



# SCIENCE RESEARCH DAY

MAY 11, 2007

## Abstract Book

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# 17TH ANNUAL BROOKLYN COLLEGE SCIENCE DAY

## PROGRAM

**9:30 A.M. POSTER SETUP**

**10:00—12:00 STUDENT PRESENTATIONS AND JUDGING**

**12:15 P.M. REFRESHMENTS IN THE GOLD ROOM**

**12:30 PM WELCOME AND REMARKS**

### **PRESENTATION OF AWARDS**

**High School Division**

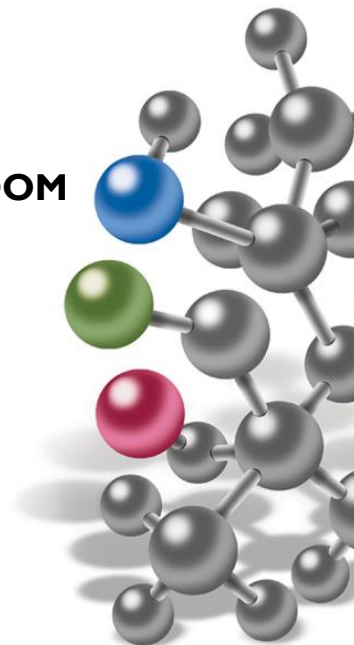
**Undergraduate Division**

**Graduate Division**

**ALL ARE INVITED TO LUNCH IN THE GOLD ROOM**

### **PRESENTER KEY**

**High School — [HS]  
Undergraduate — [UN]  
Graduate — [GRAD]**



## **PSY – 1 THE EFFECTS OF FG7142 ON ACQUISITION, EXTINCTION & SPONTANEOUS RECOVERY OF APPETITIVE PAVLOVIAN LEARNING**

**Vinn D. Campese<sup>1,3</sup>** (GRAD), R. Frederick Westbrook<sup>2</sup> & Andrew R. Delamater<sup>1</sup> Brooklyn College - CUNY<sup>1</sup>, University of New South Wales<sup>2</sup>, The Graduate Center - CUNY<sup>3</sup>

Examinations of the neural substrates involved in Pavlovian extinction learning have implied a role for GABA. Prior investigations into the extinction of fear, have suggested that extinction, its short term retention as well as the contextual modulation of extinction learning (i.e., renewal) are GABAergically mediated (Harris & Westbrook, 1998). Recent investigations in appetitive learning have also observed GABA mediation of renewal as well as spontaneous recovery (Campese, Westbrook & Delamater, 2007). In the current body of work, FG 7142 (a GABA inverse agonist) was tested for its effects on acquisition, extinction, short-term retention of extinction, and spontaneous recovery of appetitive Pavlovian conditioned responding in rats. Whereas FG 7142 disrupted spontaneous recovery, no other effects were seen. This effect on spontaneous recovery is similar to an effect previously seen with renewal, suggesting that the two phenomena share a GABAergic substrate.

Research Supported by NIMH Grant MH65947-3

## **PSY – 2 HYPERMNESIA IN GROUPS**

**Christine Baker McGrath** (GRAD) & Dr. Elisabeth Brauner, Department of Psychology, Brooklyn College, CUNY

Presenting information to groups is a common practice, whether to employees in an office meeting, to a jury in the courtroom, or to a sports team in the game room. Understanding the individual cognitive as well as social processes that act on how this information is later recalled is crucial. We investigated whether the hypermnesia effect can be found in groups. Hypermnesia, the net improvement in memory over time, has been well established in individuals (Erdelyi & Becker, 1974; Erdelyi, 1996), but has not yet been sufficiently explored in collaborative groups. Based on assumptions derived from transactive knowledge research, we assume that hypermnesia will be stronger in interactive groups. One hundred and twenty-five undergraduate students from Brooklyn College, City University of New York, participated in the study. Seventy-five students participated in collaborative three-person groups and 50 students participated individually. One hundred and ten color pictures of common objects (e.g., key, spoon, dog, ball) were presented to participants. Recall was tested over three trials. Hypermnesia in individuals was replicated. Significant main effects for condition and recall trial were found, as well as an interaction effect. Thus, hypermnesia was found in groups as well, and was significantly greater for collaborative groups. Results are interpreted in the light of hypermnesia research and transactive knowledge systems.

## **PSY – 3 ON THE FATE OF FIRST AND SECOND LEARNED ASSOCIATIONS IN FLAVOR PREFERENCE CONDITIONING**

**Janina Scarlet<sup>12</sup>** (GRAD), Vincent Campese<sup>12</sup>, Stephen Oakeshott<sup>1</sup>, & Andrew Delamater<sup>1</sup>, <sup>1</sup>Department of Psychology, Brooklyn College & The Graduate Center, CUNY

Rats were initially taught to associate flavor one with sucrose and another flavor with polycose. These relations were reversed in the consecutive phase. One of the nutrients was then devalued by being paired with Lithium Chloride either immediately or after 3 weeks following reversal. Subsequent flavor choice revealed a recency effect in Group Immediate,

but a primacy effect in Group Delay. These data suggest that second learned associations do not erase first learned associations in flavor preference conditioning.

Grant/Other Support: NIMH Grant 65947

#### **PSY – 4 A PHOTOGRAPHIC BIO-ASSAY FOR STUDYING TRANSDIFFERENTIATION OF SKIN CELLS IN THE LIVING AXOLOTL**

Lakeisha Lubin(UN), Steven Baranowitz, Israel Abramov, & Frank W. Grasso  
Department of Psychology, BCR Lab, Brooklyn College, CUNY

Stem cells are a topic of medical research because when introduced into differentiated tissues they have the potential to restore function to damaged or necrotic tissues. Trans-differentiation, though less studied, offers an alternative with similar medical possibilities but through the use of differentiated cells which could change in situ. It has been suspected for several years that transdifferentiation in axolotl (*Ambystoma mexicanum*) is induced by purines. There is strong evidence (Frost, 1987) that the pigment cells in the skin (melanophores, xanthophores and iridophores) are transformed by purine exposure. Based on these results we hypothesized that we could measure the transdifferentiation process photographically in the skin pigment cells of live axolotls over the time course of treatment with purines. We introduced purines (guanosine and guanosine-monophosphate) into the food of larval axolotls and recorded the state of their skin pigments using color digital photography over the course of several weeks. This study is ongoing but preliminary results indicate that we are able to track changes in pigment cell constitution using this method. We expect the skin of purine-treated axolotls to become progressively lighter compared to control animals over the course of the treatment.

#### **PSY – 5 LEVY WALK APPLICATION TO MOBILE ROBOT MOTION.**

Kamil Kloskowski (UN), Zohar Pasternak, and Frank W. Grasso, Department of Psychology, BCR Lab, Brooklyn College-CUNY

Odor searching behavior can be used by robots or animals to find sources of pollution dangerous chemicals without having to expose humans to any danger, much like SWAT teams use robots to help with disarming explosives. To date, most studies of odor localization have focused on locating the source of a detected chemical plume. Here we make a unique application of flow-informed Levy Walks to address the problem of plume finding. We developed a simulation environment which used real fluid flow and plume geometry regimes to better simulate the natural environment. In theory, using Levy motion is a very good idea, since it allows for a wide range of strategies to be tested, especially if a noise parameter is employed to avoid being trapped in local minima. Our experiments simulated plume finding with Levy-distribution guidance, where a virtual robot or animal (animat) searches a turbulent flow environment for a chemical plume. In tens of thousands of simulations we systematically varied the levy parameters of step-length and noise persistence, and judged on performance of plume finding based on success and efficiency in finding the plume. The results showed that high success rate carried low efficiency (74% success had 8% efficiency). Conversely, strict upstream flow following paths, showed a decreased in success rate, with greater efficiency (8% success had 92% efficiency).

Continuing simulations are underway to find an optimal balance of persistence and step size for best performance.

#### **PSY – 6 PERCEIVED EFFICACY AND ACCEPTANCE OF SOCIAL NEWCOMER INPUT IN THE GROUP DYNAMIC**

**Shawndel N. Fraser** (UN) & Elisabeth Brauner: Brooklyn College,  
Acceptance of Social Newcomers Christine M. Smith: Grand Valley State University

In the workplace, work groups are often cognitively interdependent in order to accomplish mutual goals or group tasks. How is group cohesion and performance affected when a group member is removed and a new group member or *social newcomer* is introduced? Choi and Levine (2004) addressed this question using a between-groups experiment design. They measured old-timer acceptance of newcomer suggestions, and interactions with the newcomer across multiple conditions. They found that newcomers were least influential in the groups who had previously chosen their task strategy and had been told that they succeeded in the first performance round. While this finding is clearly important for triangulating the ideal conditions where newcomer input is likely to be best received, we would like to expand on this research.

We are interested in replicating and expanding on Choi and Levine's (2004) findings. We will use a repeated measures design to capture and compare the suggestion acceptance rates of newcomers to old-timers. We anticipate that: (1) task confidence will cause the overall rate of newcomer suggestions to remain the same as in their old group, (2) newcomer suggestions will be accepted less often than in their original group, and less than the old-timers in their new group, and (3) old-timer suggestion and acceptance rates will increase so as to compensate for the loss of a trusted group member.

#### **PSY – 7 FAT AND CARBOHYDRATE PREFERENCES IN TRPM5 AND GUSTDUCIN KNOCKOUT MICE**

**Steven Zukerman** (GRAD) & Anthony Sclafani, Department of Psychology, Brooklyn College, CUNY

Overconsumption of fat and carbohydrate-rich foods promotes obesity in people. It is important to know which factors contribute to appetite for such foods. Prior research indicates the involvement of gustducin and Trpm5 taste-signaling proteins in the preference for sweets. The current study determined the role of these signaling proteins in the preference for fat and non-sweet carbohydrates. Trpm5 and gustducin knockout (KO) mice and B6 control mice were presented with various carbohydrate solutions and fat emulsions in 48-hour 2-bottle tests. Both the Trpm5 and the gustducin KO mice showed deficits in sweet (sucrose) and non-sweet (Polycose) solution intakes compared to B6 mice. Only Trpm5 KO mice, however, show a deficit in starch intake. The Trpm5 KO, but not the gustducin KO, mice were also deficient in their preference for fat emulsions (soybean oil). Extensive experience with these nutrients, however, partially compensated for the taste deficits of the KO mice. These results indicate that, in addition to mediating sweet taste preference, Trpm5 and gustducin genes are involved in the preferences for nonsweet carbohydrate and/or fat flavors. The differential response of gustducin KO mice to Polycose and starch indicate that these carbohydrates activate different signaling pathways.

Supported by NIH Grant DK031135.

**PSY – 8 MODELING THE GLOBAL DISTRIBUTION OF MONK PARAKEET HABITAT**

**Corentin Bohl** (GRAD) & Frank W. Grasso, Department of Psychology, BCR lab and The Graduate Program in Evolution, Ecology and Behavior, CUNY

The behavior of populations of invasive species of considerable interest because of the potential (positive and negative) biological and economic impacts their introduction to and environment can produce. Several studies have shown that the ecological niches of many taxa remain relatively stable over long periods of evolutionary time. In such suitable species it is possible to predict the potential geographical extent of a mature invasion from the habitat in which the species evolved. In other words, if the critical environmental features that make an environment suitable for an organism are known (i.e., its niche) it is possible to predict its potential geographic distribution beyond its natal habitat. The monk parakeet (*Myopstitta monachus*), has been artificially introduced to geographic zones outside their native range by human intervention and has been demonstrated to be able to establish stable "island" populations over the last 30 years across the United States and Europe. We used the ecological niche modeling software MAXENT to predict the potential distribution of this species based on bioclimatic and elevation variables. We then compared the predicted potential distribution to the actual invaded range. The results show that monk parakeets have established stable and growing populations in areas predicted as highly suitable by our model. However, several stable urban populations were poorly predicted by our model, suggesting that cities provide suitable microhabitats in otherwise sub-optimal climates.

**PSY – 9 LEARNING AND MEMORY IN A NOVEL OBJECT RECOGNITION TASK AND THE SPATIAL NAVIGATION TASK IN RATS**

**Sonia Afroz** (HS) & Janice Baranowski, Brooklyn Technical High School, Brooklyn, New York

To determine the relationship between working and reference memory, and learning, rats were tested in consecutively run trials of the spatial navigation task and a novel object recognition task. The object recognition task was modified to include testable variables like pause criterion, target size and target location to get a more accurate understanding of object memory and learning. The object recognition task was used to determine whether rats were using memory and visual clues, or odor clues by using replicas in the identification part of the task. One rat exclusively used odor clues while the others used them to a lesser extent. All rats were able to recover from changing conditions and were able to accurately perform in the consecutively run tasks. These results verify the accurateness of the novel object recognition task and deem consecutive task training acceptable for duplication.

**PSY - 10 EFFICIENT COORDINATION OF CONFLICTING BEHAVIORS: A COMPARISON OF FUZZY BEHAVIOR-ARBITRATING SYSTEMS**

**Peter Santiago** (UN), Zohar Pasternak & Frank Grasso, Department of Psychology: BCR Lab, Brooklyn College, CUNY

The efficient coordination of conflicting behaviors is a problem for animals as well as the field of robotics. A fundamental question in this domain is: do animals choose these behaviors based on pre-constructed perceptions, or on pure sensory data? We have used robots with fuzzy logic controllers to explore possible solutions to this question. Using Matlab and the

Fuzzy Logic Toolbox, two fuzzy controller systems were created and trained using neuro-adaptive techniques that modeled the systems to control simulated Khepera robots. We compared their performance when decisions were based on calculated perceptions, (pre-processing of inputs) and when the decisions were based on pure (unprocessed) sensor input. Both were trained on a goal-following/obstacle avoidance conflict task using neuro-adaptive techniques to find the optimal performance.

The performance of each was evaluated based on their respective deviations from the optimal performance on the data set. The results provide evidence that perceptions provide a more efficient basis for making decisions on performance of behaviors arbitration. This supports the idea that perception may help to explain animals' efficient coordination of several behaviors and our approach offers an avenue to obtain insight into their sensory processing system.

### **PSY – 11 A COMPARISON OF FACTORS CONTRIBUTING TO STRESS IN THE EMERGENCY DEPARTMENT MEDICAL STAFF**

**Jonathan Hanna** (HS), James Madison High School, Brooklyn, faculty advisor Mr. S. Kaye

The purpose of this study is to display the correlation of stress factors such as patient congestion and work overloads to the cortisol levels in saliva within healthcare providers in the E.D. including doctors and nurses. The cortisol levels were measured through saliva which was collected twice for every subject, once at the beginning of his/her work shift and once at the end. Saliva collection was collected from various other low-stress jobs within the medical center such as secretaries or security guards for control purposes.

Accompanying the saliva collection was the administering of questionnaires, there were two types, one for health care providers (variable) and one for low-stress non medical jobs (control). The saliva was collected from each subject in (2) 2ml cryovials, the collector was in a sterile environment using double gloving for personal protection and careful instruction and prior awareness towards the subject as to how to register the saliva. Both the saliva collection and questionnaire completion were supervised by the collector and the collector's supervisor to provide accuracy towards the experiment and provide proper subject treatment and safety. The data displays diversity in the opinions of the workers and in the questionnaires many workers were sided towards the options that displayed dissatisfaction at work. In conclusion the data supports the hypothesis that stress in E.D. personal is a viable factor towards the increase in cortisol levels, more so in the E.D. as several factors combine and add to the given difficulty of the E.D. Environment.

### **PSY - 12 DO MALES OR FEMALES HAVE A BETTER MEMORY**

**Janet Daif** (HS) & Francis Fisher, Franklin D. Roosevelt High School, Brooklyn, NY

The problem for this experiment is "Do males or females have a better memory?" Doing this experiment will show and tell if females or males have a better memory. This experiment will also show a little bit about each one's memory.

In this experiment, it will be tested to see if females or males have a better memory. The hypothesis of this experiment is that females have a better memory. Females are able to remember things better than males. Researches have concluded that females have a better memory in fine motor skill, words and objects. This is one reason why females have a better memory.

This experiment includes a memory test. This memory test includes different types of photos, mostly colored ones. A group of males will observe and study these photos for 1 minute, then they will be asked questions on the photos in which they studied. These questions will consist of number questions and even color questions. A group of females will then be asked to study the same photos for 1 minute and be asked the same exact questions as the group of males. Then this will all be recorded into a chart.

### **PSY – 13 WHAT DO ADULTS FEAR MOST?**

**Samra Cekic** (HS) & Francis Fisher, Franklin D. Roosevelt High School, Brooklyn, NY

Trying to find out what adults really do fear in today's society is a big question. Everyone has fears. They haunt us throughout our whole life. What would be the biggest fears of adults? This experiment was designed to find out what are adults biggest fears in the 21<sup>st</sup> century. The problem is: What do Adults Fear Most?

When doing this experiment it was found that the fear of death of loved one would be the number one fear. Fear is all around us. To over come our fear, we need to have experience in it. One of the most biggest fears is death it self. We all know that is one thing that we cannot escape. But, there are many other fears that people have. The reason why people have fear is because they do not know or understand what is on the other side, what will happen. Most people can overcome there fears, but its not easy as one may think. To overcome a fear a person needs to put themselves in front of the fear and face it, death is an exception.

### **PSY – 14 WHAT IS THE EFFECT OF AGE ON DIFFERENT RANGES OF HEARING?**

**Irene Pinto** (HS), & Ms. Fisher, Franklin D. Roosevelt High School, Brooklyn, NY

The hearing range of humans gets worse with age. People lose the ability to hear sounds of high frequency as they get older. This experiment was conducted in order to find out if age had any effect on hearing. In order to do this experiment an audio frequency generator was used. This unit is able to generate different frequencies. Frequencies are the number of sound vibrations per second. It is the same as the pitch of sound. They are expressed in Hertz (Hz).

Three people of each age group were used. The age groups consisted of 10, 20, 30, 40, 50, 60 and 70 year old people. Headphones were put on each person one at a time and the frequency was increased, starting from 30hertz. The highest frequency was recorded for each person After this, amplitude, which is also known as the volume, expressed in the SI unit of DB, was decreased. The lowest amplitude that they could hear was recorded. This was recorded in negative (-) DB. This gave the highest frequency and the lowest DB of each person.



**PSY – 15 ARE YOU AT RISK FOR ALZHEIMER'S**

**Jacqueline Puma** (HS) & Francis Fisher, Franklin D. Roosevelt High School, NY

This experiment tests to see if you may be at risk for Alzheimer's. The hypothesis of this experiment is that if you are not able to identify eight specific scents, then you may be at risk for Alzheimer's, according to a scientific study by the National Institute on Aging. Alzheimer patients were consistently not able to identify these scents according to the study.

When conducting the experiment, the researcher picked out twenty subjects and asked them if they had any family history of Alzheimer's. Those 18 subjects who said they had no family history of Alzheimer's were categorized in the control group. The 2 subjects who said they did have a family history of Alzheimer's were categorized in the experimental group. Once I tested the twenty people with the eight mystery scents, they wrote down their guesses on a pad, and then either marked their paper with a green or red mark. A red mark meant they were in the control group, while the green mark meant they were in the experimental group.

The hypothesis agrees with this experiment, because the hypothesis states that you may be able to detect people at risk for Alzheimer's disease, according to researchers at the National Institute on Aging. Researchers say this because early on set Alzheimer patients were consistently unable to identify the same ten scents (smoke and natural gas were eliminated due to safety concerns).

**PSY – 16 NEURAL PROGENITOR CELLS OFFER A PROMISING TOOL FOR THERAPEUTIC REPLACEMENT OF CELLS IN BRAIN AFFLICTED WITH NEURODEGENERATIVE DISEASES**

**Punam Thakkar**<sup>1</sup> (UN), Niloufar Haque, Ph.D.<sup>2</sup>, <sup>1</sup>Brooklyn College, CUNY <sup>2</sup>New York City College of Technology, CUNY

Neural progenitor cells offer a promising tool for therapeutic replacement of cells in brain afflicted with neurodegenerative diseases. A goal of modern medicine is to genetically modify these cells to introduce therapeutic genes into the brain. Alzheimer's disease and frontotemporal dementia with Parkinsonism linked to chromosome-17 (FTDP-17) are two major neurological diseases which are characterized by the abnormal hyperphosphorylation and accumulation of tau in the affected neurons. In the present study we genetically modified human neuronal progenitor cells as well as human neuroblastoma cells to stably overexpress the largest human tau isoform, tau441. We observed that overexpression of tau resulted in enlargement of the cell body and development of long processes which were well branched and were decorated with spines and tiny blebs. The overexpression of the adult tau isoform had no effect on endogenous tau levels as determined by <sup>125</sup>I-Western blots. The stably transfected cells were akin to mature neurons morphologically and this was further confirmed by detecting the expression of neurofilaments, synapsin, synaptophysin and GAP-43, a synaptic marker for mature neurons. No change in the phosphorylation of tau at the Tau-1 site was detected. These findings suggest that overexpression of adult human tau leads to maturation and differentiation of neuronal cells and is required for the formation of GAP junctions. Thus, abnormalities in tau can compromise neurogenesis.

**PSY – 17 INFLUENCES OF PARENTAL AND TEACHER BEHAVIOR ON EMOTIONAL INTELLIGENCE, IQ, MACHIAVELLIANISM, AND ACADEMIC ACHIEVEMENT**

Sam Pilku (HS), James Madison High School, Brooklyn, mentor Dr. Martinez-Pons Brooklyn College, faculty advisor Mr. S. Kaye

101 high school students were surveyed to examine the relations that exist among emotional intelligence, IQ, goal orientation, Machiavellianism (MA), persistence, life satisfaction, and academic achievement-as well as the influence parents and teachers exert on these processes. The data were generated by means of an IQ test and questionnaires. Path analysis revealed negative effects of MA on goal orientation and persistence, and of parental influence on goal orientation. No relations emerged between IQ and any other variables in the study.

**SCAS – 1 GREENSPAN VS ABA WHICH IS BENEFICIAL?**

Donna Sender (UN) & Renee Laura Fabus, Ph.D., Assistant Professor in Speech Communication Arts and Sciences, Brooklyn College, CUNY

Autism is a developmental disability that results from a disorder of the human central nervous system. There are various methods of treatment for someone suffering from autism. Applied Behavioral Analysis & Greenspan's Floortime approach are two different approaches used to treat autism.

I have been observing an autistic child at Brooklyn Community Therapy for this semester. At the start of therapy the client was completely non-verbal and primarily used gestures. At the present time, this child exhibits 4 word sentences and spontaneous speech. The therapist used two known approaches to develop this child's language and I will be discussing the benefits of using both approaches *simultaneously* rather than only one. (greenspan approach and the ABA approach) I will also discuss various characteristics, etiologies and theories related to autism.

**SCAS – 2 AN INTEGRATED APPROACH TO STUTTERING TREATMENT**

Yelena Merkina (UN) & Renee Laura Fabus, Ph.D, Assistant Professor in Speech Communication Arts and Sciences, Brooklyn College, CUNY

Stuttering is a multidimensional disorder that requires a clinician to focus on numerous important factors. In the treatment of stuttering, clinicians may choose to use various approaches. An integrated Approach to stuttering encompasses the psychological, social and emotional aspects of an individual in addition to their stuttering. Effective speech management becomes an attainable goal when combining support groups to individual therapy sessions. The American Institute for Stuttering (AIS) is just one example of a facility where comprehensive, positive integrated treatment is administered to clients. Through weekly observations at AIS, positive progress was recorded.

## BIO - 1 TACTILE EXPLORATION AND ENVIRONMENTAL MAPPING IN FRESHWATER CRAYFISH

Hans Michell (UN) & Dr. Jennifer Basil, Department of Biology, Brooklyn College, CUNY

Because the freshwater crayfish *Procambarus clarkii* lives in a turbid environment and has nocturnal habits, visual information is often limited. In these conditions, it is especially important for the crayfish to learn and remember the topography of their home areas. They therefore often use other senses (olfaction, tactile, hydrodynamic) to collect information about their environment. Here we focus on their well developed tactile sense, which has been demonstrated to be a key sensory channel for them to learn and remember topographic aspects of their environment. Blindfolded crayfish will be taught to learn the spatial location of a "home burrow" (they prefer to avoid light and contact with open areas) in a complex maze. The location will be associated with 1) a specific location in space relative to local cues in the maze and global cues outside the maze, 2) a rough texture on a wall near the "home burrow" (a "beacon") and 3) with a "left turn" from the start position in the arena/maze (a "turning rule"). We will observe their exploratory behavior— which consists of a sustained contact with the arena wall using their antennae— as a measure of habituation and learning. Once animals have learned where the "home burrow" is, measured as a decrease in exploratory behavior and a reduction in the time it takes to move into the burrow, we will then alter the cues in their environment to determine which are of importance in finding their goal location. Animals could be using a simple turning rule; thus moving the burrow (and the textured wall and the global cues) to the right will disrupt their ability to find it. They may be relying upon the "beacon" cue of the textured wall—any movement of the wall in the environment will result in animals looking for the burrow in the new location indicated by the wall (but not the global cues or the turning rule). Finally, they may be using the complex configuration of local and global cues to locate the burrow and any change in wall placement or turning requirement will have no effect on the animal's ability to find their home burrow. We aim to determine what kind of spatial cues the animal relies upon to solve this naturalistic task.

## BIO - 2 THE DEVELOPMENT OF LEARNING IN CRAYFISH

Sharine Rowe (UN), Dr. Jennifer Basil & Department of Biology, Brooklyn College, CUNY

Because the freshwater crayfish *Procambarus clarkii* lives in a turbid environment and has nocturnal habits, visual information is often limited. It is therefore important for the crayfish to learn and remember the topography of their home areas using other senses (olfaction, tactile, hydrodynamic) to collect information about their environment. Here we focus on their well-developed tactile sense, which has been demonstrated to be a key sensory channel for crayfish to learn and remember topographic aspects of their environment. We have previously demonstrated that this memory contains both short-term and long-term components and that there is a period where memory is "consolidated" sometime during the 24-h period after an animal learns the topography of its environment. We now examine the effect of changing topography on the animal's behavior. Once crayfish have explored and "learned" their environment, they show a preference for one physical condition over another. Here we test to find what the crayfish's preferred substrate is, and whether or not this preference is shared among all the crayfish. Acquiring this information about the crayfish will prove to be essential in the next phase of our experiments. We will shortly move into offering the crayfish rewards for learned behavior. It is therefore vital that we determine what the crayfish prefer, so to find a suitable reward.

Supported by LSAMP

### BIO – 3 IDENTIFICATION AND STRUCTURAL CHARACTERIZATION OF FYVE PROTEINS FROM THE PLANT ARABIDOPSIS THALIANA.

Ewa Wywiał (GRAD) & Dr. Shaneen M. Singh, Department of Biology, Brooklyn College & The Graduate Center, CUNY

FYVE domain containing proteins have emerged as PI(3)P-specific membrane targeting modules, which regulate proteins in various trafficking pathways in diverse organisms ranging from yeast to mammals. FYVE domains may function as individual modules, dimers or in partnership with other proteins depending on the protein to which they belong. Structurally however, FYVE domains all share a characteristic fold consisting of two small double-stranded  $\beta$  sheets, a C-terminal  $\beta$ -helix and eight  $\text{Zn}^{2+}$  ion-binding cysteines. To date, the structural, biochemical, and biophysical mechanisms for FYVE domains targeting have been actively researched for yeast, worm and animal but hardly at all in plants. To this end, we have carried out an exhaustive search of the *Arabidopsis thaliana* genome using an automated pipeline as well as manual methods to identify unknown instances of FYVE proteins as well as to verify previously known ones in this model plant. Using a combination of sequence and structure based computational methods such as sequence and structure similarity, molecular modeling, domain architecture analysis, specific head-group interactions/orientation, nonspecific electrostatic interactions and hydrophobic membrane penetration we have identified and characterized a total of fifteen FYVE proteins grouped into five functional classes in *Arabidopsis*. Our study offers a unique contribution to the understanding of the molecular basis of membrane binding and function of FYVE domains in plants, revealing unusual binding signatures, domain architectures and profiles of biophysical properties which may have implications in understanding the role of FYVE domains in general.

Supported by Arabidopsis 2010 – NSF grant # 0618233

### BIO – 4 STUCK TOGETHER: CYANOACRYLATE GLUE FOR LIVING TISSUE REPAIR

Eddie Ashkenazie (HS), Jack Kurtz (HS), Salim Mineh (HS) & Mr. Steven Kaye, Magen David Yeshivah High School, Brooklyn, New York 11214

A hypothesis was developed proposing that crazy glue is suitable for making living tissue repair in living organisms. Preliminary experimentation was performed on leaf and stem cuttings from jade plant, *Crassula argentea*. Crazy glue would then be used to put them back together, making sure that the xylem and vascular cambium were aligned. These plant grafts simulate what could be done with human tissue. The sections that were cut and glued back together continued to grow proving that reattaching living tissue with crazy glue can work. It was observed that the grafted plant segments remained green and viable.

### BIO – 5 THE EFFECT OF ANTIBIOTICS ON BACTERIAL STRAND

Jenny Li (HS), Irene Huang (HS), Professor M.K. Bhattacharjee & Mr. Stacks, Midwood High School, Brooklyn, NY

We did a recent project on bacteria. We are working on LIU17 (TOP10(PJACK17)), which is a bacterial strand. We are trying to see which plasmid shows a stronger ability to resist both Nal20 and Cn50, which are antibiotics. First, we needed to make agar plates. To do this, we

use LB, agro, deionized water and the antibiotics. Next all the materials except the antibiotics were mixed together and boiled for one hour. Afterward, we let the mixture cool and poured 10 plates with agar. We then took the antibiotics, Nal20 and Cn50, placed some of it into the leftover agro, and swirled it. Finally the mixture is poured into another 10 plates of agar.

Another LIU17 in a -70°C fridge is secreted onto a plate.

**BIO – 6 CLONING GAMETE FUSION GENE(S) IN *Chlamydomonas Reinhardtii***

**Munevver Aksoy** (GRAD) 1,2 & Charlene L. Forest 2 1: The Graduate Center & 2: Brooklyn College, Department of Biology, CUNY

Our goal is to identify the gene(s) involved in gamete fusion in the green alga *Chlamydomonas reinhardtii*. We have isolated several independently generated fusion-defective mating type minus insertional mutants and are using these mutants to clone the gene. The plasmid pSP124S, containing the *ble* gene, was inserted as a random mutagen, using the acid-washed beads transformation technique. All of the fusion-defective mutants we have analyzed form 15 – 20 % pairs when mated with the opposite mating type (similar to the pair formation in the previously isolated temperature sensitive fusion-defective *gam* mutants). Using Tail-PCR to identify the flanking genomic DNA for each of the mutants, we were able to sequence the flanking DNA for 2 of these mutants. We are now using BACs that contain the wild type genes found in these genomic regions to complement the mutants. We will discuss the possible roles of the genes we have identified, in the fusion process.

**BIO – 7 ENDOSCOPIC THORACIC SYMPATHECTOMY FOR FOCAL PRIMARY HYPERHIDROSIS: FACTORS INFLUENCING POST-OPERATIVE OUTCOME, RECURRENCE, AND PATIENT SATISFACTION**

Mark Chwajol, M.D., **Shamik Chakraborty** (UN), Robert Starke, B.S., Jonathan B. Lesser, M.D., Cliff P. Connery, M.D., Noel I. Perin, M.D.  
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Primary focal hyperhidrosis (PFH), or excessive sweating, afflicts 2.8% of the US population causing significant occupational, emotional and physical impairment, and social embarrassment. Endoscopic thoracic sympathectomy (ETS) is the definitive treatment. Symptomatic improvement and recurrence rates after surgery vary greatly. Factors affecting these outcomes after ETS have not been clearly elucidated.

220 patients underwent bilateral ETS procedures. A retrospective chart review was conducted recording age, gender, weight, location and severity of presenting symptoms, and the level of surgery. Patients' responses regarding compensatory hyperhidrosis (CH), and their level of satisfaction after ETS were recorded and analyzed. We conclude that ETS for PFH is a safe and effective procedure with high rates of improvement, low recurrence, and few complications. CH is common after ETS, but satisfaction with the ETS procedure is high.

**BIO – 8 DEVELOPMENT OF A FLOW CYTOMETRY BASED ASSAY TO ANALYZE THE INTERACTIONS OF AGROBACTERIUM TUMEFACIENS WITH POTENTIAL RECEPTORS**

Anna Cheban (UN), Darnelle Delva, & Theodore Muth, Department of Biology, Brooklyn College, CUNY

*Agrobacterium tumefaciens* is a species of Gram negative bacteria commonly found in the soil. The bacteria are pathogenic to plants and cause crown gall disease in a number plant types, including several important fruit trees such as apples, cherries and peaches. *A. tumefaciens* bacteria have a unique ability to act as natural genetic engineers and they actually introduce several of their own genes into infected plants in order to establish an infection. Before this essential transfer of bacterial genes into the plant cells can take place, however, the bacteria must attach to the surface of the targeted plant cells. Little known about what plant factors the bacteria recognize during the attachment step. Our work here describes initial attempts to develop an assay using flow cytometry to measure the interaction of bacteria with possible plant attachment factors.

A publication from Wagner et al., 1992 suggests that plants have a vitronectin-like factor that may serve as an attachment site for *A. tumefaciens*. Wagner et al., found that mammalian vitronectin was able to compete away the binding of *A. tumefaciens* bacteria, and they found that antibodies against vitronectin disrupted bacterial attachment. We have decided to test if we can detect the interaction of *A. tumefaciens* with mammalian vitronectin using flow cytometry approach. If we are able to confirm the original published results we can then go on to use our flow cytometric attachment assay to identify other factors that may play a role in the attachment of *A. tumefaciens* to plant cells.

This work is supported by a grant from the USDA to T. Muth.

**BIO – 9 DETECTION OF TRANSIENT AGROBACTERIUM-MEDIATED TRANSFORMATION OF *ARABIDOPSIS THALIANA* USING AN ENZYMATIC MUG ASSAY**

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Crown gall disease is a type of cancer in plants caused by the soil bacterium *Agrobacterium tumefaciens*. *A. tumefaciens* has the unique ability to transfer a piece of its DNA, the T-DNA, into the plant genome. The T-DNA carries genes that code for plant growth hormones, which, when expressed in infected plant cells, leads to excess production of hormones and subsequent uncontrolled cell division that results in a tumor (called a gall in plants). The goal of this study is to use the beta-glucuronidase gene (also known as GUS or uidA) as a marker gene for transient transformation in *Arabidopsis* root segments. The method of detecting transient transformation is a fluorimetric assay known as the MUG assay. In this assay we first inoculate plant roots with *Agrobacteria*, allow time for transformation and gene expression, and then release the GUS enzyme from the infected plant cells by lysing the root segments. When the 4-MUG substrate is added to the solution, the newly introduced GUS enzyme hydrolyzes the substrate, producing a fluorescent product under basic conditions. The amount of fluorescence that we detect allows us to determine the efficiency of the transient transformation. This method is useful in providing us with quantitative results. It is hoped that this technique will help us in exploring the factors that can influence *Agrobacterium*-mediated transformation.

## BIO – 10 DO AMINO ACIDS ACTIVATE THE TOR PATHWAY DURING MOSQUITO LARVAL GROWTH?

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The larval stage of holometabolous insects such as mosquitoes is dedicated to growth in preparation of metamorphosis into the reproductive adult. The control of growth and body size is, in part, controlled by the TOR (Target of Rapamycin) signaling pathway. A downstream component of this pathway is S6K (ribosomal protein S6 Kinase) which is also involved in the control of organism and cell size. In eukaryotes, amino acids activate the TOR pathway and are propagated through the TOR cascade. TOR kinase activates ribosomal protein S6 Kinase, one of its downstream targets, which in turn initiates further phosphorylation to start DNA replication. In order to investigate the role to the TOR pathway in the control of larval size and growth we used Real Time PCR to quantitate the expression of TOR and S6K, in the mid-gut of *Aedes aegypti* larva during the 4<sup>th</sup> instar. To detect DNA replication we used the method of BrdU (Bromo-deoxyuridine) incorporation. BrdU, an analog of thymine, is incorporated into the DNA of the mosquito larvae cultured in amino acids solution during DNA replication. In order to show what nutrient is essential to activate the TOR pathway, starved and non-growing 4<sup>th</sup> instar mosquito larvae were grown in different solutions (amino acids solution, sucrose solution, and distilled water). We find that starvation of mosquito larvae halts cellular growth, DNA replication hence preventing the larvae from pupating. Only amino acids can reactivate DNA replication in starved mosquito larvae. It suggests that TOR is able to recognize the level of amino acids and initiate cellular growth.

## BIO – 11 QUANTITATIVE MEASUREMENTS OF CELL ATTACHMENT OF *AGROBACTERIUM TUMEFACIENS* TO *ARABIDOPSIS THALIANA* WITH THE USE OF A FLOW CYTOMETER

Anna Petrovicheva (GRAD), Leslie Aguirre (UN), Khudeja Mir, Lourdianie P-Charles & Theodore R. Muth.

*Agrobacterium tumefaciens* is a bacterium that is able to infect a diverse array of plants. It attaches to plant roots and transforms the plants cell to induce crown gall tumors, a type of plant cancer. The plants used in this experiment are *Arabidopsis thaliana*, a member of the mustard family.

The goal is to create an efficient quantitative measurement assay that improves upon the past methods. Agro infection assays using transformation leading to fluorescence and tumor formation are informative, but these do not measure actual attachment. The previously reported attachment assays use either microscopy that gives a more qualitative than quantitative result, and colony counts are labor intensive and measure only the numbers of living bacteria that can be released from roots. Some of the attached bacteria may be killed, or enter a dormant state, in the preparation process.

The flow cytometer measures the number of particles in a media sample and determines their size and fluorescence in a data sheet of the program. Using the flow cytometer, the number of bacteria extracted from the root surface will be measured. From these data we will be able to identify mutant bacterial clones, or mutant *Arabidopsis* lines, that exhibit enhanced attachment or inhibited attachment.

## BIO – 12 CURCUMIN DOWNREGULATES HIGH GLUCOSE-INDUCED MATRIX METALLOPROTEINASE-2 EXPRESSION IN HUMAN AORTIC ENDOTHELIAL CELLS

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Cardiovascular diseases are very potent killers. Type 2 diabetic patients are at great risk of being plagued by cardiovascular diseases. High glucose has been shown to upset the balance between extracellular matrix (ECM) synthesis and degradation, by causing increased production of major matrix degrading enzymes, matrix metalloproteinases (MMPs). Curcumin, an extract from the rhizome of the turmeric plant, possesses anti-inflammatory and anti-carcinogenic properties. Because curcumin has the ability to block several growth factors of human aortic endothelial cells (HAECs), we tried to see if the exposure of HAECs to curcumin would lead to altered cell viability and a dysregulation of ECM production.

Cytotoxicity tests were conducted to determine the lethal dose of curcumin for HAEC. Monolayers of HAEC induced with high glucose were treated with curcumin in differing concentrations. Cell viability, protein extractions, Western analysis, gel zymography, and RNA isolation were performed.

Curcumin significantly reduced viability in HAECs in a dose-dependent manner. The increase in high glucose induced MMP activity was significantly down-regulated with curcumin treatment. Therefore, curcumin could reduce ECM degradation and prevent further damage to the endothelium. In conclusion, if diabetic patients were directed to consume turmeric, a decrease in vascular complications may result.

## BIO – 13 A NOMENCLATURE RESOLVED RELATIONAL DATABASE OF LIGHT HARVESTING COMPLEX PROTEINS IN *CHLAMYDOMONAS REINHARDTII*

Deoranie Nikita Brasse\* (UN), Ramy Abdel-Naby\* (UN), Stacie Ann Newell, Juergen Polle, & Shaneen M Singh, Department of Biology, Brooklyn College

Light harvesting complexes (LHC) are a family of chlorophyll-binding proteins that drive photosynthesis in plants and algae by absorbing and channeling excitation energy into the reaction centers. LHC proteins potentially possess the same structural fold since they share significant sequence similarity. However, distinct pigment organization properties, protein-protein interactions and modes of regulation of light-harvesting events for various LHCs suggest variations in the three-dimensional structure and biochemical properties of different LHC proteins based on differences in their primary structure. In order to fully clarify the structural bases for the difference in various LHC proteins, we need to model and analyze the three dimensional structures of members of LHCI and LHCII family of proteins in the organism *Chlamydomonas reinhardtii* using a number of bioinformatics approaches including comparative modeling, sequence to profile analysis, and multiple sequence and structure alignments. During the course of working towards our goal, a disparity in the nomenclature of chlorophyll binding proteins hindered our progress. There have been several groups who have attempted to resolve the confused state of the nomenclature of higher plants, but their efforts were unsuccessful. This presents an obstacle in the path of resolving the structural differences, as the prediction of the structures depended on the protein and gene sequences. Here we present a resolution in the nomenclature differences and a comprehensive database of all LHCs in *Chlamydomonas reinhardtii*.

\* Both authors contributed equally to the work.



**BIO – 14 COMPARATIVE GENETICS DATABASE FOR THE STUDY OF FEMALE INFERTILITY**

**Grace B. Olamijulo** (HS) & Janice Baranowski, Department of Science Research, Brooklyn Technical High School

Approximately 6.1 million people in the United States alone suffer from infertility. An estimated 15% of couples worldwide are affected by infertility, with 40% of these cases caused by female infertility. Generally the etiologies of female infertility have been attributed to congenital anomalies and/or the obstruction of organs of the female reproductive system. However, underlying genetic causes remain elusive. The use of mice for hypothesis testing is a common method used to search for the underlying genetic causes of female infertility. Through previous experimentation and investigation researchers have identified many genes that play a role in female infertility. However, the results are dispersed in a variety of sources. This dispersion of information creates the time consuming task of sifting through an array of sources, many of which display the same information. In an effort to increase accessibility and reduced redundancy the Comparative Infertility Informatics (CIFI) database has been designed, integrating relevant information from multiple sources regarding these genes. After integration a partial analysis of the data was performed to suggest new hypotheses for the identification of genes involved in female infertility, which will ultimately lead to the creation of new modes of treatment.

**BIO - 15 FUNCTIONAL ANNOTATION OF THE MyTH4 DOMAIN USING BIOINFORMATICS TOOLS**

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Myosins constitute a large super family of proteins with diverse properties adapted for a variety of important cellular activities. The relevance of myosins for mammalian physiology and pathology is underscored by the finding that many pathological conditions and genetic diseases are associated with mutations in myosins. Some important questions that remain unanswered in the field of myosin pertain to the role of the domains present in a particular region of the proteins called the tail. This present work investigates one such myosin tail domain called the MyTH4 domain, a domain whose structure and function is essentially unknown but has been implicated in pathological conditions associated with mutations in myosins and is also found in another class of motor proteins called Kinesins. Using a computational approach that integrates various bioinformatics and computational tools, for the first time, we propose a structural fold for the MyTH4 domain called the "alpha alpha superhelix" which is often found in proteins that are involved in protein-protein interactions. MyTH4 domains modeled on this fold allow us to predict biological function for this domain and provide a starting point for understanding why mutations in these domains in myosin and other proteins result in pathogenic conditions.

## BIO – 16 UNDERSTANDING THE FUNCTION OF SPLIT PLECKSTRIN HOMOLOGY DOMAINS

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PH domains are protein modules of about 120 amino acids, present in many proteins involved in cellular processes in which membrane association plays an integral role e.g. signal transduction, vesicular trafficking and cytoskeletal rearrangements. PH domains are best known for their ability to target cellular membranes by binding specifically to membrane phosphoinositides, but the physiological role of many PH domains has not yet been established. The structural core of each PH domain consists of a  $\alpha$ -sandwich of two nearly orthogonal  $\beta$ -sheets. One end of the  $\alpha$ -sandwich is capped by the C-terminal  $\alpha$ -helix and the other contains three 'variable loops', which are highly diverse in both amino acid sequence composition and length. Interestingly, this fold can also be found in certain proteins as a split fold with its two halves separated in sequence by large inserts. This study describes the initial characterization of the split PH domain fold and analyzing its properties derived from its sequence, modeled structure, and derived biophysical properties such as surface potential. We also compare the structure and properties of Evectin1 PH domain (which falls in an intermediate category between typical and split PH domains) with those of the typical split PH domains with a goal to understand why and how split PH domains evolved in nature.

## BIO – 17 PPAR-GAMMA LIGANDS ENHANCE PHAGOCYTIC CLEARANCE OF APOPTOTIC MACROPHAGES PHAGOCYTIC ENHANCEMENT OF APOPTOTIC MACROPHAGES AS A NOVEL TREATMENT STRATEGY FOR PREVENTION OF ATHEROTHROMBOTIC CARDIOVASCULAR EVENTS

**Kerron Gilford**<sup>1</sup>(UN), Edward Thorp<sup>2</sup>, & Ira Tabas<sup>2</sup>, Department of Biology, Brooklyn College of the City University of New York<sup>1</sup> & Department of Medicine, Columbia University, New York<sup>2</sup>

PPAR-gamma ligands decrease early atherosclerotic lesions in experimental animal models, but their effects on advanced atherosclerosis are not known. A unique process in advanced atherosclerosis is the accumulation of free cholesterol (FC) by macrophages (Mfs), which, according to previous in-vivo studies, can result in Mf death, lesional necrosis, inflammation, and plaque susceptibility to rupture. Mf apoptosis occurs throughout all stages of atherosclerosis, and inefficient phagocytic clearance of dying Mfs may lead to cellular necrosis and release of plaque destabilizing factors. Here we sought to determine how PPARg agonists would affect phagocytosis of FC-induced apoptotic cells. *We found that with the use of these PPARgamma agonists, phagocytosis of these apoptotic cells increased significantly.* This enhanced phagocytic uptake was associated with increased accumulation of filamentous actin at the interface between phagocyte and apoptotic cell (i.e., the phagocytic cup), suggesting an effect of PPARgamma ligands on intracellular actin signaling. Indeed, macrophages treated with the PPARgamma ligand Rosiglitazone had decreased levels of the actin-modulating protein RhoA. Thus, compounds designed to activate PPARg, including those in clinical use such as Rosiglitazone and Pioglitazone may reduce atherosclerotic maturation by enhancing phagocytic clearance of dying macrophages. Future derivations of PPARgamma ligands may be selected to further exploit this phagocytic property.

## **BIO – 18 THE EFFECTS OF AIR TEMPERATURE AND HUMIDITY ON DIABETIC GLUCOSE MONITOR DEVICES**

**Robert Huberman** (HS), James Madison High School, Brooklyn, faculty advisor Mr. S. Kaye

Diabetes is rising to epidemic proportions throughout the world. Most diabetics monitor their blood sugar with a glucose monitor, which means that optimal accuracy is necessary for every meter. Experiments were conducted testing how extreme temperatures and humidity affect glucose monitor results. A series of control solution tests were performed at room temperature and normal humidity levels. Then tests were performed in low temperature, high temperature and at high humidity conditions. The results showed that all extreme environmental conditions applied to the meter skewed the glucose test results. The tests at low atmospheric temperatures and high relative humidity caused the greatest deviation from control levels.

## **BIO – 19 THE AVIAN FLU, A FUTURE PANDEMIC?**

**Margaret Taormina & Laura Weiss**, (HS), James Madison High School, Brooklyn, faculty advisor Mr. B. Harvey

What are pandemics such as the avian (bird) flu? How do they spread? Which species is affected most? Where did the avian flu start? And how can they be stopped before they really spread? We believe that pandemics such as avian flu will affect birds and other small animals more than others. The bird flu originated in South-eastern China, where it first infected poultry. Though the virus originally started in birds, humans are more susceptible to it. The virus spreads in two ways, reassortment and adaptive mutation... Over time people become less susceptible to the virus and therefore, it is not transmitted as easily. To compensate for this, the virus will evolve in order to spread and survive....Scientists are trying to find a way to prevent the virus from globally spreading but have not been successful due to the fact that they have not been able to identify disorders in the DNA sequences of the victims.

## **BIO – 20 HOW DO VARIOUS COOKING METHODS AFFECT THE LEVELS OF ANTIOXIDANTS IN BROCCOLI?**

**Zarina Yelskaya & Max Nestor** (HS), James Madison High School, Brooklyn, faculty advisor Mr. B. Harvey

There is an ongoing debate regarding the effects of different methods of cooking on the nutritional levels of food. We decided to conduct an experiment to observe how modifications of cooking methods affect Vitamin C (an antioxidant) levels in broccoli. The procedure consists of three major parts. Vitamin C extraction (by blending broccoli in distilled water), titration (filtering out the Vitamin C from the mixture) and finally, using Indophenol solution as a Vitamin C indicator. The results of these experiments can be depicted in the following descending order of the amount of the antioxidant. Broth from the boiled broccoli, microwaved, steamed, fried, boiled and raw. We discovered that heat plays an important role when it comes to the antioxidant environment...In conclusion, we discovered that microwaving and steaming are the best methods when cooking broccoli, unless soup is made out of broccoli, in which situation the broth, rich in antioxidant, is consumed.

## BIO – 21 WHAT ARE THE EFFECTS OF VARYING PH LEVELS ON THE TRIOPS LONGICAUDATUS?

Slav Doroshev (HS), James Madison High School, Brooklyn, faculty advisor Mr. S. Kaye

The Triops Longicaudatus is an extremely unique creature. Triops Longicaudatus are crustaceans that are also called Dinosaur shrimp or Tadpole shrimp that look like miniature horseshoe crabs. They have a short life cycle of 20-90 days- growing very quickly in this time to about 2 inches in length. Fossils of Triops have been found that show they were on the earth around 200 million years BC. The unusual thing is that Triops haven't really changed in all those years. Triops survived because their eggs exist in a state of suspended animation until they are added to water, scientists think that this is what helped the Triops survive the extreme temperatures and long droughts that existed at the time. The eggs will remain in a state of diapause for up to 25 years at a time.

This project explores the survival of these living fossils under several environments with varying pH levels. During my experiment, I cultivated a colony of Twelve Triops up until the adult stage of their life. After which I placed two in each of the six tanks we prepared earlier, one being the control, and watched what happened. The main idea of our experiment is to see what environment they thrive in the best, it being acidic or extremely alkaline. I base my observations mainly on their behavior and physical appearance, the Triops are very active creatures who intake oxygen from the water by means of their "flippers", so in order to breathe they must be constantly moving, I hypothesize that if their living habits or their environment is affected in any way, it will affect their chances of survival.

## BIO – 22 KINETICS OF CELL WALL DISPLAY WITH A GFP-GPI-MANNOPROTEIN IN YEAST

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Mannoproteins play an essential role in the cell wall of yeast. These proteins are responsible for creating a protective layer on the outer surface of the cell wall. Yeasts localize many mannoproteins to the cell wall with the help of a glycosyl phosphatidylinositol (GPI) anchor. Without this glycolipid the GPI protein cannot localize to the cell wall and is then excreted out of the cell into the media. This is important because many alterations result from the lack of this GPI anchor such as loss of growth, inefficient reproduction, and even change of cell wall conformation. To understand more about the processes in yeast we must understand the kinetics of expression of these mannoproteins.

A plasmid was created in which DNA encoding GFP was fused to DNA that had a gene that encoded the C-terminal half of the GPI mannoprotein  $\alpha$ -agglutinin. The construct of interest consisted of four parts: a secretion signal, GFP, the GPI mannoprotein, and the GPI addition signal respectively.

The construct of interest, with and without the GPI addition signal, was purified from E. coli and inserted into a plasmid where expression was regulated under the *GAL1* promoter. This plasmid was transformed into three yeast strains, and selected on CSM – His plates. The three strains differed in their degree of glucose repression of the *GAL1* promoter. One mutant strain, YM4279, was grown in glucose media, and induced with galactose after the cells reached exponential phase. Samples were collected and so far YM4279 has not started showing expression 48 hours after induction.

More tests are being conducted with different yeast strains, YM4281 and YM4282, which have less glucose inhibition than YM4279. By comparing these results, we will analyze the kinetics of cell wall localization while the *GAL1* promoter is being repressed at different degrees.

**BIO – 23 MOLECULAR MODELING STUDIES OF GRAM DOMAINS IN THE MODEL PLANT, *ARABIDOPSIS THALIANA***

**Jeffney Tanis** (UN) & Shaneen M. Singh, Department of Biology, Brooklyn College, CUNY

The GRAM (Glycosyltransferase, Rab-like GTPase activator, and Myotubularin) domain is found in glucosyltransferases, myotubularins, and other important membrane-associated proteins. The GRAM domain is found in various organisms across different phyla signifying a conserved biological function. It is not definitive how the GRAM domain works; however, experimental studies have revealed that the GRAM domain may act as a membrane targeting module and may be essential for proper association of the protein with its target membrane. The model organism *Arabidopsis thaliana* contains at least 20 known instances of the GRAM domain but almost nothing is known about the function of these domains in this plant. The major goals of this study are to (a) use an automated high-throughput comparative modeling pipeline to identify and model known and new instances of the GRAM domain in *Arabidopsis thaliana*, and (b) make predictions of the biological function of these GRAM domains in *Arabidopsis thaliana* and plants in general, the preliminary findings of which are presented here.

**BIO – 24 ASSESSMENT OF THE EFFECT OF ARBUSCULAR MYCORRHIZAE SYMBIOSIS ON THE ATTACHMENT OF *AGROBACTERIA TUMEFASCIENS***

**Solomon Bisangwa** (UN) & Catherine McEntee, Department of Biology, Brooklyn College, CUNY

Arbuscular mycorrhizae are a type of fungus that lives symbiotically with 95% of all studied plant species. The mycorrhizae penetrate the roots of the host plant and aid in nitrogen assimilation and the uptake of water and nutrients in exchange for the carbohydrates produced by the plant's photosynthesis. The aim of this project is to understand the effects, if any, a prior symbiotic relationship between a host plant and arbuscular mycorrhizae has on the attachment of *Agrobacterium tumefaciens* to the plant's root. *A. tumefaciens* is a species of bacteria that attaches to a plant and causes tumors in the hosts by inserting segments of its DNA that code for plant hormone production. These tumors are damaging, and often fatal, to the host plant.

Alfalfa (*Medicago Sativa*) seeds are sterilized in a detergent and bleach solution and then placed onto nutrient agar gel plates for germination. Upon germination the roots are then excised and placed on separate plates for further growth. After these roots grow to a sufficient size they are infected with the mycorrhizal fungus *Glomus mosseae*.

The objective of this experiment is to attempt to coinfect the mycorrhizal roots, alongside non-mycorrhizal control roots, with *A. tumefaciens* and observe any differences in the success of *A. tumefaciens* attachment.

This research could reveal whether symbiosis with mycorrhizae provides a plant protection from *A. tumefaciens* and possibly other pathogens. It may also shed light on the mechanisms by which any protection is afforded to the plant.

#### **BIO – 25 THE IMPORTANCE OF PROSTATE CANCER EDUCATION FOR AFRICAN AMERICAN MALES**

Marlon McLeod (HS) & Janice Baranowski, Brooklyn Technical High School, Brooklyn, NY

Prostate cancer is a form of cancer caused by malignant growth in the prostate gland. It is the second most common form of cancer found in American men besides skin cancer. Also, prostate cancer is the second leading cause of cancer-related deaths in American men, after lung cancer. There seems to be a disparity amongst the diagnosis/treatment of prostate cancer by ethnicities. Although the reasons are unknown, prostate cancer is found mostly in African-American men (term not used interchangeably with "blacks"). The study examined any and all possible reasons for such disparity in the diagnosis of prostate cancer among ethnicities.

In order to examine this disparity a one-way analysis of variance (ANOVA) was utilized. This analysis was used to compare the diagnosis rates to age, and ethnicity. The charts will show a direct relationship that the average age at which an African-American male takes a prostate-specific antigen test (PSA) is much older than that of all other ethnicities, when the cancer is in much later stages. This will display the importance of the prostate-specific antigen test (PSA), although not proven to aid in prostate cancer prevention, it is believed to give the victim a higher chance at recovering from the cancer with early detection. These results will most likely increase prostate cancer awareness, informing scared/unaware/in denial African-American males to get tested as early and routinely as possible.

#### **BIO – 26 EFFECT OF JUVENILE HORMONE ANALOG ON MOSQUITO MIDGUT METAMORPHOSIS**

Inimfon Sandy (UN), Fayeann Crawford, & James T. Nishiura, Department of Biology, Brooklyn College, CUNY

Methoprene interferes with mosquito metamorphosis, which includes programmed death of polytene cells and duplication of diploid cells. The question is, when during the fourth instar do programmed cell death of polytene cells and division of diploid cells occur. Fourth instar larvae are collected at different times and are treated with different concentrations of Methoprene. These larvae are allowed to remain in the Methoprene solution until pupation. The midguts are stained with DAPI to determine what cells are present. The degree to which Methoprene affects the midgut is dependent on the concentration of Methoprene used. DNA staining using DAPI indicates that a high concentration of Methoprene affects diploid cell division and programmed death of polytene cells. DNA Staining also indicates that low Methoprene concentration does not affect diploid cell division but there is an incomplete removal of polytene cells. Understanding how juvenile hormone analog affects mosquito midgut metamorphosis will aid in enhancing methods used in hormonal control of insect development.

**BIO – 27 BROMODEOXYURIDINE (BrdU) INCORPORATION DURING MOSQUITO MIDGUT METAMORPHOSIS**

Maria Mercedes\*(UN), James Nishiura, Chi Yan Choi & Doris Chan, Department of Biology, Brooklyn College, CUNY

Mosquitoes are vectors for microbes that cause many human diseases such as yellow fever, dengue fever and malaria. Widely used mosquitocides have juvenile hormone analogues (JHA) as their active agents. The JHAs block mosquito metamorphosis but the mechanisms by which they do so are not well understood. One overall purpose of our experiments is to study mosquito metamorphosis with the goal of understanding the mechanism of JH action. The larval midgut contains diploid and polytene cells. During mosquito metamorphosis there is a remodeling of the midgut. This involves removal of polytene cells by programmed cell death and an increase in the number of diploid cells. The pupal midgut is composed on only diploid cells. The remodeling of the midgut is altered by the exogenous application of the JHAs, pyriproxyfen and methoprene. The experiments reported here use Brdu to follow the pattern of diploid cell division during midgut remodeling. The results indicate that during the first 24 hours of the last larval molt DNA synthesis occurs in both polytene and diploid cells. After 24 hours polytene cell DNA synthesis ceases while diploid cell DNA synthesis continue. The number of diploid cells carrying out DNA synthesis greatly increases 48 hrs after the last larval molt. This coincides with the period of maximum ecdysone titer. We hypothesize that JH is required for polytene cell DNA synthesis and ecdysone stimulate diploid cell division.

**BIO – 28 SCREEN FOR ARABIDOPSIS THALIANA MUTANTS RESISTANT TO AGROBACTERIUM TUMEFACIENS- MEDIATED TRANSFORMATION**

Lourdianie Pierre-Charles (UN), Khudeja Mir, and Theodore R. Muth, Department of Biology, Brooklyn College of CUNY

*Agrobacterium tumefaciens* is a soil bacterium that causes crown gall disease in a variety of plant species. *A. tumefaciens* are capable of recognizing wound sites on a plant by detecting chemicals produced during the wound response of the plant. Laceration of the plant tissue causes the production of phenols and sugar molecules which in turn trigger not only the chemotaxis of the bacteria towards the injury, but the processing of the tumor inducing plasmid (Ti plasmid) as well as the expression of certain virulence genes. It is known that the bacteria insert a segment of their Ti plasmid, the transfer DNA or T-DNA, into the plant at the wound site. The integration of the T-DNA allows for the production certain plant hormones. It is the uncontrolled plant cell division stimulated by the overproduction of growth hormones that leads to the formation of tumors. Currently there is very little known about how *A. tumefaciens* attach to plant cells and transfer the T-DNA into these cells. Through experimental analysis we seek to identify mutant lines of *Arabidopsis* that are resistant to transformation, or hypersensitive to transformation. Identification of resistant or hypersensitive plant types is done through root tumor assays, histochemical GUS assays and flourometric MUG detection assays. In using these methods, it was determined that some *Arabidopsis* mutants show evidence of increased resistance while other mutants exhibit susceptibility to transformation similar to wild types. There is little known about the mechanism behind *A. tumefacien* attachment and transfer of T- DNA into plant cell, but it is our hope that identification of *Arabidopsis* genes associated with transformation in this screen will allow greater understanding of how the bacterial genetic material is transferred into the plant genome.

## **HNS - 1 JAMKHED MODEL: INCOME GENERATION PROGRAMS, HEALTH POLICIES, AND SUSTAINABILITY**

**Ravi Parikh** (UN) & Dr. Antoniello, Department of Health & Nutrition Sciences, Brooklyn College, CUNY

Microfinance has been praised as a social innovation to alleviate poverty; the most well-known microfinance organization, Grameen Bank, was jointly awarded the 2006 Nobel Peace Prize. This paper will raise questions about the sustainability of microfinance schemes and describe the success of an alternate model in Jamkhed, India. The Comprehensive Rural Health Project Jamkhed (CRHP) is a community-based primary healthcare organization that incorporates social and economic programs into its model. CRHP policies created a system and an organizational structure of women's groups which became Mahila Vikas Mandals (MVMs called Women's Development Associations) to promote income generation programs that combine microeconomic loans and business training to help women develop financial security, foster cooperative associations, and provide household resources. By 1978, 31 villages had MVMs and today over 6,000 women are involved in microfinance schemes, which are started by the Jamkhed trained Village Health Workers (VHWs). VHWs and MVMs use microcredit loans for livestock, tailoring equipment, bangles for sale, dry fruits, dry food, land development, and agricultural purchase seed. The MVMs are organized around income generation programs and are also a forum for VHWs to teach health promoting behaviors such as oral rehydration, tracking pregnancy outcomes, and safe-deliveries. Methods: This project collected data using ethnographic field methods, including life history methodology, to collect qualitative data to assess financial resources. Results: This data allowed an analysis that elucidates the link between income generation and health. Thus, CRHP policies that incorporate microcredit loans with income generation training, both of which are connected to improving health, demonstrate the sustainability of the model.

## **HNS - 2 THE EFFECTS OF WEIGHT LOSS DIET COMPOSITION ON CCK RESPONSE IN OBESE RATS**

**Virna Hallak** (GRAD), Kathleen Axen, Kenneth Axen, Mark Phillips and Malki Miller, Department of Health and Nutrition Sciences, Brooklyn College-CUNY

Cholecystokinin (CCK) is a hormone that is secreted by intestinal cells following a meal. Secretion of CCK causes physiological changes: 1) stimulation of gastric acid release, 2) increased gallbladder and pancreatic secretion, 3) decreased gastrointestinal motility and 4) suppression of energy intake.

Can different weight loss diets affect the satiating effects of CCK in obese rats? Male Sprague - Dawley rats were divided into two weight-matched groups: control (C) group received standard chow; and HF group was fed a high fat diet to produce obesity. Two-thirds of HF rats were divided into two weight loss diet groups, High Carbohydrate (HC, 60% of energy as carbohydrate, 15% fat) and Very Low Carbohydrate (VLC, 5% carbohydrate, 60% fat; similar to the Atkins Diet). The two groups were pair fed daily for 12 weeks. An intra-peritoneal injection of CCK or saline was administered at three trials at least a week apart. A test diet with composition intermediate to the HC and VLC diets was given and food intakes were measured at 30, 60 and 120 min post injection.

At 30 min, high doses of CCK (2 mcg/kg BW) significantly decreased food intake in all groups except HF rats ( $p=.0185$ ). At 30min post injection, HC rats reduced their intake more than C rats ( $p=0.0211$ ). On the low dose of CCK (0.5 mcg/kg BW) HC rats showed a greater suppression of food intake than VLC rats at 120 min. Diet rats showed a greater suppression



of food intake than VLC rats at 120 min. Diet affected the rats' response to the satiating effects of CCK.

### **HNS – 3 SCHOOL FOOD PROVISIONS: A POTENTIAL CAUSE OF ADOLESCENT OBESITY**

**Melissa S. Alvarado** (HS) & Janice Baranowski, Brooklyn Technical High School, Brooklyn, NY

Adolescent obesity has increased to 27% prevalence in the past ten years in the United States. Adolescent obesity can lead to health problems including diabetes, heart disease, and high-blood pressure. Studies that examine adolescent eating patterns often reveal various sources that may of cause obesity. Since 35% to 40% of adolescents' total daily energy is consumed at school, the school food environment is a suitable place to assess adolescent food consumption. In this study the approximate number of calories of 1088 students in 20 Minnesota secondary schools consumed from school snacks available, was determined. The difference between the recommended number of calories and the actual number of calories consumed was determined. It was found that adolescents exceed recommended daily intake of calories by approximately 57%. The results also showed that about 47% of adolescents' daily calories were consumed from salty snack items. Limitations to this study included the short time period over which it was conducted and the fact that it was only conducted in Minnesota does not allow for a generalized statement to be made for the entire adolescent population in the US. Future research should include the nutritious value of all foods being served in the school environment and how many students are consuming the food and how often. This may help raise awareness of ways to improve the nutritious value of foods in the school environment, thus decreasing the adolescent obesity population.

### **HNS – 4 WEIGHT LOSS DIET COMPOSITION AND EFFECT ON GLUCOSE TOLERANCE**

**Nel Trasybule** (UN), Virna Hallak, Mark Phillips & Kathleen Axen, Department of Health & Nutrition Science Brooklyn College, CUNY

Obesity is associated with Type 2 diabetes mellitus. Weight loss is effective in lowering diabetes risk but the effect of the composition of the weight-reducing diet on diabetes risk is not known. We therefore studied the effects of two different calorie-matched, weight reducing diets on control of blood glucose in a glucose tolerance test (GTT) since impaired glucose tolerance is a predictor of diabetes.

Weight-matched male Sprague Dawley rats were assigned to either control (C, N= 18) group, fed standard lab chow or the obese group (N=46), fed a high-fat (HF, 15% carb, 60% fat) diet ad libitum. : At week 8, ip glucose tolerance tests (2ml of 50% glucose /kg) and insulin tolerance tests (ITT, 0.75 U insulin /kg) were performed. The HF group was then split into three weight matched groups: 1) VLC received a very low carbohydrate (5% carb, 60% fat, similar to Atkins diet), energy- restricted diet; 2) HC received a high carbohydrate (60% carb, 15% fat, similar to Weight Watcher's diet) diet with calorie intake matched with that of VLC rats 3) HF rats continued their diet ad lib.

Results showed that after 3 weeks, the HC group had better glucose tolerance than VLC. ITT indicated no difference between the two groups in responsiveness to insulin. These results

show that the VLC diet provided poorer reduction of diabetes risk than the HC diet despite equal calorie intake and that the effect was not due to greater insulin resistance, suggesting that the HC diet better preserved insulin secretion.

#### **HNS – 5 THE ASSOCIATION BETWEEN HEALTH LITERACY AND PATIENT-PHYSICIAN COMMUNICATION, SOCIO-ECONOMIC STATUS, AND OVERALL HEALTH OUTCOMES**

Shana Richards (HS) & Janice Baranowski, Brooklyn Technical High School, Brooklyn, NY

Health literacy has become a critical factor in the health care industry, affecting patient-physician communication for adults. Immediately after leaving the doctor's office, patients are able to recall less than 50% of information just told to them. Scientists are trying to improve levels because patients with inadequate health literacy can face major problems in the health care system. Patients may not be able to complete forms proficiently, may be embarrassed to ask for help, and may end up missing important appointments or sign documents they did not understand. Studies have shown that about 14% of adults in the country have a below basic health literacy level, which is the lowest level on a four level scale. Another 22% had a basic literacy level, which is the next highest level. Most health care materials are written at a grade level higher than most people can understand. In this study, results have shown that diabetes patients with a lower health literacy level also have bad patient-physician communication, a low socio-economic status, and poor overall health. Future research needs to be done to find out the superlative method for effective communication with patients with low health literacy. Also, doctors need to plan on how to attack low health literacy in all areas of the country.

#### **HNS - 6 TREATING ANOREXIA NERVOSA-INDUCED OSTEOPOROSIS WITH A COMBINATION TREATMENT OF WEIGHT GAIN, ANTIDEPRESSANTS AND REDUCED LEVELS OF LEPTIN**

Alphina Kain (HS) & Janice Baranowski, Brooklyn Technical High School, Brooklyn, NY

The goal of this study was to examine treatments that combine weight gain, antidepressants and reduced levels of leptin in an attempt to increase bone mineral density, which tends to decrease as a result of the eating disorder anorexia nervosa. Along with the fact that this disease usually occurs during adolescence, many female patients become susceptible to osteoporosis at a much younger age than a normal female. A previous study noted that when anorexic patients gained weight as a method of treating the disease, their bone mineral density increased and subsequently, the probability of bone fractures as a result of osteoporosis decreased. The risk of developing osteoporosis was highest when the body mass index was below 15 kg/m<sup>2</sup>. In a future experiment, four groups of mice would be used, one for each individual treatment and one for the combined group. Each group would be on a restricted diet, emulating anorexia nervosa before appropriate treatments follow. The weight gain group would return to a nutrition diet and is the control group. Leptin would be tested using leptin-deficient mice injected with leptin along with weight gain while the antidepressant group would use the antidepressant Sertraline HCl and like the leptin group, receive a nutrition rich diet. Current treatments for such lowered BMD treat one aspect of the disease, and since anorexia nervosa affects multiple facets of the patient, it is expected that a combination treatment should be more effective.

## **HNS – 7 DETERMINING THE SIGNIFICANCE OF HYDRALAZINE OXIDATION RATE TO FURTHER UNDERSTAND DRUG-INDUCED LUPUS**

**Suhaniya Aumbhagavan** (HS) & Janice Baranowski, Brooklyn Technical High School, Brooklyn, NY

Systemic lupus erythematosus (SLE or lupus) is a chronic, inflammatory, multisystem disorder of the immune system that causes autoimmunity, which means that the body develops antibodies that react to the body's own normal tissue. Drug-induced lupus erythematosus (DIL) is a type of lupus that develops after the use of certain drugs. There are over 70 lupus-inducing medications, but of the three known antihypertensive lupus-inducing medications, hydralazine poses the most significant risk. Continuous use leads to organ damage and to counteract this effect DIL patients must discontinue use of hydralazine. This study was done to determine why hydralazine might induce lupus through the patterns found in its oxidation rate. The basis of the study was to find something unique about the way in which hydralazine works in the body. It was hypothesized that hydralazine may induce lupus by making hydrogen peroxide harmful to the body and therefore causing autoimmunity. This experiment used hydralazine, DTNB, EDTA, hydrogen peroxide, distilled water and cysteine to create an environment similar to that of a human body and progression of the reaction was observed for any significant change in the hydralazine compared to the control. The data collected was analyzed using the t-test but did not show significant results. Some readings indicate that there maybe significance in the first 3 minutes of the reaction that can be experimented with in the future.

## **HNS – 8 EFFICACY OF HEALTH EDUCATION PROGRAMS IN THE UNITED STATES**

**Rachel Lachhman** (HS), Brooklyn Technical High School, Brooklyn, NY

The aim of this study was to determine if a relationship existed between a state's health education policy and the rate of pregnancy among high school teenagers, ages 15-19. Health education material was collected via email and telephone. A uniform email was sent to state education representatives asking if a state-wide compulsory health education program was incorporated into their high school curriculum. If the health program was not state-wide, they were asked to clarify how a decision was made as to whether or not a school would have a health education program. Information on state teenage pregnancy rates were obtained from a private state endorsed surveying company. The data showed that states with no health education programs and a low population density held similar statistics as states with non-compulsory health education programs and low population densities. It also showed that states with a high population density and a compulsory health education program curriculum tended to have lower teen pregnancy rates than states with no health education curriculum and a low population density. The overall trend of the data showed that states with a compulsory health education curriculum had a more effective impact in reducing the teen pregnancy rate.

**PEES – 1 DOES HEAVY RESISTANCE EXERCISE CAUSE HYPERTENSION IN ADOLESCENT MALES?**

**Jack Mlabassati** (HS), Magen David Yeshiva High School, Brooklyn

Many studies have been conducted on the effect of exercise and blood pressure. Most of the reports stated that exercise may reduce blood pressure. Several adolescent males have been reported to have developed high blood pressure while engaging in extreme weight lifting. A hypothesis was developed stating that adolescent males that engage in extreme weight lifting may experience an increase in blood pressure.

**ENV SCI – 1 A COMPARISON OF AQUAPONICS METHODS: RAFT AND AEROPONICS**

**YuFu Luo** (UN), Diane Rhoden, Robert Dickie, Martin P. Schreibman, Aquatic Research and Environmental Assessment Center (AREAC), Brooklyn College, CUNY

Aquaponics is a new and emerging approach to sustainable plant and fish culture; it is the merging of aquaculture and hydroponics. Using the same water, plants and fish are co-cultured in a closed recirculating system and ultimately this results in two marketable crops. In this study, we will use Tilapia (*Oreochromis niloticus*) and the plant, Arugula (*Eruca sativa*). Two Hydroponic techniques involved will be Aeroponics and Deep Flow Technique ("Raft culture"). In the first phase of this study, we designed, constructed and confirmed the hydrodynamics of the system, which will be discussed. We will be assessing plant and animal mass growth over a four week time period. The data collected will be used to compare the two different techniques. When the technique that yields the best growth is found, it will be applied to other crops for high capacity crop production. Ideally, developing and developed countries can use this information for more efficient and environmentally responsible food cultivation

**ENV SCI – 2 DOES INCREASED HETEROZYGOSITY RESULT IN IMPROVED OVER-WINTER SURVIVAL AND PHYSIOLOGICAL CONDITION OF HARD CLAMS, *MERCENARIA MERCENARIA*?**

**Yousra Abdelhadi**<sup>1</sup> (UN), Chester B. Zarnoch<sup>1</sup>, Martin P. Schreibman<sup>1</sup>, and Matthew Sclafani<sup>2</sup>, <sup>1</sup>Aquatic Research and Environmental Assessment Center (AREAC), Brooklyn College, CUNY, <sup>2</sup>Cornell Cooperative Extension of Suffolk County (CCE), Centerport, NY 11721

Greater heterozygosity has been positively correlated with growth rate in bivalves. The physiological explanation for this relationship is that increased heterozygosity enables individuals to sustain their basal metabolism at lower energy costs; therefore more energy can be directed to growth. However, no direct connection between an electrophoretic locus and growth has been found. We suspect that physiological parameters can explain differences in growth and survival due to heterozygosity. Aquaculturists use selectively bred *Mercenaria mercenaria* var. *notata* clams because of their greater growth. However, *notata* clams were shown to have a heterozygous deficit when compared to wild clams. In this study, we compared survival, biochemical composition, and activity of the electron transport system (ETS) of *notata* and wild clams in relation to over-winter stress. Survival was greater in *notata* clams (50%) than wild clams (33%). Significant changes were observed in carbohydrate and protein concentration (ANOVA;  $p \leq 0.001$ ) of both clam strains. No significant changes occurred in lipid concentration (ANOVA;  $p \geq 0.74$ ). Initially, the wild clams had greater ETS activity than the *notata*. However, as water temperature increased the *notata*'s ETS activity was up to 33% greater than the wild. The *notata* also utilized 25% of their carbohydrate reserves during this period. Although survival was greater in *notata* clams, the physiological data suggests that they have higher metabolic costs during spring warming. Thus lower heterozygosity may have a negative influence under specific environmental conditions. This data is pertinent to the multi-billion dollar hard clam industry in the US.

**ENV SCI – 3 DOES CULTURE AFFECT SANITATION?**

**Annie Lee** (UN) & Micha Tomkiewicz, Department of Environmental Studies, Brooklyn College, CUNY

The goal of this study is to investigate whether or not cultural practices affect sanitation conditions. The study area Chinatown, NY was chosen because it is a historical immigrant neighborhood with a predominantly Asian population. The study begins with a survey of residents regarding their sanitation concerns (if any) in Chinatown. Residents cite restaurants and open markets as main causes for an accumulation of litter on the street and as the main generators of garbage in the area. A literature review and field research was conducted to investigate the place of these establishments in Chinese culture. A special focus was placed on East Broadway; the location of Chinatown's newest immigrants, as it is likely their practices have yet to be changed by American culture. A review of Little Italy, a predominately Italian neighborhood adjacent to Chinatown, was done for comparison of sanitation conditions. Interviews indicate that food is major part of Chinese culture and for historical reasons, the majority of establishments in Chinatown are restaurants and markets. The structural layout of the open market was found to be culturally significant. At the conclusion of the study it was found cultural practices do have some impact on sanitation conditions. In the case of open markets, Chinese are accustomed to and expect this type of structure. However this layout creates sidewalk congestion and street litter. Future applications for this research include providing different language materials to keep businesses informed about city sanitation standards as there is a need to overcome language barriers in immigrant neighborhoods.

**ENV SCI – 4 THE PRAGMATIC PRINCIPLE OF PAPER RECYCLING; HOW MUCH IT HAS CHANGED AND ITS INFLUENCE ON ENVIRONMENTAL HEALTH**

**Fayeann Crawford** (UN) & Dr. Micha Tomkiewicz, Department of Physics, Brooklyn College, CUNY

Paper recycling has shown great potentials for the reduction of deforestation and the amounts of waste sent to dumping grounds. The process of paper recycling also carries concerns over how safe its practice is. The aim of this project is to look at the current practices employed in the recycling process and to analyze what, if any, progress has or is being made to implement safer practices. A recycling plant within a reachable proximity was chosen, and an analysis of its environment was done. A visit was paid to the site and an interview with the senior vice president was done. Chemicals used in the recycling process were analyzed for their potential health risks and a toxicological report of the area around the plant was studied. We wanted to look at whether there may be a correlation between the potential pollution production of the plant and the health of people living around the site. This was done by comparing the chemicals that are used or that surface in the recycling process, methods of their disposal or treatment, location of this facilities and health of the community located around it. An understanding of how current paper recycling techniques can, and do, affect the environment, will allow needed accommodations to be made so that a sustainable future can be achieved.

### **ENV SCI – 5 CORRELATION BETWEEN SALAMANDER ABUNDANCE AND EPIPHYTIC BIODIVERSITY IN REDWOOD FOREST CANOPIES**

**Anna Akker** (HS) & Janice Baranowski, Brooklyn Technical High School, Brooklyn, NY

The objective of this study was to find a correlation between the abundance of the California southern clouded salamander (*Aneides vagrans*) and the species diversity of epiphytic plants inhabiting coastal redwood (*Sequoia sempervirens*) canopies in northern California. Using secondary sources, scientists in the published research conducted a mark-recapture study of *A. vagrans* salamanders in ten living old-growth redwoods over 87.0 meters in height, using canvas sacks as traps and cover boards to mimic their natural habitat. This was done three times a month in October, November, January, and February to calculate salamander abundance in the designated redwood stands. A survey of all epiphytic plant species residing in the redwood canopies was conducted twice a year. Both the mark-recapture studies of *A. vagrans* and the survey of epiphytic plant diversity were performed every year for ten years. Ultimately, the goal was to determine whether the salamander *A. vagrans* is an effective indicator of epiphytic diversity, as it is the only salamander species known to reside in forest canopies outside of the New World tropics.

### **ENV SCI – 6 COPEPODS**

**Edita Greben** (HS) & Francis Fisher, Franklin D. Roosevelt High School, Brooklyn, NY

This experiment was conducted to determine if copepods were present in New York's water reservoir. The experiment was interesting because it had real world application and would affect several communities in Brooklyn. The experiment included testing salt and fresh water for the presence of copepods. A salt water sample was taken from two different beaches in Brooklyn. The salt water was viewed under a microscope to determine if it contained copepods. After testing the salt water, the tap water that was taken from a faucet was tested. A cotton swab was placed into the faucet so it could act as a filter for the water that was passing through it. After a day or so, the cotton swab was removed and soaked in water. The water that the cotton swab soaked in was viewed under a microscope to see if it contained any copepods. This procedure was conducted several times in order to get accurate results. After conducting the experiment the results were recorded.

It was reported in certain communities in Brooklyn that copepods were found in New York's water reservoir. The experiment that is being done challenges this report by having a different opinion about this topic. The hypothesis is that there are no copepods in New York's water reservoir because copepods mostly come from the ocean and New York gets its water from a reservoir which is located all the way in upstate New York. Knowing that copepods come from salt water, it was thought that it would be very unlikely that copepods would be present in the reservoir because it's far inland and has very little if no exposure to salt water. Also knowing that before entering the faucet, the water from the reservoir undergoes many different stages of filtration. Knowing this a hypothesis was developed that says that there are no copepods in New York's water reservoir.

### **PHYSICS – 1 A PRACTICAL, YET EFFICIENT SHIELD FOR COSMIC RAYS**

**Barbara M. Richards** (HS) & Janice Baranowski, Gateway to Medicine, Brooklyn Technical High School, Brooklyn, NY, 11217

The purpose of this research is to develop a shield to protect astronauts from the radiation of cosmic rays. Realistically, such a shield needs to be light, strong and unable to release great amounts of secondary radiation. There are many candidates for an effective shield, however polyethylene has been proven to be able to protect human cortical neuron cells. In order to ascertain this, a million cells within a petri dish were bombarded with iron, carbon, and silicon nuclei, while being sheltered by one to five layers of polyethylene. The results showed that the fewest number of brain cells died in the petri dish protected from simulated cosmic rays by five polyethylene layers. It can be seen from this experiment that polyethylene could safeguard astronauts against solar and cosmic rays, as a component of space crafts. The development of such a shield will allow mankind to visit and later inhabit celestial bodies, such as the moon and Mars, without the fear that solar ! cosmic radiation released from a coronal mass ejection will cause multiple cancers within the body.

Research funded by the Department of Energy, and conducted at the National Space Radiation Laboratory, Brookhaven National Laboratory

### **ENG – 1 ELECTROMAGNETIC LEVITATION**

**Tomasz Turek** (HS), James Madison High School, Brooklyn, faculty advisor Mr. B. Harvey

The engineering goal of producing and maintaining stable levitation is one of the most interesting phenomena in science. Magnetic levitation is a method by which an object is suspended above another object with no support other than magnetic fields. The electromagnetic force is used to counteract the effects of the gravitational force by means of incorporating a feedback system which counteracts the forces working against maintaining stable levitation. The system can detect the position of an object in space and feed it into a control system, which can vary the strength of electromagnets that are acting on the object, making it stable. Improvements to this technology may lead to scientific innovations in transportation and space technology.

### **ENG – 2 EXPLORING THE DESIGN BEHIND VISUALLY REALISTIC AUTOSTERIOSCOPIC DISPLAYS**

**Alex Goldis & Eugene Pepsh** (HS), James Madison High School, Brooklyn, faculty advisor Mr. S. Kaye

Autostereoscopic displays and projectors can easily become the means of displaying digital information in the future but problems remain that engineers and designers have yet to address that stop these systems from attaining perfection. In this study we will evaluate Autostereoscopic projection systems and create a concept, based on the research and experimentation that we have performed in the hope of addressing, at the very least, a small portion of the difficulties experienced with Autostereoscopic display systems. Autostereoscopic systems differ from stereoscopic systems in that the viewer or user does not have to wear any headgear to perceive images differently (3D goggles). There are several commercial products currently available but they can cost many thousands of dollars. Despite the price being so high many of the systems lack both in practicality and performance. The end goal of all stereoscopic systems is to create an image that is 3



dimensional and can be perceived by an unlimited number of viewers on an unlimited number of height levels. The initial experimentation that has been performed has yielded a system that projects true Sutostereoscopic images with still and motion picture images.

**CHEM – 1 THE RELATIONSHIP BETWEEN THE IONIC STRUCTURE AND VISCOSITY IN THE ROOM-TEMPERATURE IONIC LIQUIDS**

Hualin Li (GRAD), Murfat Ibrahim, Ismail Ageremi and Mark N. Kobrak Department of Chemistry, Brooklyn College & The Graduate Center, CUNY

We investigate the relationship between the ionic structure and the viscosity in Room-Temperature Ionic Liquids (RTILs). We build on earlier theoretical work and derive an ionic property we call the Charge Lever Moment (CLM). We use electronic structure calculations to estimate the CLM, and demonstrate a correlation between this property and the experimental viscosities of RTILs. We also explore the importance of ionic rigidity to viscosity.

Supported by American Chemical Society Petroleum Research Fund

**CHEM – 2 THE DIPOLE DENSITY: AN UNUSUAL LIQUID PROPERTY**

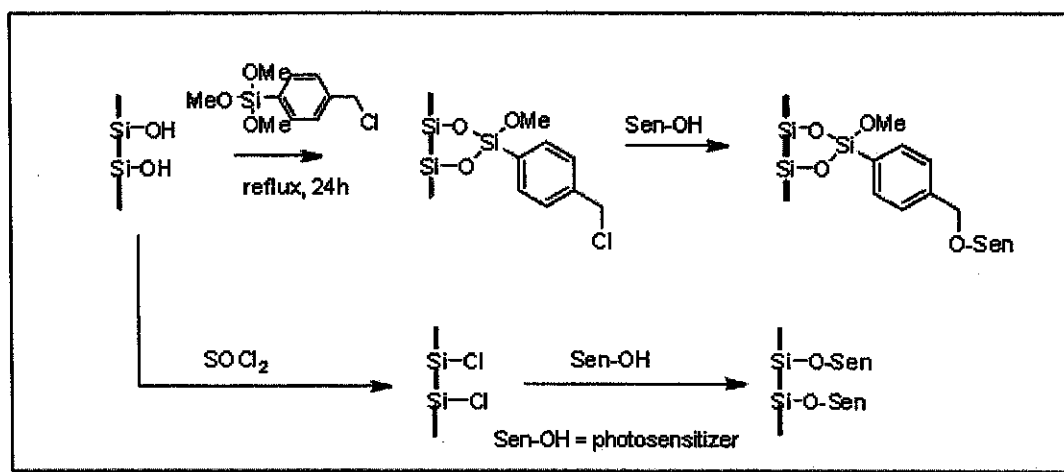
Adil Billa (HS) & Mark N. Kobrak, Midwood High School at Brooklyn College: Department of Chemistry & Brooklyn College, CUNY

We investigate a property of liquids called the dipole density, the magnitude of a molecular dipole divided by the number density of the liquid. Statistical investigation of a representative sample of molecular liquids shows that they may be cleanly divided into two classes of liquids based on this parameter: High dipole density liquids and low dipole density liquids. We study the physical properties of liquids in each category, and identify differences between the two categories. The results may be of interest to engineers and scientists studying structure-property relationships in liquid systems.

**CHEM - 3 SINGLET OXYGEN GENERATION IN SOLUTION BY GLASS-BOUND PHOTSENSITIZER**

Matibur Zamadar<sup>1</sup> (GRAD), David Aebisher<sup>1</sup>, Nikolay Azar<sup>1</sup>, Harry D. Gafney<sup>2</sup>, and Alexander Greer<sup>1</sup>. (1) Department of Chemistry and Graduate Center, City Brooklyn College, CUNY, (2) Department of Chemistry & Biochemistry, Queens College, CUNY

New methods for the generation of singlet oxygen [ $^1\text{O}_2$  ( $^1\Delta_g$ )] on glass surfaces are being developed. Our research concentrates on attaching molecules capable of generating singlet oxygen via a sensitization process to porous vycor glass. The crushed porous vycor glass is first functionalized with p-chloromethylphenyltrimethoxysilane followed by attachment of photosensitizers 2,9,16,23-tetrahydroxy phthalocyanine and *meso*-tetra(*p*-hydroxyphenyl) porphyrin. The characterization of these glass-sensitizer adducts is being conducted using DRIFT, FT-IR and solid state NMR spectroscopy. Success with the delivery of singlet oxygen to bulk solution via this glass 'heterogeneous' method may provide us a means to use it further with glass optical fibers with a goal for cancer treatment called photodynamic therapy.



#### CHEM – 4 INSIGHT INTO INNATE IMMUNITY: STIMULATION OF THE TOLL-LIKE RECEPTOR 2 (TLR2) USING VARIOUS MICROBIAL LIGANDS

**Kerton Victory**<sup>1</sup>(UN), Katie Meehan<sup>2</sup> & Marilyn Halonen<sup>2</sup>

Brooklyn College of The City University of New York, Brooklyn NY<sup>1</sup> & Arizona Respiratory Center, The University of Arizona, Tucson Arizona<sup>2</sup>

The innate and adaptive immune responses play a vital role in the detection of invading pathogens. Toll-like receptors (TLRs) function as key regulators in the recognition of pathogens. The majority of TLRs function as homodimers however, TLR2 has been shown to form heterodimers with TLR1 and TLR6. The aim of this study was to determine the effects of various microbial ligands on peripheral blood mononuclear cells (PBMCs) with regards to proinflammatory cytokine production and cell surface expression of TLR2. Innate cells (PBMCs) were stimulated with purified lipoteichoic acid (LTA) derived from *Staphylococcus aureus* at concentrations of 10ug/ml, 1ug/ml and 100ng/ml or Lipomannan (LM-MS) derived from *Mycobacterium smegmatis* at concentrations of 1ug/ml, 10ng/ml and 100ng/ml for 24 hours at 37°C. TLR2 has been shown to bind to these ligands resulting in the release of various proinflammatory cytokines. Enzyme linked immunosorbent assay (ELISA) and Cytometric Bead Array (CBA) were used to determine the presence and concentrations of proinflammatory cytokines secreted by the PBMCs. Cytokines tested included Interleukin-2 (IL-2), Interleukin-4 (IL-4), Interleukin-5 (IL-5), Interleukin-8 (IL-8), Interleukin-10 (IL-10), Tumor Necrosis Factor alpha (TNFα) and Interferon Gamma (INF-γ). Flow Cytometry was used to determine the presence of TLR2 expression on the surface of PBMCs. Elevated levels of IL-8, IL-10 and TNF cytokines were observed from stimulated PBMCs when compared to un-stimulated control cells. In addition, TLR2 expression on stimulated PBMCs was increased compared to controls. This data provides some insight into the innate immune response by demonstrating that PBMCs respond to LTA and LM-MS (likely via TLR2) by secreting elevated levels of proinflammatory cytokines.

## CHEM – 5 ANALYSIS OF FISH BONES FROM EXCAVATION SITES OF NORTH ATLANTIC REGION: TRACES OF HEAVY METALS

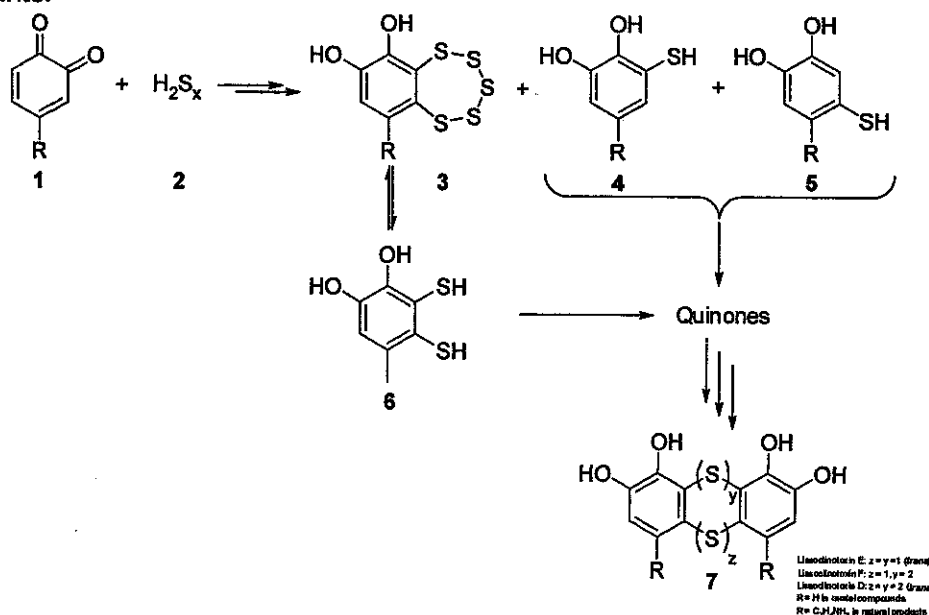
**Taralee C. Thompson** (UN), Malgorzata Ciszowska, & Walter B. Greigg  
Department of Chemistry, Brooklyn College-CUNY

This project is on the analysis of fish bones from the site of Hrisheimar located near Lake Myvatn in North East Iceland for the traces of heavy metals such as lead and mercury. New methods of fish bones mineralization, preparation and treatment were explored. The samples will be analyzed using spectroscopic techniques such as graphite furnace atomic absorption spectroscopy (GF-AAS) and cold vapor atomic absorption spectroscopy (CV-AAS). The project is interdisciplinary and is part of a collaborative effort with Professor Sophia Perdikaris of the Department of Anthropology at Brooklyn College.

## CHEM – 6 DENSITY FUNCTIONAL THEORY STUDY (DFT) OF THE TWO ELECTRON OXYDATION OF SULFUR CONTAINING CATHECOLS. PREDICTIONS OF FORMATIONS OF ANTIBIOTIC NATURAL PRODUCTS

**Alvaro Castillo**,<sup>1</sup>(GRAD) Joel F. Liebman,<sup>2</sup> & Alexander Greer<sup>1, 1</sup>Department of Chemistry, Graduate Center & The City University of New York (CUNY), Brooklyn College,  
<sup>2</sup>Department of Chemistry and Biochemistry, University of Maryland, Baltimore County, Baltimore, Maryland

The two electron oxidation of mono and bismercapto *o*-cathecols (4-6 see the scheme below) can yield several quinones. Those quinones might play a role in the formation of naturally occurring polycyclic sulfur containing compounds (7). The goal of this study is to gain understanding of the thermodynamical properties of those quinones in order to appreciate their possible role as precursors. For this purpose we are employing DFT calculations and isodesmic reactions. These calculations will help to map enthalpies of formation of the quinones allowing to narrow down which ones might be involved in the natural process. It is expected that the enthalpies of formation of the different quinones can be used to discriminate among them. This work is supported by NIH-SCORE and PSC-CUNY grants.



## CHEM – 7 ARENE-RU-CHLOROQUINE COMPLEXES AS POTENTIAL ANTIMALARIAL: DNA BINDING AND HEME AGGREGATION INHIBITION PROPERTIES

Cula Dautriche (UN), Chandima Rajapakse, Alberto Martinez, Ph.D., Becky Naoulou, and Roberto A. Sanchez-Delgado, Ph.D., Department of Chemistry and Graduate Center, City University of New York, Brooklyn College, CUNY

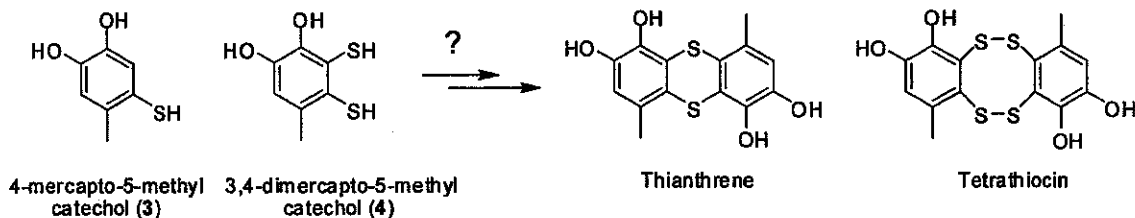
The success of cisplatin has stimulated the area of inorganic medicinal chemistry. Ruthenium complexes are being developed for applications in several diseases including malaria. Chloroquine diphosphate (CQDP) is a common antimalarial treatment, but widespread resistance dramatically limits its use. We have previously shown that complexation of CQ to metals enhances the activity against resistant strains of *Plasmodium falciparum*, e.g. in  $[\text{RuCl}_2(\text{CQ})]_2$ .

We synthesized a series of new Ru-chloroquine complexes including  $(\text{arene})\text{RuCl}_2(\text{CQ})$ ,  $[(\text{arene})\text{Ru}(\text{CQ})][\text{PF}_6]_2$  (arene = *p*-cymene or benzene) and  $\text{Cp}^*\text{RuCl}(\text{CQ})$  and characterized them by 1D/2D NMR and other methods. We have studied the interaction of the new complexes with DNA by several techniques and their potential as heme aggregation inhibitors. These compounds are promising candidates as target antimalarial agents.

## CHEM – 8 SULFUR CONTAINING QUINONES: HIGHLY REACTIVE SUBSTANCES THAT MAY UNDERGO NUCLEOPHILIC REACTIONS TO YIELD DIMERIC (BIOACTIVE) COMPOUNDS

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Quinones derived from 6-mercaptodopamine (1) and 5,6-dimercaptodopamine (2) may serve as precursors for sulfur-containing natural products, such as thianthrenes and tetrathiocins which are pharmacologically important sulfanes. Thus, we undertook an experimental effort to generate possible quinones from a model system, using 4-mercapto-5-methyl catechol (3) and 3,4-dimercapto-5-methyl catechol (4) as reagents. The formation of quinones and corresponding dimers from the oxidation of 3 and 4 are assessed by NMR, HPLC, and mass spectrometry. The experimental data will also be compared with our DFT computations.



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**CHEM – 9 DEVELOPMENT OF HIV-1 NUCLEOCAPSID PROTEIN INHIBITORS**

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Currently, drug protocols are ineffective for the HIV infection because the viral proteins mutate and evade the drugs. One way to solve this problem is by developing drugs that target highly conserved proteins, essential for viral replication. Nucleocapsid protein in HIV-1 is a possible target. It has been demonstrated in previous studies that covalent modification of this protein by potential drugs inhibit its functioning and renders the resulting virions non-infectious. We have synthesized electrophilic molecules designed to covalently modify this protein. The purpose of our work is to use high performance liquid chromatography, mass spectrometry, and protein sequencing to investigate the mechanism and nature of the modification.

**CHEM – 10 CHARACTERIZATION OF THE S315G DRUG RESISTANT MUTANT OF MYCOBACTERIUM TUBERCULOSIS CATALASE-PEROXIDASE KATG**

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KatG (S315T) is the most common mutant found in clinical isolates of *Mycobacterium tuberculosis* resistant to the antibiotic Isoniazid (INH). Resistance due to the S315T mutation has been assigned to a decrease in the enzyme affinity for the drug likely due to a decrease in the dimensions of a substrate access channel caused by the methyl group of the Threonine side chain. The main goal of the present study was to examine the origin of drug resistance in the related mutant, S315G. Site-directed mutagenesis was used to prepare the mutant KatG (S315G). The overexpressed enzyme was characterized using optical, EPR and resonance Raman spectroscopy. Catalase and peroxidase specific activities (artificial substrate) were reduced by nearly 50% and 35%, respectively, compared with wild type (WT) KatG. Interestingly the rate of Compound I formation and decay were approx. 2 fold faster compared to wild-type. The rate of INH activation by KatG (S315G) was approximately 70% of that observed for the WT enzyme consistent with the low level of resistance reported for this mutant (MIC = 8 µg/ml). The INH affinity of this mutant was unchanged compared to WT enzyme. Double mixing stopped flow spectrophotometry and Rapid Freeze Quench - EPR experiments strongly suggest that the decrease of the INH activation and therefore the low level drug resistance conferred by this mutant is due to alteration in the kinetics of the peroxidase cycle, decreasing the efficiency of INH activation.

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# **CHEM – 11 PLANAR CHIRALITY DUE TO A POLYSULFUR RING IN NATURAL PENTATHIEPIN CYTOTOXINS. IMPLICATIONS OF PLANAR CHIRALITY FOR ENANTIOSPECIFIC BIOSYNTHESIS AND TOXICITY**

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A low energy pathway for pentathiepin racemization has been found using density functional theory (DFT) calculations. 3-[1,2,3,4,5]Pentathiepin-6-yl-propylamine served as a model compound for tunicate-derived pentathiepins. Pentathiepin racemization becomes a low-energy process in the presence of a thiolate ion nucleophile. It is unknown whether the biosynthetic process for pentathiepins is enantiospecific (Bentley, R. *Chem. Soc. Rev.* 2005, 34, 609) or whether toxicity differs between enantiomers. However, the ease for thiolate ion attack on the polysulfur ring suggests that nucleophiles may induce optical instability on the laboratory time scale. The DFT study predicts that enantiospecific behaviors, such as toxicity difference between *P*- and *M*-pentathiepins would be difficult or impossible to determine experimentally. The computed results fit into a broader picture that nucleophiles assist in ring-opening and equilibration reactions of polysulfanes.

# **GEO – 1 PYRITIZED SPINOSE MICROSPHERES FROM THE MIDDLE DEVONIAN TULLY FORMATION OF PENNSYLVANIA: THE FIRST RECORD OF MUELLERISPHAERIDA FROM THE UNITED STATES**

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Spinose spherical microfossils occur in the lower part of the Middle Devonian (Givetian) Tully Formation near Lock Haven, PA. The microspheres occur in a single 20 cm thick bed of hard, dark-colored, fine-grained limestone, and so far are unknown from other beds in the exposure or equivalent beds elsewhere. The microspheres are about 100 µm in diameter and possess spines that are up to 20 µm in length. The spines expand toward the base, are circular in cross-section, and are broken at the tips. Spines are spaced about 40 µm apart and are arranged in a regular pattern over the surface of a microsphere. The microspheres are composed of a mosaic of authigenic pyrite crystals about 5-10 µm in length. The microspheres occur with microscopic (larval?) bivalves, gastropods and other organisms, all of which are preserved as pyrite steinkerns lacking original carbonate. Macrofossils do not occur in the microsphere horizon. The size and shape of these microspheres and the presence of spines indicates that they are representatives of an enigmatic group of microfossils known as *Muellerisphaerida* (*incertae sedis*). Although *muellerisphaerids* are generally phosphatic in composition, pyritic examples are known from the United Kingdom. The Lock Haven specimens are the first *muellerisphaerids* reported from the United States.

## GEO – 2 CHONDRICHTHYANS OF THE CRETACEOUS-TERTIARY BOUNDARY SEQUENCE, MONMOUTH COUNTY, NEW JERSEY

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Recent work by Landman et al. (2004, 2006) in Monmouth County N.J. reports the K/T boundary to be bracketed by the Hornerstown (Danian) and New Egypt/ Tinton (Maastrichtian) contact. The contact shows to be missing no more than 100,000 years. Chondrichthyan teeth have been collected across this K/T boundary in Monmouth County studied by Landman et al. at three measured intervals. The first sampled interval was 20cm to 70cm above the contact, Danian. The second was from the contact to 20cm above it, Danian. The third interval was 20cm below the contact to the contact, Maastrichtian. The teeth are rare to abundant depending on stratigraphic position, locality, and lithology. Ray teeth are not nearly as common as shark teeth. There are also various degrees of preservation, with some teeth being pristine to many pieces of shards. The boundary sequence contains such genera as: *Cretolamna*, *Carcharias*, *Odontaspis*, *Dasyatis*, and *Palaeogaleus*. Although bioturbation and reworking is an issue, specimen counts from measured volumes of sediment sampled indicate that some species (*G.girardoti*) are more abundant in the Maastrichtian, while others (*P.vincenti*) are more abundant in the Danian. Some species (*C.samhammeri*) go across the boundary. The data gathered to date, does not show an apparent diversity decline of chondrichthyans across the K/T boundary in Monmouth County.

## GEO – 3 STRATIGRAPHIC IMPLICATIONS OF THE DISTRIBUTION OF AMMONITES ON THE ATLANTIC COASTAL PLAIN

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Upper Cretaceous deposits are exposed in a thin NE/SW strike section of New Jersey. They are represented by repeating upward shoaling sequences of shallow marine coastal plain deposits. Gravel lag to glauconite rich to fine muddy/marl to quartz rich sand represents the usual change in lithology during each sequence. This pattern of deposition has been interpreted as cycling changes in sea level along the coastal plain of the east coast during the late Cretaceous time period---quick deepening (transgression) followed by slow shallowing and progradation (regression) are assumed to be responsible. During the Middle Campanian to Maastrichtian part of the sequence, facies changes have complicated the stratigraphy leading to confusion over interpretation of the sequence. This study uses sedimentologic and paleontologic analysis of 30 exposures over the length of the outcrop belt in New Jersey to identify 6 distinct lithofacies focusing on ammonite occurrences to facilitate correlation of the facies over large distances.



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**LEGEND:**

BIO – Biology  
CHEM – Chemistry  
ENG – Engineering  
ENV SCI – Environmental Sciences  
HNS – Health and Nutrition Science  
PEES – Physical Education & Exercise Sciences  
PSY – Psychology  
SCAS – Speech Communication & Arts Sciences

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