water in parts per million, and compared our results. Our results show that the plots expelled the phosphate into the ground water but held onto the nitrate. We concluded this from our increased phosphate levels post-testing and the fact that there was a large amount of algae growing in the catch basins of the plots where feces were added.

Title: Montclair State University's Recycling Policy

Presenter: Candace Quinn

Advisor: Gregory Pope

Abstract: With growing concern surrounding resources and waste, it is important for communities to have effective and thorough recycling programs. This study was designed to research the recycling policy at Montclair State University with hopes of providing insight on how it can be improved. Information was collected primarily through internet research, interviews, legal documents, as well as campus wide residential surveys. Despite a Memorandum of Understanding with the EPA, contractual agreements with Waste Management, and yearly participation in RecycleMania, it was discovered that the recycling policy here at Montclair State University was perhaps too simple to be optimally effective. Overall, the school only recycles about 35% of its total waste stream. The problem seems to lie in the overwhelming sense of apathy among students, as they seem to possess limited motivation to recycle, as well as with overall allotted funds for the development of the recycling program. Only \$27,274 is budgeted for the removal of recycling materials and \$374,670 for 8 waste management personnel. Re-evaluation of the entire recycling policy should be done to ensure a greater amount of materials is recycled.

Title: Synthesis of a fluorophore-bridging polyphenyl ligand

Presenter: Luis Rodriguez, Jr; **Co-author:** Kenneth Yamaguchi (New Jersey City University)

Advisor: Kenneth Yamaguchi

Abstract: The coupling of fluorophore-bridging unit with a polyphenyl ligand represent an important class of compounds used in photolithographic, solar cell, and light emitting diode (LED) applications. The synthesis of the fluorophore unit and polyphenyl ligand are currently under investigation. The synthesis and characterization of the ligand will be presented.

Title: The Effect of Bacteriophage X174 and T4r on E. Coli

Presenters: Pablo Salcedo, Warren Farber, Yvonne Okereke and Lauren Small

Advisor: Sandra Adams

Abstract: The purpose of this investigation is to compare the infectivity of two different coliphage, Phage X174 and phage T4r. *E. Coli* is the natural host for each. Differences in infectivity will be determined by plaque assay and comparison of the size and morphology of plaques.

Title: Diphenhydramine Influences Development and Hatching of Freshwater Pulmonate Snails

Presenter: Diana Sanchez

Advisor: Robert Prezant

Abstract: Diphenhydramine is one of the several pharmaceuticals detected in New Jersey waterways. This pharmaceutical can increase the concentration of serotonin in the freshwater snail *Helisoma trivolvis*. Serotonin, a monoamine neurotransmitter, plays an important role in the mediation of larval ciliary activity and metamorphosis in *Helisoma*. Juvenile snails can release chemical signals that can be detected by the neurons of the encapsulated larvae. As a result, an induced twofold prolongation of the embryonic capsular stages may occur due to the chemical

signals causing an increase of the monoamine. Consequently, a pharmacological experimental treatment with diphenhydramine may influence similar developmental regulation and create perturbation of embryonic growth in *Helisoma*. Close observations of the embryos exposed to 1.0 mM diphenhydramine result in an approximate doubling of respective capsular stages. As a result, delayed embryonic development within the egg capsules as well as delayed hatching rates occurred. This could have important implications in the reproductive ecology of these gastropods in nature.

Title: The Delaware Water Gap Recreation Area: An Ideal Location for Promoting Education in the Parks

Presenter: Sarah Schuchman

Advisor: Greg Pope

Abstract: Outdoor and hands-on learning experiences are important in all subjects, especially the sciences, throughout a student's education. Our National Parks here in the United States provide excellent opportunities for students to receive outdoor education in some of our country's most fascinating environments. However, many schools do not take advantage of our National Parks for hands on learning. This paper explains the benefits of outdoor and hands on learning while showing that the Delaware Water Gap National Recreation Area is an ideal environment with learning opportunities for students throughout the Tri State Area. In this paper I will discuss the results of a survey I conducted among schools throughout Sussex County and Warren County. Sussex County and Warren County are the two New Jersey Counties which border the Delaware Water Gap National Recreation Area. The survey was sent to twenty five schools throughout these two counties to gather information about the schools outdoor learning, field trips, and visits to the Delaware Water Gap. The potential conclusion is that school systems throughout these counties should take advantage of the learning opportunities offered by the Delaware Water Gap National Recreation Area. The potential implications are that school systems throughout the country should also take advantage of their state and national parks for outdoor learning opportunities.

Title: Synthesis of a Novel, Water-soluble Fluorescent Sensor

Presenter: Biban Sethi

Advisor: Jack Isidor

Abstract: Our research has designed and successfully synthesized a new type of fluorescent sensor that is highly soluble in water. The molecular design incorporates the unique properties of so-called "ionic liquids" with a traditional type of anthracene-amine fluorescent "PET" sensor as scaffold. In aqueous solution, the sensor functions as a hydrogen ion (pH) sensor by relating fluorescence intensity to pH. Very few water-soluble fluorescent sensors have been developed, despite the fact that these types of sensors are ideal as biosensors at the cellular level. The design and synthesis of the sensor is presented along with data on its fluorescence properties.

Title: Mitochondrial genome sequence of *Epidalea calamita*

Presenter: Janeth Solorzano

Advisor: John J. Gaynor

Abstract: Mitochondrial DNA is the genomic information that is maternally inherited. Like nuclear DNA, mitochondrial DNA contain mutations. Recent studies have confirmed that mitochondrial DNA is a powerful tool for tracking ancestry through females and has been used in this role to track the ancestry of many species back hundreds of generations. Similarity of mtDNA for any two toads could provide a rough estimate of how closely related are organisms through their maternal ancestors. The purpose of this study is to detect how closely related is the Natterjack toad (*Epidalea calamita*) to other toads. In this study, Polymerase Chain Reaction (PCR) technique was used to amplify and extract short strands of mtDNA from the Bufo Natterjack sample. A 288 base sequence was generated at the 7200 - 8700 mid ND2, 5 tRNA's, 1 ori, mid COX1 regions of the Natterjack mitochondria. Then, the sequence was aligned to other Bufo mitochondrial DNA sequences to compare them. The organism produced significant alignments with the maximum identity of 92% closely related to the Bufo melanostictus mitochondrion. This suggests that Bufo calamita and Bufo melanostictus share a common female ancestor.

Title: Lunar Feature Depths Calculated from Shadow Lengths

Presenter: Eric Sonnenwald

Advisor: Mary Lou West

Abstract: The depth of any part of the lunar landscape may be calculated from a photograph by measuring the crater diameter and the length of the shadow it casts. A terminal line was established along the dark edge of the moon, varying between 55 -60°W. Excel was used to calculate and correct for lunar tilt, sun angle, shadow length, shadow location as a function of crater center lat. & long. and finally depth. The error was then calculated against

accepted values and yielded 9.79%. There were some craters that did not have published accepted values so the results for Gassendi A & Drebbel C may be considered a standard.

Title: Time Variations in the Luminosity of Quasars

Presenter: Elizabeth Taylor; **Co-author:** Wesley Wan

Advisor: Mary Lou West

Abstract: We have analyzed time series observations of several quasars including OJ 287, MRK 501, 3C 664, and Q0957+561. Our analysis included cleaning the data sets from the literature as well as comparing and contrasting data by color filter (blue, visual, red and infrared), brightness (magnitude), and date. An examination of outlier points permitted the exclusion of some for valid reasons. These quasars are brightest in the infrared and red, dimmer in the visual band (yellow green), and faintest in the blue. This is due to their intrinsic color as well as their large cosmological redshift, due to their recession velocity from the solar system being roughly 30% the speed of light. During outbursts their spectral energy distribution changes somewhat. As expected, the standard deviation decreases when the sources are brighter, due to observational limitations. In order to better characterize outbursts we have plotted the light curve, and also calculated the change in brightness with time and plotted this vs. date. We have tabulated the variations on time scales of hours to years. The structure function also provides some information on the timescale of the random outbursts. The current model is that quasars are galaxies powered by supermassive black holes in their centers which devour whole stars in their path. Weather permitting, telescope images of quasars will be presented.

Title: The morphological effect of Coliphage T4r on various strains of *E. coli*

Presenters: Daniel Traum, Andrew Boulos, Thomas Fuchs and Joseph Daibes

Advisor: Sandra Adams

Abstract: Bacteriophages are host specific, they will only infect a particular species of bacteria. The purpose of this specific experiment is to compare the infection of two strains of *E. coli* bacteria by T4r coliphage (rapid lysis). Infection of *E. coli* (85 W 0401) will be compared with another strain of the same species of bacteria. Differences in the infections of the two strains will be assessed by plaque assay. Plaques will be compared in terms of number, morphology, and size.

Title: Effects of Road Deicers on the Migration and Behavior of Adult Eastern Newts

Presenter: Diane Vig

Advisor: Lisa Hazard

Abstract: The eastern newt (*Notophthalmus viridescens*) has multiple aquatic stages during its lifetime. It, like other amphibians, begins its life as aquatic larvae, but unlike many other amphibians, it returns to freshwater ponds for its adult life after a terrestrial juvenile phase. The ponds in which they live and breed are in danger of salt pollution. Road deicers often get caught up in runoff and end up in many of these aquatic habitats. As high salt concentration can be quite detrimental to their survival, we looked at the response of eastern newts to different concentrations of salt to determine whether or not they could detect whether specific pools were safe for habitation. Once the newts were made thirsty after a short period of dehydration, they were placed in a Petri dish containing 20 mL of 0-375mM salt water solution and observed for ten minutes. Observations of “in” versus “out” as well as “sit” versus “move” were recorded. Eastern newts showed a dislike for solutions of high concentration by leaving the dish prior to the end of the trial period, but remained in lower concentrations for the full time. Eastern newts, therefore, have some method of detecting salt in aquatic habitats and could potentially modify pond selection based on salinity.

Title: Bubble and Bubble Chains in Magnetic Fluid (Ferrofluids)

Presenter: Jong (James) Yoo; **Co -authors:** Philip Yecko, David Trubatch and Wah-Keat Lee

Advisor: Philip Yecko

Abstract: We observed and studied small bubbles in a magnetic fluid (ferrofluid). In collaboration with Wah-Keat Lee, we used high intensity high resolution X-ray beam at Advanced Photon Source at Argonne National Lab. Single bubbles are distorted by magnetic field while multiple bubbles merge, resulted in long chains of bubbles. Chains occurred due to the magnetophoretic force in which bubbles behave as individual "magnets" within the ferrofluid. We confirm this model by performing computer simulations. We have proposed a simple mathematical model for the merger dynamic that agrees with experiments and simulations.

Title: Fluorescent Sensors for Zinc Ions

Presenters: Agnieszka Zieba, Christopher Chu, Robert Cuellari and Agnieszka Chojnowski

Advisor: Saliya de Silva

Abstract: Many fluorescent sensors for cations that use photoinduced electron transfer (PET) as the signaling mechanism have been reported over the past three decades. These sensors are based on a chromophore-spacer-receptor architecture and have a tertiary nitrogen as a part of the receptor. Since the tertiary nitrogen is also a receptor for protons, these sensors generate fluorescent signals for various metal ions as well as protons. The goal of this project is to design a new fluorescent sensors that contain common nitrogen based receptors and are not sensitive to protons. These sensors is based on a second generation sensor developed in our labs that is sensitive to zinc(II) ions as well as protons. The new sensors have an additional dimethoxyphenyl group that is expected to generate an additional PET process that would quench a signal due to protons. The synthesis of the new sensors and preliminary fluorescent studies will be presented.

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