

Science Research Day

A microscopic image of a hippocampus, showing its characteristic curved structure. The image is overlaid with a green, semi-transparent layer that highlights specific regions. A complex network of white and red branching structures, likely representing neural connections or dendrites, is visible across the entire field of view.

MAY 11, 2012

ABSTRACT BOOK 

"Hippocampus" - Greg Dunn, PhD

**Sponsored by
NIH RISE, MARC, CSTEP & STEP Programs
Office of Student Life,
GK-12 "City as Lab"**

Brooklyn The City
University
of New York
College

22ND ANNUAL BROOKLYN COLLEGE SCIENCE DAY



PROGRAM

9:30 AM	POSTER SETUP (Student Center)
10:00—12:00	STUDENT PRESENTATIONS AND JUDGING (2 nd floor)
12:15 PM	LUNCH IN THE GOLD & MAROON ROOMS (6 th floor)
12:30 PM	WELCOME AND REMARKS
	PRESENTATION OF AWARDS
	High School Division
	Undergraduate Division
	Graduate Division

ALL ARE INVITED TO LUNCH IN THE GOLD & MAROON ROOMS

PRESENTER KEY

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

PSY – 1 WHICH ASDOLESCENTS ARE MOST INFLUENCED BY THEIR PARENTS IN MAKING VOCATIONAL DECISIONS?

Sahira Asia (HS) and Faith Di Angelis, Abraham Lincoln High School, Brooklyn, NY 11235

This project was designed to determine which students are more likely to fall under parents' influence when it comes to making vocational decisions. Career planning becomes a serious topic to think about as high school begins. Each step adolescents make will leave an impact on their career. With major stress, do most students end up pleasing their parents and follow their values? Or, do they make the transition from dependent to independent and follow what they believe is right? In order to answer these questions, each student was given a career values assessment and a Locus of Control survey. This Locus of Control survey determined whether a student is dependent or independent. Parents of these students completed a career value assessment as well. A scoring key was used to determine whether the student had an internal or external locus of control. In the career value survey the points in each category were added. Each category is followed by statements relating to each value. Five values were chosen as important and subsequently were compared to the parents' five values. This determined which students were more likely to fall under their parents' influence when it comes to vocational decisions. The data revealed that students with an external locus, or even an internal and external locus, were likely to fall under parents' influence. Students with an internal locus were less likely to have values that match their parents. This data showed a positive correlation between parents influence and an external locus of control.

PSY – 2 IS THE QUALITY OF MEDIA SOURCES RELATED TO POSITIVE LIFE OUTCOMES?

Wajeh Masud (HS) and Faith Di Angelis, Science Research, Abraham Lincoln High School, Brooklyn, NY 11235

The purpose of this study was to determine whether a person's choice of sources for information is related to their level of education and age. Fifteen adults aged 30 through 63 and 15 adolescents aged 14 through 17 participated in this study. The data was gathered through surveys after the participants (and, where necessary their parents) completed consent forms and were informed of the rights they have. The survey that was administered to the subjects asked about their age, their level of education and their preferred sources of information and included different scenarios asking them about which source the subject would use when they are given a specific task. After the subject completed the questionnaires, they were placed in a sealed white envelope to protect their anonymity. In students earning a "High" GPA the primary choice of source for information was mostly high quality sources and a few medium quality sources. In the specific scenarios, the students with a "High" GPA chose mostly high and medium quality sources. The majority of adults chose high and medium quality sources, especially the adults with a bachelor's or a master's degree. Overall, results showed that level of education had little effect on the quality of sources chosen by adults. In students, choice of sources also seemed unrelated to their GPA. Interestingly, however, it is noteworthy to mention that the greatest difference between choices of information sources existed between adults and students, regardless of their respective educational success.

PSY – 3 IS THERE SUBJECT SENSITIVITY TO INTERPERSONAL GAZING?

Yu Tun Ng (HS), Khadjiah Johnson, Kalvinder Kaur, Faith Di Angelis, Science Research, Abraham Lincoln High School, Brooklyn, NY 11235

The purpose of this research is to measure the degree to which subjects can recognize when they are being gazed upon. The hypothesis was that people could tell if they were being gazed upon. In the attempt to measure interpersonal sensitivity of the subjects, ten students from Abraham Lincoln High School agreed to participate in this research experiment. First, they were placed in the same room and were being gazed at by a viewer for approximately three minutes. Then they were asked to complete a questionnaire while being observed. The questions asked them to indicate on any of the ten given trials, whether or not they sensed that the viewer was gazing at them. Meanwhile, the “viewer” was asked to reply on his or her questionnaire, which of the ten participants actually was being gazed at during each of the ten trials. At the conclusion of the trials, results of participants and viewers were correlated to determine any correspondence. After reviewing the data that was collected, it was clear that there was only a small percentage of people who perceived the gaze accurately when the viewer was making the interpersonal gazing contact towards them. This research has proven the importance of how people should be more aware of their surroundings and be more careful.

PSY – 4 HOW HAVE CHANGING MORAL STANDARDS IN MEDIA INFLUENCED MORAL JUDGMENT?

Janeil A. Dennis (HS) and Christina C. Jackson, Faith Di Angelis, Science Research, Abraham Lincoln High School, Brooklyn, NY 11235

After observing people making decisions that might be considered morally questionable, the current study was designed. The purpose of the study was to measure the relationship between different variables (age, ethnicity, family structure, media experience) and moral and ethical decision making. After obtaining parental consent, volunteer participants completed surveys that contain background information questions as well as James Rest’s Defining Issues Test (DIT). The DIT required participants to make moral and ethical judgments in several scenarios. The data from the background information was correlated to responses of the DIT. The results of the study showed that there is a difference between the issues people find important and their media habits. People who watched reality television cared about issues such as family bonds and courage while they did not care about exploitation.

PSY – 5 THE RELATIONSHIP BETWEEN EYEWITNESS TESTIMONY AND AGE

Makhzuna Khudoynazarova (HS), Parvina Amirkulova, Faith Di Angelis, Abraham Lincoln High school, Brooklyn, NY 11235

In the current study, an experiment was conducted to study whether age has an effect on the accuracy of eyewitness testimony. The hypothesis was that amongst 18-year-old students, eyewitness accounts would be more accurate, because these students are older and more cautious about their surroundings during a crime scene and tend to notice even tiniest details. Data was gathered after showing a video of a crime scene to groups of students who belong to different age groups. The video was an excerpt from the “Criminal Minds” drama series, and it is about an unknown serial killer who already killed all members of two families. Then participants were given a questionnaire with questions on different difficulty levels, asking them to recall crime scene details, and also to provide their age and to answer questions that determined their “cognitive failures”. The

experiment measured the relationship between three variables: the chronological age of participants, accuracy of their answers about the details in the video, and score on a questionnaire measuring “cognitive failures. Once data was collected, we correlated accuracy of responses to age. The results showed that younger students are likely to give more accurate testimony than older students.

PSY – 6 SEEING RED: DOES COLOR HAVE AN EFFECT ON ANAGRAM PERFORMANCE?

Jordan Griffith¹, **Dannette Lombert**¹ (HS), Wendell Pressoir² and Tashana Samuel³
Brooklyn Academy of Science and the Environment (BASE)^{1,2} The Graduate Center and Brooklyn College, City University of New York³

Color exposure has been proven to have an effect on the way humans solve simple problems. When primed with a color, the human brain makes an association with something that the person has experienced. This association can also affect task performance; particular colors have been shown to affect the way people work during tests. Previous research has demonstrated that exposure to red patches or print tends to yield a decrease in task performance, since the color red has been correlated with danger or failure. On the contrary, participants perform best when exposed to blue. The current research investigated the effects of different colors (red, yellow, blue and black) on performance on an anagram task. High school students (N=55) at Brooklyn Academy of Science and the Environment (BASE) were randomly assigned to different color conditions and were asked to unscramble 15 anagrams. Based on previous research, we hypothesized that compared to the control group (anagrams printed in black), performance would increase in participants with anagrams printed in blue; however, performance would be worse for those with anagram packets printed in red. While we found no significant differences among color conditions, the data revealed a trend showing a decrement in performance of participants in the red condition. Although performance was better for blue compared to black (control) and red, the yellow condition had the highest mean score. Future research based on this trend may provide insight on how environmental variables, specifically color, could potentially affect test performance in students.

PSY – 7 GREEN SPACE EXPOSURE AND SELF-PERCEIVED ANXIETY: IS THERE A CORRELATION?

Rebecca Francois¹, **Beberly Garcia**¹, **Madison Rivera**¹ (HS), David Johnston², and Tashana Samuel³, Brooklyn Academy of Science and the Environment (BASE)^{1,2}, The Graduate Center and Brooklyn College, City University of New York³

Green spaces are plots of undeveloped land surrounding places of residential or industrial areas that are maintained for recreational enjoyment. City parks, green urban landscapes, and rooftop gardens are some examples of green spaces. Anxiety is a normal sustained reaction to stress. Is there a correlation between a person’s exposure in green spaces and self-perceived anxiety? We investigated this question by constructing survey questions that focused on two parameters: green space exposure and self-perceived anxiety. Surveys were administered to freshman students (N=74) at Brooklyn Academy of Science and the Environment (BASE). We hypothesized that green space exposure should reduce anxiety. Pearson r analyses indicated that there was a positive correlation between green space exposure and anxiety; specifically that increased exposure to direct sunlight in green spaces tended to slightly increase self-perceived anxiety. Although the results were not consistent with our initial hypothesis, we surmised that students taking the survey during the winter season could account for these data. Perhaps spending time in direct sunlight and in green spaces in the winter also means spending time in cold air. Furthermore, green spaces in the winter are not “green” at all, since many trees are bare, and flowers and plants die in the winter. Therefore, cold

weather and less “greenery” in the environment are some factors that could possibly explain the data in this sample. Future research will explore how taking the survey during different seasons (winter vs. summer) may yield different responses of self-perceived anxiety.

Funded by the National Science Foundation through GK-12 grant 0638718.

PSY – 8 CORRELATIONS BETWEEN SELF-MONITORING, COLLECTIVE SELF-ESTEEM, RELIGIOSITY, LOCUS OF CONTROL, ALTRUISM AND CHARITABLENESS

Carolyn Aboudi (HS), Steven Kaye, Magen David Yeshivah High School

The present study investigated correlations between self-monitoring, collective self-esteem, religiosity, locus of control, altruism and charitableness. Questionnaires were completed by 87 teenagers at Magen David Yeshivah, a private high school in Brooklyn, New York. The hypotheses: “Teenager high self-monitors are more likely to donate to charity than teenage low self-monitors”, “The greater a teenager’s religiosity the more likely he/she will donate to a religious charity than a secular charity”, “Teenagers with a high sense of altruism will donate equally to secular and religiously oriented charities”, “Teenagers with an internal locus of control will donate more to charity than teenagers with an external locus of control”, and “The greater a teenager’s collective self-esteem the more likely he/she will donate to a community charity than a national charitable foundation” were not supported by the data.

PSY – 9 LOOK AT ME! EYE TRACKING SHOWS THE SELF-REFERENTIAL MEMORY EFFECT

Delfina Samu (UN), Carrie A. Pappas, Ekaterina Krasavina, Cinder Cohen, Elizabeth R. Persaud, Curtis D. Hardin, PhD., Elizabeth F. Chua, PhD., Brooklyn College & Graduate Center, The City University of New York

Self-referencing is known to significantly improve a person’s ability to remember information. Participants (N=31) listened to two different stories (proud and embarrassing) about another person in an online video chat. During the conversation, they viewed both the self and their conversation partner, while having their eye movements tracked. After the conversation, participants were given a surprise memory task during which they were asked to type as much of the proud and embarrassed stories as they could recall. Their responses were coded based on the proportion of specific details remembered, with a total of 13 possible details, and the number of words typed for each story. As self-checking increased, the proportion of details recalled about the proud story increased $r(30)=.40, p<.05$. Similarly, as self-checking increased, the number of words typed for the proud story increased $r(30)=.50, p<.01$. These results suggest that looking at the self may be related to self-referential processing, as evidenced by the self-reference effect in memory. However, there may be limits to this effect given that significant results were found only with the proud story.

PSY – 10 TESTING PERIPHERAL VISION OF VARIOUS EYE COLORS USING A VISION PROTRACTOR

Daniel Dayen, Tana Siboonruang, Opeyemi Ibikunle (HS), Janice Baranowski, Brooklyn Technical High School, Brooklyn, NY 11217

Peripheral vision is a part of our sight that operates at the corner of the stare. This aspect of sight has been crucial to the survival of animals in the wild. Although humans are no longer hunting and struggling to survive against other animals, peripheral vision is still significant in their awareness of their surroundings. While common people may only need to worry about peripheral vision to avoid accidents, soldiers, explorers, and other professions heavily depend on peripheral vision to avoid dangers. The big question for jobs that require high alertness of the environment is which types of

eyes are better suited for these jobs. The current study examined how eye color affects peripheral vision. An experiment involving the testing of sixty test subjects, including four groups of fifteen people with different color (green, hazel, blue, and brown), was conducted using a two foot, cardboard vision protractor. After the results of this experiment were analyzed, it can be concluded that eye color does affect peripheral vision, with green eyes having the worst peripheral vision and brown eyes having the best peripheral vision. With these results, factors can be added to selecting people, who are more qualified, into professions that heavily rely on awareness of the surroundings. More research could be done to add factors such as age, eye sight, and eye size. Perfecting the understanding of peripheral vision can lead to breakthroughs in ocular technology.

PSY – 11 SOCIAL RECOGNITION: EYE TRACKING DISCLOSES IMPACT OF SELF-CONSCIOUSNESS IN ESTABLISHING RELATIONSHIPS

Elizabeth R. Persaud (UN), Cinder Cohen, Ekaterina Krasavina, Delfina Samu, Carrie A. Pappas, Curtis D. Hardin, and Elizabeth F. Chua, Brooklyn College & Graduate Center-CUNY, Brooklyn, NY 11210

In natural conversation, direct eye contact may indicate the attention given to the listener's reactions. However, direct eye contact may sometimes be uncomfortable, causing people to avert their eyes and shift focus to the face. Both allow for recognition of listener reactions, but the approach vs. avoidance behaviors related to eye contact may reveal traits that can impact a relationship. We explored whether self-consciousness would affect the attention given to a listener's eyes or face. In an online Skype-like video conversation, participants were prompted to describe emotional experiences that should elicit different levels of self-consciousness, while having their eye movements tracked. Results revealed that the higher the self-consciousness scores reported by participants, the more they averted direct eye contact to focus on other parts of the face, whether telling a proud story, $r(31) = -.38, p < .05$, or telling an embarrassing story, $r(31) = -.36, p < .05$. Both stories were also correlated with total self-consciousness ($r(31) = -.36, p < .05$; $r(31) = -.38, p < .05$), respectively, on the total self-consciousness scale. Thus, the more self-conscious one is, the less likely one is able to maintain eye contact with others and may resort to shifting attention to the face. This behavior suggests that high self-consciousness may indicate avoidance behavior. Overall, analyzing eye contact behavior may divulge how self-consciousness could inhibit establishing relationships.

PSY – 12 ARE YOU LOOKING AT ME? EYE CONTACT DEPENDS ON PERSONALITY AND CONVERSATION CONTENT

Ekaterina Krasavina (UN), Carrie A. Pappas, Cinder Cohen, Delfina J. Samu, Elizabeth R. Persaud, Curtis D. Hardin, and Elizabeth F. Chua, Brooklyn College – CUNY, Brooklyn, NY 11210

Previous research suggests that the amount of eye contact people establish during conversation fluctuates depending on the nature of the conversation as well as on the personal traits of people engaging in it. An experiment was conducted to explore the relationship between these variables. Thirty-one undergraduate students participated in an online video chat, during which their looking behavior was recorded by an eye tracker. Percentages of time establishing eye contact were compared depending on the type of story that was being told by the subjects' conversation partner (proud vs. embarrassing) and subjects' self esteem (measured on Rosenberg's scale, with median split for high vs. low). Participants made more eye contact during proud story compared to embarrassing story ($t(30) = 2.08, p < .05$). However, closer analysis showed this effect was only for low self-esteem participants ($t(14) = 2.17, p < .05$). Consistent with this finding, high and low self esteem participants showed differences in eye contact in the embarrassing story only ($t(30) = 2.29, p < .05$).

While these findings partially support previous research, they suggest that low self-esteem participants are more likely to adjust their looking behavior according to the content of the conversation.

PSY – 13 THE EFFECT OF DORSAL HIPPOCAMPAL LESIONS ON ACQUISITION OF CONDITIONAL CONTROL BY TEMPORAL CUES IN A FEATURE POSITIVE OCCASION-SETTING TASK

Rifka C. Derman (UN), Vinn Campese, and Andrew Delamater, Department of Psychology, Brooklyn College-CUNY, Brooklyn, NY 11210

Previous studies have shown that simple Pavlovian learning can be brought under conditional control by temporal stimuli (Bouton & Hendrix 2011). Other research has suggested that the hippocampus may play a role in the development of conditional control by temporal cues (Campese & Delamater, 2010). In this experiment, I studied the role of the dorsal hippocampus (DH) in the acquisition of conditional control by temporal cues in a feature-positive occasion-setting task. Long Evans rats received either neurotoxic lesions of the DH or control non-lesion surgeries. After recovery, the subjects underwent training in a Pavlovian learning task in which the offset of a 10-sec auditory conditional stimulus (e.g., a tone) was reinforced with two food pellets when it followed a 16-min intertrial interval (ITI), but was not reinforced when it followed a 4-min ITI. There was no evidence that DH lesions impaired learning in this task. If anything, lesioned rats may have performed slightly better than control subjects.

PSY – 14 EYE TRACKING REVEALS THE ORIGIN OF MEMORY ERRORS

Jeanny Kim (UN) and Elizabeth F. Chua, Department of Psychology, Brooklyn College-CUNY, Brooklyn, NY 11210

The purpose of this study was to reveal the origins of memory distortions through eye tracking. We tested whether 1) irrelevant binding at encoding, and 2) retrieval monitoring errors influenced memory distortions using a paradigm similar to the board game Memory®. Twenty “cards” were laid out on screen and participants saw 2 cards with different objects turned over at the same time. Each card had a hidden matching card with the same object on it. They were then tested on their memory. Participants saw one card turned over and either had to indicate where the matching card was (Same Card Task), or where the card that was turned over with it was (Same Time Task). Participants (n=16) were more likely to falsely choose the matching card in the Same Time Task [mean = 0.38 ± .06] compared to falsely choosing the same time card in the Same Card Task [mean = 0.22 ± 0.025; p<0.005]. Because the encoding task focused on the Same Card Task, these results suggest that encoding orientation influences memory distortions. Eye movement measures of binding (i.e., looking at the matching card during encoding) showed minimal effects, with a trend towards predicting choosing the matching card during the Same Card Task (p<0.12). During retrieval, eye movements suggested that recalling a specific spatial location predicted choosing that location during recognition for both true and false recognition across tasks (all p’s<0.05). These findings suggest that memory distortion occurs mainly because of retrieval monitoring errors, but that encoding also contributes.

PSY – 15 ARE THERE CEREBRAL ASYMMETRIES IN GENERATING LITERAL VERSUS FIGURATIVE MEANINGS?

Isabel V. Rodriguez, Lolly Starr-Glass (UN), Rita W. El-Haddad, & Natalie A. Kacinik, Brooklyn College and the Graduate Center, City University of New York

The right hemisphere's (RH) preferential involvement in processing figurative language is unclear (Kacinik & Chiarello, 2007; Schmidt et al., 2010), but the majority of this research has been conducted with comprehension paradigms. The present study used visual half-field presentation and a word generation procedure to examine hemispheric differences in generating and producing literally versus figuratively related nouns in response to adjectives with a literal and figurative sense. A typical overall RVF/LH advantage was found for reaction time but not accuracy. Contrary to expectations, but in accordance with previous work by Kacinik and colleagues (Kacinik & Chiarello, 2007; Kacinik et al., 2008) participants were NOT more likely to generate figuratively related words in the LVF/RH and literal responses in the RVF/LH. Responses were also coded and analyzed according to their frequency and imageability, but there were also no differences in the proportions with which more or less frequent and high or low imageability responses were generated in either visual field/hemisphere. The RH therefore does not appear to be preferentially involved in either the comprehension or generation of figurative meanings, or in generating less typical more distantly associated words, or more highly imageable responses, as some previous research suggests (e.g., Anaki et al., 1998; Bub & Lewine, 1988; Klepousniotou & Baum, 2005; Seger et al., 2000; Shibahara & Lucero-Wagoner, 2002).

PSY – 16 THE EFFECTS OF MUSIC GENRES ON MORAL VALUES

Bella Kabariti (HS) and Steven Kaye, Magen David Yeshivah High School

The present study investigated the effects of music genres on moral values. Questionnaires were completed by forty five teenagers at Magen David Yeshivah High School in Brooklyn, New York. Magen David is a private high school, which consists of approximately six hundred students belonging to the Syrian Jewish community. The hypotheses, "The more a teenager listens to rap music, the more likely he/she will engage in academic cheating", "The more a teenager listens to rap music, the more likely he/she will engage in theft", "The more a teenager listens to rap music, the more likely he/she will engage in lying", "The more a teenager listens to rap music, the more likely he/she will engage in violence", "The more a teenager listens to rock/heavy metal music, the more likely he/she will engage in academic cheating", "The more a teenager listens to rock/heavy metal music, the more likely he/she will engage in theft" and "The more a teenager listens to rock/heavy metal music, the more likely he/she will engage in violence" were not supported by the data. The hypotheses, "The more a teenager listens to hip hop music, the more likely he/she will engage in academic cheating" and "The more a teenager listens to hip hop music, the more likely he/she will engage in theft" were supported by the data. The hypothesis, "The more a teenager listens to pop music, the more likely he/she will engage in academic cheating" was not supported by the data; however, a significant correlation was found. Results suggest that the more a teenager listens to pop music, the less likely he/she will engage in academic cheating.

PSY – 17 SUPERSTITION AND ITS EFFECTS ON HUMAN PERFORMANCE

Gavin X Young (HS), Michael Magee and Adam Johnston, Brooklyn Academy

Even though we live in a world filled with logic and new technology which we use to improve our lives and performance in almost every difficult task we face, superstition still seems to enter our lives

when performing these difficult tasks and somehow helps us to improve our results instead. This research examines how a person's performance can be enhanced or improved by the use of superstition and how superstition could also play a negative role in someone's performance. This experiment includes a mathematic test constructed of algebraic questions which was designed by a high school mathematics teacher from the Brooklyn Academy for Science and the Environment. Participants will be asked to perform different tasks depending on the assignment of the groups, one testing positive effects on performance, another the negative effects on performance and the third which will not be manipulated which will be used as a control. All groups are given a time limit which will help give more accurate results. The results from this experiment will be collected from students of several grades from the Brooklyn Academy for Science and the Environment high school, which are expected to show a positive correlation between positive superstition and good performance and poor performance and negative superstition. In other words, students which are exposed to positive superstition will have a higher score on the mathematics test compared to the participants that are exposed to negative superstition.

PSY – 18 THE BITTER TRUTH ABOUT MORALITY: EXPLORING THE EFFECTS OF MINDFULNESS AND MORAL EVENT TYPES ON GUSTATORY PERCEPTION

Igor Beytelman (UN), Kendall J. Eskine, Thomas McAusland, & Natalie A. Kacirik,
Department of Psychology, Brooklyn College & the Graduate Center, CUNY

To demonstrate that sensory and emotional states play an important role in moral processing, previous research has induced physical disgust in various sensory modalities (visual, tactile, gustatory, and olfactory modalities, among others) and measured its effects on moral judgment. To further assess the strength of the connection between embodied states and morality, Study 1 investigated whether the directionality of the effect could be reversed by exposing participants to different types of moral events prior to rating the same neutral tasting beverage. As expected, reading about moral transgressions, moral virtues, or control events resulted in inducing gustatory disgust, delight, or neutral taste experiences, respectively. Study 2 demonstrated that neutralizing one's embodied emotional states can similarly neutralize one's moral judgments. These results demonstrate that morality and perception share a bidirectional relationship, providing further support that the processing of abstract concepts like morality is embodied, but that it is possible to moderate the effect with mindfulness.

PSY – 19 ALPHA, BETA, AND GAMMA POWER IN THE PERISACCADIC EEG

Matthew Chin, Irene He (HS), Department of Neurology, State University of New York
Downstate Medical Center, Brooklyn, NY 11203

In this study, we investigated the activation of alpha, beta, and gamma power in cortical areas of the brain associated with horizontal voluntary saccades in the light and dark. The neuronal oscillatory changes and saccadic activity of eleven normal healthy volunteers was recorded using electroencephalography (EEG) with electro-oculogram (EOG) monitoring. We have analyzed the temporal course of perisaccadic EEG oscillatory changes over frontal, posterior parietal, anterior parietal, temporal, and occipital scalp recording sites. During the task in light and in dark, gamma activity was least, alpha activity was highest and beta activity was in between. Gamma had the highest power in the posterior part of the brain and found more over the frontal eye field. Beta power was highest temporally over each hemisphere. In the light parietal and occipital recordings, alpha power was suppressed. Alpha and beta powers were slightly higher in the right hemisphere.

This could suggest that the right hemisphere is not as involved with vision as the left hemisphere is. Significant increase in the gamma power over the temporal region may be attributed to its role in sensory processing and memory in response to visual and imaginative stimuli.

BIO - 1 THE EFFECT OF VEGETATION UPON THE PREDATION RATE ON JUVENILE FISH

Jamon Davis¹ (HS), Wendell Pressoir¹, Lilja Nielsen², ¹Brooklyn Academy of Science and the Environment High School, ²City University of New York Graduate Center

Current research indicates that the amount of eel grass (*Zostera marina*) coverage along the Eastern Coast of United States has been decreasing. Many juvenile fish use vegetation as a protective nursery from predators, so this rapid decrease in eelgrass could impact their survival rates. The current study considered the effect plants have on predation rates of juvenile fish. The mummichog (*Fundulus sp.*) was utilized as a model predator, and as model prey juvenile guppies (*Poecilia reticulata*) were chosen, as they often rely on vegetated areas as a nursery. The hypothesis was that if an aquatic ecosystem contains vegetation then it will increase the survival of juvenile fish. The experimental set up consisted of two fish tanks, one with vegetation and one without; each containing the same amount of predators and prey. Survival rates were recorded daily over the course of a week. Although the results were not statistically significant there was a trend indicating more rapid decrease in survival in the absence of vegetation. In conclusion, diminished plant beds could result in decreased populations of juvenile fish in natural habitats. Based on the crucial role of eelgrass beds in juvenile fish development, as indicated in the current study, rehabilitation efforts are recommended to prevent further vegetation loss, and potential impact on fish populations.

BIO – 2 NEURAL RESPONSE PATTERN TO CONSPECIFIC ADVERTISEMENT CALLS IN TYPE I MALE MIDSHIPMAN FISH

Christopher L. Petersen¹ (GRAD), Miky Timothy¹, Spencer Kim¹, Joseph Sisneros⁴, and Paul Forlano^{1,2,3}, ¹Department of Biology, CUNY Brooklyn College, ²Aquatic Research and Environmental Assessment Center (AREAC), Brooklyn College, ³CUNY Graduate Center Subprogram in Neuroscience, and Ecology, Evolution, and Behavior, ⁴Department of Psychology, University of Washington, Seattle

Type I male midshipman fish, *Porichthys notatus*, produce a long duration (> 1 min) vocalization that serves as an advertisement call to attract females. As multiple courting males establish nests in close proximity to one another, the perception of another male's call may modulate individual calling behavior in competition for females. We tested the hypothesis that type I males listening to conspecific mate calls would show elevated neural activity in auditory brain centers and differential activation of dopaminergic neurons compared to males listening to ambient noise. Males were collected from nests and subjected to underwater playbacks of other male advertisement calls for 30 minutes in an outdoor arena at night. Control males were placed in the same arena for 30 minutes at the same time of night without a sound stimulus. Stimulus and control males were sacrificed 120 minutes post trial, and their brains were labeled by immunofluorescence (-ir) for tyrosine hydroxylase, a marker for dopaminergic neurons, and cFos, a marker for neural activation. Both midbrain and thalamic levels of the ascending auditory pathway showed significantly higher levels of neural activity in sound stimulus males. We also found that males listening to other males had significantly more cFos-ir within dopaminergic cells in the periventricular posterior tuberculum in the diencephalon. An increased activation of dopaminergic neurons could underlie a change in motivational state in males that hear conspecific mate calls and play an important neuromodulatory role in social behavior of these animals.

BIO – 3 COMPUTATIONAL ANALYSIS OF GRAM DOMAINS IN THE MODEL PLANT ARABIDOPSIS THALIANA.

Itrat Fatima (UN), Shaneen Singh, Department of Biology, Brooklyn College-CUNY, Brooklyn, NY 11210

The goal of this study is to use the model plant *Arabidopsis thaliana* to understand the role and mechanism of the lipid binding domain, GRAM. Previous studies have uncovered that GRAM domains are present in glucosyltransferases, myotubularins and other membrane-associated proteins, and are structurally similar to PH domain but may have functional differences and/or membrane binding mechanisms. The main focus of our study is to identify all GRAM domain containing proteins in this model organism, evaluate their location with in different proteins and analyze their functions to see whether they are similar to the PH domain or not. PH domains are typified by 7 beta -strands and a C-terminal helix. We have examined the location of potential GRAM domains in 13 different proteins in *Arabidopsis* and successfully modeled their three-dimensional structure. However, it is not clear whether GRAM domains contain all 7 of the beta strands found in the PH domains despite their structural similarity. Through various computational biology tools, we present our functional analysis of the modeled domains including the docking of phosphoinositde ligands to elucidate their membrane binding preferences and modes.

Supported by NSF Grant 0618233

BIO – 4 STEROID HORMONE REGULATION OF DOAPMINE IN THE PERIPHERAL AUDITORY SYSTEM OF A VOCAL FISH

Philip Kurochkin^{1,2} (UN), Elizabeth Whitchurch³, Joseph Sisneros³, Paul Forlano^{1,2}

¹Department of Biology, Brooklyn College, CUNY 11210

²Aquatic Research and Environmental Assessment Center (AREAC), Brooklyn College, CUNY

³Department of Biology, University of Washington, Seattle, Washington 98195

Female plainfin midshipman locate a mate by following the male's advertisement call to his nest in the rocky intertidal zone of northern CA and WA. The frequency tuning of the sacculle, the main endorgan of hearing, changes seasonally in midshipman females to better encode male mate call, and this seasonal change in auditory tuning can be mimicked by manipulating circulating estrogen levels. We recently discovered that dopaminergic neurons in the diencephalon, a brain area of high estrogen production and estrogen receptor expression, project to the sacculle in midshipman. Therefore, we tested the hypothesis that estrogen regulates dopamine innervation in the sensory epithelium of the sacculle. Tyrosine hydroxylase (TH), a marker for dopamine synthesis, was quantified by immunofluorescence (-ir) and confocal microscopy on the sacculle of non-reproductive females that were ovariectomized and implanted with either estrogen dissolved in oil or oil alone and sacrificed 24-28 days later. TH-ir area and intensity was analyzed in sections throughout the sacculle and compared between groups. The estrogen treated group showed higher TH-ir intensity overall, and greater intensity on dorsal and ventral parts of the ear. There was no difference in TH-ir area between treated and control groups. Estrogen-regulation of dopamine in the inner ear of female midshipman may reflect natural changes in dopamine caused by seasonal changes in circulating estrogen. The dopaminergic efferent system in midshipman may serve to modulate natural changes in peripheral auditory frequency sensitivity to better encode reproductive-related social acoustic signals.

BIO – 5 THE ROLE OF SDF1 INTERACTING PROTEINS IN COLLECTIVE CELL MIGRATION

Tammy Jiang (HS), Holger Knaut, Skirball Institute of Molecular Biology, NYU Langone Medical Center, NY, NY 10016

It is unclear how the SDF1 protein guides the cells of the migrating lateral line primordium to their destination because SDF1 is expressed uniformly along their route. We did high resolution fluorescent imaging across the primordium and saw that there might be more mRNA in front of the primordium than in back of it. In situ gene expression analysis allowed us to see the way in which the SDF1 protein is distributed along the primordium. The primordium may inhibit the transcription of SDF1 behind it so that it will follow the higher gradient of protein. In situ hybridizations allowed us to identify and see the gene expression of proteins that interact with SDF1. The proteins identified were *seraf*, *kal1a*, *spn2a*, and *igfbp1a*. Morpholino knockdown of *kal1a* resulted in minor impairment of the migration of the primordium and size reduction of the neuromasts deposited by the primordium. This disproves past research claims that *kal1a* morpholino injection results in severely impaired primordium migration.

BIO – 6 EFFECT OF LEMON JUICE, BAKING SODA SOLUTION, VINEGAR, AND ORANGE JUICE ON BACTERIA GROWTH

Brian E. Sarango, Jun Ye Cai, Kevin Koon (HS), Brooklyn Technical High School Brooklyn, NY 11217

The purpose of our experiment was to test which daily use non-toxic cleaners worked the best in decreasing bacteria growth. In this experiment, baking soda, lemon juice, orange juice and vinegar were used as the non-toxic cleansers. After being cleansed with different non-toxic cleaners, samples were collected from a bathroom counter surface using sterile cotton swabs. Results indicate that vinegar is the most effective at ridding the surface of bacteria, while lemon juice was the least effective. Orange juice was a second effective cleaner after vinegar unlike the baking soda solution which was the second least effective and had close results to lemon juice. Future research can include further studies of vinegar's acidity and how it may have affected the surface cleaning. Studies can also be done to see what baking soda solution and lemon juice lacked in comparison to Vinegar. Also, more research can be done on why certain non-toxic cleansers use lemon juice and baking soda solution, which in this experiment, was shown to be not as effective as vinegar and orange juice.

BIO – 7 NUCLEOLAR STRESS FACTORS: NUCLEOLIN AS A NOVEL INTERACTOR OF POLY(A)-SPECIFIC RIBONUCLEASE (PARN) TO REGULATE GENE EXPRESSION

Zaineb Nadeem (GRAD), Anjana D. Saxena, Department of Biology, Brooklyn College-CUNY, Brooklyn, NY 11210

During DNA damage response nucleolar stress factors are released from the nucleoli to nucleoplasm and play an important role in regulating cellular checkpoint mechanisms. Activation of cell-cycle checkpoints then regulates gene expression of various pathways that control cell-cycle arrest, DNA repair or cell-death pathways. Nucleolin, an RNA-binding phosphoprotein constitutes ~10% of total nucleolar protein and involved in many cellular processes such as ribosome biogenesis, DNA replication, cell-proliferation and apoptosis. Upon various genotoxic or ribosomal stresses nucleolin mobilizes to nucleoplasm. Although nucleolin-phosphorylation is linked to its stress-responsive function, how nucleolin and its phosphorylation status regulate gene expression remains poorly understood.

The objective of this study is to investigate the role of nucleolin phosphorylation on modulating protein-protein interactions and sub-cellular localization upon UV treatment. Our immunofluorescence localization suggests a significant amount of hypo-phosphorylated nucleolin mutant present in the nucleoplasm and hence readily gets translocated upon UV treatment as against wild-type. Although this mobilization upon dephosphorylation of nucleolin does not alter localization of its other nucleolar protein interactors namely ARF and B23, there appears to be a decrease in ARF protein levels. Further, our co-immunoprecipitation data suggest that hypo-phosphorylated nucleolin binds to p53 protein even under non-stressed conditions. We also observed that nucleolin associates with poly(A)-specific ribonuclease (PARN), a factor that controls mRNA stability of different genes during DDR.

Our data thus provides first evidential support that nucleolin phosphorylation can play a regulatory role in controlling gene expression during DNA damage response by its direct associations with p53 and PARN and probably affecting p53-signaling as well as deadenylase activity.

BIO – 8 PROTEIN – LIPID INTERACTIONS OF PGK1

Emilee Yang, Amanda Ye, and Jacinda Zhou (HS), Dr. William J. Chirico, Department of Cellular Biology, SUNY Downstate Medical Center, Brooklyn, NY 11203 and Midwood High School at Brooklyn College, Brooklyn, NY 11210

Little is known about cell membrane repair despite its importance for cellular homeostasis. Phosphoglycerate kinase 1 (PGK1) is located in the cytosol, but can be released from cells in a Ca^{2+} -dependent manner via a nonclassical secretory pathway. Cytosolic PGK1 acts in glycolysis and extracellular PGK1 participates in angiogenesis. PGK1 accumulates at sites of plasma membrane damage suggesting it also plays a role in membrane repair. To identify cellular components mediating PGK1's localization to sites of membrane damage, its interactions with membrane lipids and cellular proteins were examined. A fusion protein consisting of PGK1 linked to glutathione S-transferase (GST) was engineered to facilitate these studies. GST-PGK1 preferentially bound phosphatidic acid, phosphatidylinositol, cardiolipin, and sulfatide. Based on sequence homology to lipid-binding proteins, a putative lipid-binding domain was identified in PGK1. Using site-directed mutagenesis this domain was replaced with 6 glutamine residues and the lipid-binding properties of mutant GST-PGK1 were examined. GST-PGK1 was used as bait to identify several cytosolic binding proteins, of which at least one bound in a Ca^{2+} -dependent manner. Together these results suggest that PGK1's localizes to sites of membrane damage by directly binding membrane lipids and that its Ca^{2+} -dependent nonclassical secretion may be mediated by interactions with other proteins.

BIO – 9 DBRAINBOW: MULTICOLORED NEURAL CIRCUITRY ANALYSIS OF PARKINSON'S DISEASE (I)

Ishmael Amu (GRAD), Chonn Cadiz, Paul Thomas, Abdalla Allawaj, Anvar Djabbarhodjaev, Onur Altintas, Fahad Sadiq, Saboor Shaheed, Jessica R. Christolin, Ghada Alhabbab, Morris Kopyt and Qi He, Department of Biology, Brooklyn College of the City University of New York, NY 11210

The severe degeneration of dopaminergic neurons is a likely cause for the onset of Parkinson's disease in adults. It is observed that dopaminergic neural degeneration frequently occurs at locations where α -synuclein is released from Lewy bodies of Parkinson's disease patients. Reduced dopamine levels suggest that dopaminergic neurons are lost, resulting in gaps in the neuro-muscular circuitry. Presently, very little is known about neuronal interaction and degeneration related to the onset and progression of Parkinson's disease. Our research utilizes the fruit flies *Drosophila* as a model to investigate neural circuit formation and neural degeneration. We have three phases in our approach:

(1) Creating a new *Drosophila* Brainbow (DBrainbow or DBB) method that will enable us to identify different groups of neurons in the brain and to establish their lineages and developmental history. Coupled with another technique (TOLD) we have developed, we will be able to assess neural synaptic interactions in the brain that have the potential to reveal neurons involved in the formation of neural circuits. (2) We will analyze candidate genes that cause Parkinson's in humans. In particular, we will characterize Vps35 in flies for its expression pattern and synaptic partners of Vps35 neurons. (3) We will conduct locomotor behavior investigations to analyze Vps35 mutant flies for their neural muscular defects and to examine the rescuing effects of human Vps35 gene in *Drosophila*.

BIO – 10 CREATION OF PLASMIDS FOR MULTICOLOR CELL MARKING

Chonn Cadiz (UN) and Qi He, Department of Biology, Brooklyn College of the City University of New York, Brooklyn, NY 11210

One important issue in developmental neuroscience is to identify individual neurons involved in a particular neural circuit. The central nervous system of *Drosophila* offers a powerful model for analyzing neural lineages and circuit formation. Furthermore, the *Drosophila* model has been increasingly become a system of choice for characterizing molecular basis of animal behavioral traits that will have direct applications for studying human diseases including Parkinson's and Alzheimer's. One remaining difficulty in the *Drosophila* model is a lack of an effective multicolor cell marking method that will enable us to analyze neural lineage and synaptic interactions. To address this problem, we are developing a new genetically based cell marking technique and as part of this scheme, we have generated some key plasmid constructs and are in the process of assembling the final expression plasmid. Here, we report (1) the strategy for creating the constructs; (2) the progress made thus far; and (3) future plans.

BIO – 11 INVESTIGATING ECE1 FUNCTION DURING HYPHAE FORMATION IN CANDIDA ALBICANS

Rachele Dolce¹ (GRAD), Desmond Jackson¹, Raymond Fung², and Peter Lipke^{1,1} Brooklyn College of the City University of New York,²The Graduate School and University Center, CUNY

The Graduate School and University Center, CUNY, 365 Fifth Avenue, New York, NY 10016, USA
Previous studies showed that *ALS3* (agglutinin-like sequence) and *ECE1* (Extent of Cell Elongation) are genes that encode hyphal-specific proteins in *Candida albicans*. The aim of this project is to determine the phenotype of a double knockout *als3* and *ece1* strain during hyphal growth. We hypothesize that a double knockout of *als3* and *ece1* may give a more severe phenotype than either gene alone. We are using the mini-Ura blaster method for disrupting genes in *C. albicans* (Wilson et al., 2000. *Yeast*. 16 (1): 65-70). Plasmid pDDB57 containing the *URA3-dpl200* cassette was transformed into *E. coli*, amplified, and purified using a Miniprep Kit (Qiagen). Recovered plasmid was analyzed by agarose gel electrophoresis. PCR amplification of the *URA3-dpl200* was done with primers made with 60 bp of flanking homology to *ECE1* on either side of the cassette. The PCR product and a negative control were transformed in a *C. albicans als3* null mutant strain CAYF178U. Both yeast transformation yield similar growth on CSM-URA plates. This first experiment was therefore unsuccessful. In order to convert these URA+ *als3* null mutant strains to URA-, we are currently growing the CAYF178U strains from a CSM-URA plate onto 5-FOA. Once URA- selection is done, we will do the first round of yeast transformation. The ultimate goal of the disruption of both *ECE1* and *ALS3* *C. albicans* genes is to gain additional insights into the function of these genes in hyphal growth and biofilm formation.

Supported by New York City Louis Stokes Alliance for Minority Participation (NYC-LSAMP), Bridge to Doctorate

BIO – 12 THE ROLE OF NUCLEOLIN PHOSPHORYLATION BY CK2 IN REGULATING CELL-PROLIFERATION UNDER NORMAL AND DURING DNA DAMAGE

Shu Xiao (GRAD) and Anjana D. Saxena, Department of Biology, Brooklyn College-CUNY, Brooklyn, NY 11210

Cell growth (increase in cell size) and cell-proliferation (increase in cell-division) are two critical and interconnected processes. Deregulation of the mechanisms governing growth or cell-division leads to many pathological conditions including cancer. Nucleolin, an abundant Nucleolin has been also implicated in cellular stress-responsive mechanisms by transiently relocating to nucleoplasm, interacting with phosphorylated p53 and regulating p53-translation. Although nucleolin phosphorylation at its N-terminus has been linked to its stress-responsive function as well in regulating p53-stability, the role of phosphorylation in regulating cell cycle remains poorly understood. The objective of this study is to understand the activation of cell-cycle checkpoint to regulate cell-proliferation under normal as well as genotoxic stress conditions.

We engineered a novel inducible cell system derived from human osteosarcoma to express either nucleolin-wt (wild-type) or phospho-mutant (6/S*A, six consensus CK2 serine mutated to alanine to reduce its phosphorylation). Our preliminary data shows that although in unstressed cells, nucleolin phospho--mutant slows the growth rate as compared to wt; under genotoxic stresses it causes higher cell-viability. This suggests that nucleolin regulates cell-cycle differently under normal vs. stressed conditions, and its response is phosphorylation-dependent. We are pursuing studies to determine how nucleolin-phosphorylation regulates p53-stability and its role in regulating cell-cycle arrest or apoptosis. This will advance our understanding about nucleolin phosphorylation in regulating cell-growth, cell-division or cell-death.

BIO – 13 CONSTRUCTION, EXPRESSION AND CHARACTERIZATION OF INFLUENZA M2E AND FP RECOMBINANT FUSION PROTEINS

Tianna Chin (HS), Midwood High School, Brooklyn, NY 11210, Lanying Du, Ph.D, New York Blood Center

Development of universal influenza vaccines has become increasingly necessary as mutations of viral influenza become more prevalent. In this study, a vaccine subunit was designed by fusing conserved sequences of the influenza M2e and FP proteins to either Fc of human IgG, foldon, or Fc plus foldon. The proteins were constructed, expressed and purified using both an *E. Coli* and mammalian T39 cell expression systems. The amplified sequencing was confirmed by gel electrophoresis. The expressed proteins were analyzed using an SDS page. Based on the sequencing and sizes of the expressed proteins, the proteins were able to be expressed properly and maintained structure high levels of expression. Proper expression of these proteins signifies their capability to be used in vaccines once properly tested in animal and clinics trials.

BIO – 14 DEVELOPMENT OF A RAPID, HIGH-THROUGHPUT, ASSAY FOR TESTING THE TOXICITY OF HEAVY METAL-CONTAINING COMPOUNDS AGAINST BACTERIA.

Steinberg, Adina (UN), Nuruddinkhod, Zakirhodjaev, Maurice Hamaoui, Yolande Ramazani-Salima, Dr. Theodore Muth, Department of Biology, Brooklyn College-CUNY, Brooklyn, NY 11210

As a method for obtaining data with increased efficiency, the 96-well microplate reader has become an invaluable tool to researchers. The BioTek ELx808IU performs the functions of both an incubator and a spectrophotometer, the two tools most commonly used for growing and obtaining periodic measurements of bacterial growth. This allows us to set-up an experiment and leave it to run for a

full 24 hours without concern of introducing any unwanted variables that would otherwise be introduced in the process of removing a sample from an incubator and obtaining an absorbance reading in a spectrophotometer. An advantage of the program associated with the BioTek ELx808IU 96-well microplate reader is that it does not require human involvement throughout a 24 testing cycle. It can be set to incubate the plate for a length of time and take absorbance readings at set intervals. This gives researchers greater freedom by removing the need to stay late to take readings and increasing the amount of data that can be obtained. The ease of manipulation of the resultant data has given increased clarity and insight into the inhibitory effects of heavy-metal containing compounds on various bacteria.

BIO – 15 DISCRIMINATION OF A. VITIS ISOLATES USING RT-PCR AND HIGH RESOLUTION MELT CURVE ANALYSIS OF A CONSERVED TANDEM REPEAT REGION ON CHROMOSOME 1.

Igor Britan (UN), Naomi Déloné, Aisha Dorta, Danielle Lombardi and Theodore Muth.
Department of Biology, CUNY—Brooklyn. Brooklyn, NY 11210

The goal of this study is to determine whether 27 isolates of *Agrobacterium vitis* can be discriminated on the basis of real-time-PCR (rt-PCR) amplification followed by high resolution melt (HRM) curve analysis of a conserved tandem repeat region (TRR) on chromosome 1. For rt-PCR/HRM and subsequent curve analysis, the Qiagen Rotor-Gene Q was used along with associated software. We designed PCR primers to target a suitable TRR—suitable meaning, lengthy enough to allow ample variability yet short enough to permit use in HRM applications. The TRR was identified using genomic sequence data for *A. vitis* strain S4. Bi-directional genetic sequencing of purified PCR amplicons was later performed by Genewiz, Inc. Our PCR primer set yielded 26 amplicons that fell into one of two length categories, 135bp and 150bp, and 1 outlying amplicon of 120bp—note: all multiples of 15 base pairs. ClustalW alignment revealed that the sequences of all 27 amplicons were between 80% and 100% identical. We hypothesized that if we minimized or eliminated the influence of distorting factors like template-concentration and sample-contamination, then we could use HRM curves as indicators of amplicon sequence differences. Partially inclusive runs have led to promising preliminary findings; however, we have yet to perform wholly-inclusive runs or to mitigate all identified sources of distortion. We anticipate that resolving the remaining technical hurdles will enable us to draw a final conclusion as to the suitability of using HRM analysis for *A. vitis* strain identification.

BIO – 16 BACTERIAL INHIBITION WITH PLANTS EXTRACTS NATIVE TO DEVELOPING COUNTRIES

Lima Hossain(HS), Anna Petrovicheva, and Dr. Theodore Muth, Department of Microbiology, Brooklyn College-CUNY and The Brooklyn Academy of Science and the Environment (BASE), Brooklyn, NY 11210, 11225

Consumption of water contaminated with *Escherichia coli* in developing countries is the cause of high rates of death amongst infants and elderly in those nations. Due to financial status or geography most citizens of these nations are unable to receive proper medical attention; therefore the traditional folk medicine is used. These medicines are derived from local plants sources. The antibacterial activity against *E. coli* and pure chemical extracts of plants from developing regions were assessed through disc diffusion and zone of inhibition methods. The chemical extract of *Brassica juncea*- Allyl Isothiocyanate (AI) showed significant reduction in *E. coli* growth. The minimum concentration of AI that showed significant reduction was 5 µL whereas other chemical extracts such as Hamamelitannin from *Hamamelis virginiana* and Kaempferol from *Hypericum perforatum* showed no significant reduction.

BIO – 17 TOWARD A CULTURE-DEPENDENT METHOD FOR STRAIN-TYPING HUMAN COMMENSAL STAPHYLOCOCCUS EPIDERMIDIS

Robert Mansky, Jessica Mendelsohn, Pearl Feder (UN), Betty Kolod, Dr. Theodore Muth, Department of Biology, Brooklyn College-CUNY, Brooklyn, NY 11210

The clinical significance of *Staphylococcus epidermidis* has increased in recent years due to the frequency of nosocomial infections and proliferation of drug resistance (1). Rapid methods to characterize and distinguish between pathogenic and non-pathogenic strains of *S. epidermidis* are lacking. Here, variable-number tandem repeat regions, conserved within the *S. epidermidis* genome (2), are exploited to enumerate distinct *S. epidermidis* strains present on human skin. To increase efficiency and eliminate culture-bias, *S. epidermidis* DNA was obtained by skin swab and tandem repeat regions were amplified with nested colony PCR. Following 454 sequencing, pilot data for a single tandem repeat region of the *S. epidermidis* genome was sorted into operational strain groups of $\geq 97\%$ sequence identity. Ten such groups were identified. Future work will seek to confirm these findings and apply this technique to a greater number of samples to discern factors that affect *S. epidermidis* persistence and diversity, including turnover of protective strains to potentially pathogenic or drug resistant strains.

- (1) **von Eiff, C., G. Peters, and C. Heilmann.** 2002. Pathogenesis of infections due to coagulase-negative staphylococci. *Lancet Infect. Dis.* **2**:677–685.
- (2) **A. Johansson, S. Koskiniemi, P. Gottfridsson, J. Wistrom, and T. Mønsen.** 2006. Multiple-Locus Variable-Number Tandem Repeat Analysis for Typing of *Staphylococcus epidermidis*. *J. Clin. Microbiol.*, 260–265

BIO – 18 THE PERSISTENCE OF STAPHYLOCOCCUS EPIDERMIDIS ON COMMON URBAN SURFACES

Amina Kharmaj, Rudy Saint-Dic (UN), Rosa Chen, Adam Moreira, and Theodore Muth, Department of Biology, Brooklyn College-CUNY, Brooklyn, NY 11210

Recent work indicates that microbial diversity decreases the persistence of pathogens in soil¹. Our project seeks to determine the persistence of opportunistic pathogen *Staphylococcus epidermidis* in a microbially diverse urban environment, such as a subway platform. To address this question, it is necessary to determine the persistence of *S. epidermidis* on common urban surfaces, in the absence of other bacteria. Small ceramic tiles of various textures are inoculated with *S. epidermidis* and then sampled at different time intervals. The proportion of *S. epidermidis* remaining on the tile is then determined by viable cell count. Upon determination of *S. epidermidis* persistence, the effect of microbial diversity will be addressed, using this technique to study samples that mimic the diversity of an urban environment.

1. Jan Dirk van Elsas, et al. (2011) Microbial diversity determines the invasion of soil by a bacterial pathogen. *PNAS*. 01/24/2012, Vol. 109 no. 4 – 1161

BIO – 19 DETERMINING CANDIDATE MICROALGAL STRAINS USING LIPID SCREENING AND BIOMASS ASSESSMENT FOR BIOFUEL APPLICATIONS

Elina Badiner and Larry Malkin (UN), F. Joseph, S. Registe, and Juergen Polle, Department of Biology, Brooklyn College of CUNY

With the growing concern to replace fossil fuels with independent biofuels, various studies have been performed to determine the use of microalgae of biofuel production. Algae have emerged as one of the most promising sources for biofuel production, and drastically differ from the current

source of energy. Unlike fossil fuels, harvested algae are biodegradable, consume CO₂, can be grown in fresh water, salt water and wastewater, virtually harmless to the environment, and reasonably inexpensive. Microalgae are very diverse unicellular photosynthetic organisms, and thousands of species exist. Microalgae strains are all unique in production of carotenoids, fatty acids, and enzyme. To determine which strains yield the highest rate of oil bodies that contain triacylglycerides, new strains must be isolated and screened.

In order to determine strains of potential candidacy, microalgae were extracted from various sites with unique environments. The samples were grown in standard media and were ultimately isolated into unicellular colonies via the cell sorter. Following was the lipid screening, which screens for triacylglycerides (TAG) biomass using chlorophyll-a-absorbance at 750nm (OD750) as well as lipid content via Nile Red fluorescence of triacylglycerides (TAG) at 530nm. Thereafter, plausible high-yielding-TAG strains were processed for lipid content and surveyed. To concurrently assess the potential of strains for their capability to clean wastewater, strains were cultivated photoheterotrophically with lactose and glycerol (by-product of cheese production) and were assessed as recyclable proxy.

Currently, over 2,000 total strains were isolated; an estimated 1,600 had been screened, generating approximately 250 candidates. These candidates will then be grown in new temperature based environments such as the greenhouse to replicate real outdoor conditions.

HNS – 1 HOW DO FAST FOOD COUPONS AND SALES CONTRIBUTE TO OBESITY?

Olajumoke M. Jimoh (HS) and Faith Di Angelis, Abraham Lincoln High school, Brooklyn, NY

The purpose of this study is to investigate how coupons and fast food sales relate to obesity. The origin of this topic stemmed from experience with the use of coupons, and then developed into an interest to find out if there was a correlation between coupon use, sales, and obesity. A parent consent form will be given to each minor participant in order to be eligible to take the survey. Those who returned the consent form completed a survey asking about their weight, height, gender and age as well as a series of questions about the likelihood of them purchasing fast food or soda if these items were on sales, or if a coupon were available, relative to purchasing them at regular price. Participants' body mass indices (BMI) were calculated through the information supplied on the first part of the survey, and subsequently correlated to their responses about their food purchasing habits. Interestingly, coupon use was not correlated to BMI, as posited in the hypothesis. It turned out that gender had more of an influence on coupon use than did any other variable.

HNS – 2 PREDICTORS OF INSULIN RESISTANCE IN A RAT MODEL OF DIET-INDUCED OBESITY

Doha Salem, Benjamin Reiter (UN), Juliane Locquet, Arzu Manashirova, Ambar Kasmani, Kenneth Axen, Kathleen Axen, Department of Health and Nutrition Sciences, Brooklyn College-CUNY, Brooklyn, NY 11210

Insulin is an anabolic hormone that is secreted by the beta cells of the pancreas in response to the presence of glucose in the blood. Insulin's functions include regulation of blood glucose and fat metabolism. Insulin resistance (IR) is the failure of insulin to exert its normal physiological effects at a given concentration. IR is a prominent feature of obesity and Type 2 diabetes. This 10-week study used 20 adult male Sprague-Dawley rats weight-matched into two diet groups to examine risk factors that are predictive of insulin resistance, and to identify risk factors that are correlated with each other. One group received a high-fat (55% fat, 19% carbohydrate) diet to induce obesity; the other received a low-fat (15% fat, 55% carbohydrate) diet. Measurements of basal plasma insulin level and glucose tolerance test results were used as indicators of IR. Data on the following seven categories

were collected and evaluated as potential risk factors for IR: percent body fat, leptin level, visceral fat, hepatic lipid, plasma triglyceride, and adiponectin level. The most predictive risk factors for IR, for the entire cohort, are visceral body fat ($r=0.79$, $p<0.05$) and percent body fat ($r=0.80$, $p<0.05$) since both show a positive correlation with indicators of IR. The risk factors found to correlate most highly with one another are leptin and percent body fat ($r=0.88$, $p<0.05$). These results demonstrate that our model of dietary obesity parallels the risk factors for IR with human obesity.

HNS – 3 EKG Measurement On Stressed H.S. Students

Jack Avidan, Abraham Tobias, Joey Levy (HS), and Steven Kaye, Magen David Yeshivah H.S.

Electrocardiography (EKG) is a medical technique used to record the electrical activity within the heart. A doctor can determine the heart rate and electrical behavior by reading an Electrocardiograph.

Stress has both short term and long term effect on heart rate and function. The goal of this research is to examine the effect of a physical stressor (exercise) and a mental stressor, test anxiety on electrical activity in high school students.

A Vernier Labpro data logger, using the Vernier EKG sensor (code model EKG-BTA) and a desktop computer running Logger pro 3 software has been used to perform test EKG readings on healthy high school students. This equipment provides “standard 3-lead EKG tracings” using disposable electrodes. Initial trials both tested the reliability of the equipment and proved that specific segments of the EKG tracing could be accurately record, printed, and measured.

The experiment would use data from about 15 high school students when they are relaxed. Their electrical activity will be used as a non-stress control. Experimental data will be collected when the students are exercising and cramming for the high anxiety SAT exam. Measurements will be taken from the tracings and compared. Preliminary data suggests that the PR interval and QT interval change as a result of physical and academic stress.

HNS – 4 DETERMINING WHICH IS MORE EFFECTIVE IN KILLING BACTERIA: HAND SOAP OR HAND SANITIZER

Bilal Nadeem, Samuel Cantillo, Emily Yong (HS), Janice Baranowski, Brooklyn Technical High School, Brooklyn, NY 11217

Every day, countless bacteria come into contact with our hands, so both hand soap and hand sanitizer are widely used by people. In order to find the most effective product, an experiment was performed to gain conclusive results. It was hypothesized that hand soap is more effective in killing bacteria than hand sanitizer. For this experiment, bacteria were obtained from a person’s hand by using a sterile swab, and plated on ready-made 5% sheep blood agar Petri dishes. Each Petri dish had blotter paper soaked in either CVS brand soap, CVS brand hand sanitizer, or nothing at all (control). These dishes were placed in an incubator at 37° Celsius for three days to allow the cultures to grow. After three trials, it was observed that soap prevented bacterial growth, while hand sanitizer did not. In the Petri dishes with soap-soaked blotter paper, most bacteria did not grow beyond the hemolysis ring, and there was no growth on the blotter paper. However, on the hand sanitized blotter paper, bacteria grew on and around the blotter paper. It is believed that hand soap was more effective due to its alkalinity. The basic pH of soap may counteract with the slightly acidic oil secretions from hands, causing bacteria to be killed. Hand sanitizer does not have this effect because it is slightly acidic. Future research includes actually gram-staining the bacteria to find out which type of bacteria dominated the cultures.

HNS – 5 THE ROLES OF REGULATING ADENOSINE RECEPTORS (A1R, A2BR) IN PREVENTING FATTY LIVER THROUGH CLOCK PROTEINS

Amy Chen (HS), Glenn Elert, Midwood High School, Professor Hailing Liu, NYU Langone Medical Center

A1 and A2B Receptors can be a prime factor in the accumulation of fat in the liver of non-alcoholics. By stimulating either the A1 or A2B receptor, it was found that cells were less likely to develop Steatosis. To study this theory, AML-12 cells were treated and collected at different time points (4, 8, 12, 16, 20 and 24 hours). The RNA and proteins were extracted. The RNA was quantified and then 2µg of the RNA was reverse transcribed to complementary DNA. Real-time PCR (qPCR) was performed to check the levels of clock and its regulating genes over the time course. Western blotting was performed to confirm qPCR results. The fold change between the experimental and controls groups were graphed to show that clock genes helped determine that it is possible to prevent the presence of any fat in the liver, an abnormal situation, by altering the flow of protein development in the cell.

HNS – 6 EFFECT OF GLUCOSE ON CONTENT AND TRANSLOCATION OF CARBOHYDRATE RESPONSE ELEMENT BINDING PROTEIN IN A RAT MODEL OF DIETARY OBESITY

Yu-Fu Kuo(GRAD), Marianna A. Harper, Steven Clarke, Kenneth Axen, Kathleen Axen, Department of Health and Nutrition Science, Brooklyn College-CUNY, Brooklyn, NY 11210

The effect of obesity and insulin resistance on content and translocation of carbohydrate response element binding protein (ChREBP) was studied in dietary obese rats. Method: Male Sprague-Dawley rats were separated into: LF (N=8) fed 55% carbohydrate: 15% fat (% kcal) and HF (N=8) fed 19% carbohydrate: 55% fat ad libitum for 10 weeks. Liver samples were collected from LF and HF after 20 h food deprivation (D) and then 3 h after oral glucose load (G). Liver protein extracts and homogenates, separated into cytoplasmic and nuclear fractions were analyzed by western blotting. Results: In the deprived state, total ChREBP was greater in HF than LF rats. However, after the glucose load the level of total ChREBP was increased in LF, but not HF rats, resulting in similar levels of total ChREBP in the two groups. In addition, LF groups showed increases in nuclear ChREBP content after the glucose load, but this effect was not seen in the HF group. Conclusion: Higher basal levels of total and nuclear ChREBP protein in the obese group suggest higher basal hepatic fat synthesis than in the lean group. Given that LF rats showed an increase in total and nuclear ChREBP in response to a glucose load but HF did not, it suggests that ChREBP plays a role in glucose-stimulated fat synthesis in rats on low-fat diets but not rats made obese on high-fat diets. Supported by 1 SC3 GM086298-01A1

HNS – 7 THE IMPACT OF DIOXINS UPON EXPRESSION OF THE PIK3R1 GENE IN ACTIVATING CANCER SIGNALING PATHWAYS

Dassy Levilev (UN) and Jean A. Grassman, Department of Health and Nutrition Sciences, Brooklyn College-CUNY, Brooklyn, NY 11210

The phosphatidylinositol 3-kinase signaling pathway is frequently activated in cancer. Emerging evidence supports the p85a regulatory subunit gene, PIK3R1, as a novel oncogene. This study will identify whether dioxin-like compounds have an effect on the expression of gene PIK3R1. To do this, we will isolate culture and harvest lymphocytes at 1, 3, 7, 10 days to test whether PIK3R1 behaves as a dioxin. This will done by measuring gene expression after exposure to varying concentration of the dioxin-like PCB 126, or non-dioxin like PCB 180. Gene expression will be measured by real-time PCR.

Over the course of the experiment we expect that the expression of genes will vary in a time-dependent manner. Responsiveness to PCB126 and not PCB 180 will provide evidence that PIK3R1 possesses dioxin like activities. As a control, a known dioxin responsive gene, CYP1A1 will be measured along with TATA, a gene that is not affected by dioxins. Initial studies have determined that an adequate number of cells for the analyses can be obtained from 1 ml lymphocyte cultures. The results will indicate how PCBs affect the RNA transcript levels of PIK3R1 and provide evidence of whether it plays a role in the development of dioxin-related health effects.

This project has IRB Approval from the Brooklyn College Human Research Protections Program. Supported by: PSC CUNY 64233-00 42

HNS – 8 MEASURING THE EFFECTS OF PCBs ON HUMAN GENE EXPRESSION USING THE IL8 AND KLF4 GENES

Kaymisha D Knights (UN) Jean A. Grassman , Health and Nutrition Sciences, Brooklyn College- CUNY, Brooklyn, NY, 11210

The purpose of this project is to investigate how the expressions of dioxin-responsive genes change through time. Dioxins are widespread pollutants whose health effects are mediated by the aryl hydrocarbon receptor (AHR). Dioxin binds to the AHR and translocates to the nucleus where it acts as transcription factor. This project highlights the results of previous biological studies that show dioxin-like PCBs alter the signaling of the AHR pathway whereas the pathway is unchanged by non-dioxin like PCBs. We will evaluate two genes to determine whether they are influenced by the AHR signaling pathway: IL-8, which plays a role in causing bronchiolitis, and KLF4 which acts as an activator or repressor during embryonic development. To do this, we will isolate human lymphocytes from blood samples. Preliminary studies indicate that antifungal/antibiotics inhibit cell growth and therefore will not be used during cell culture. RNA will be isolated, measured and reverse transcribed. Using real time polymerase chain reaction, RNA transcripts for the IL8 and KLF4 genes will be measured over the course of 1, 3, 7 and 10 days. We will evaluate the two genes to determine whether their expression is dosimetrically affected by either dioxin-like (PCB126) or non-dioxin like (PCB180) PCBs. This research will provide evidence of how the activity of these genes (IL8 and KLF4) are influenced by environmental pollutants.

This project has IRB Approval from the Brooklyn College Human Research protections Program. Supported by PSC CUNY 42

HNS – 9 EFFECTS OF EXPOSURE TO POLYCHLORINATED BIPHENYLS ON HUMAN GENE EXPRESSION

Monica L. Bojko (UN) Jean A. Grassman, Department of Health and Nutrition Sciences, Brooklyn College-CUNY, Brooklyn, NY 11210

Polychlorinated biphenyls (PCBs) are persistent organic pollutants which may have an adverse health effect on humans. Certain genes are known to be dioxin-responsive (AHR, ARNT, CYP1A1, CYP1B1, AHRR) while others (PIK3R1, KLF4, TATA, IL-8) are suspected to be dioxin-responsive, but have only been recently described in microarray studies and require further analysis. We hypothesize that treatment of human lymphocytes with PCBs will alter the expression of these genes, and will perform a dosimetry study in which cultured human lymphocytes (3 days at 37°C) are treated with varying concentrations of dioxin-like PCB-126 and non-dioxin-like PCB 180. We first validated the TAQMAN™ expression assays in the genes using real-time polymerase chain reaction (PCR) to document uniform efficiency across a range of expression levels. The validated assays will be used in the dosimetry experiment to elucidate any variation in gene expression following treatment with PCBs. Our validation results show that transcript levels differing by three orders of magnitude had similar

amplification efficiencies. These results indicate that the assays will be capable of accurately detecting the range of expression levels anticipated in the upcoming dosimetry experiment. Our research will add to the data available on these newly identified dioxin-responsive genes. If determined to be dosimetrically responsive to dioxins, their detection will augment studies of the human health impact of exposure to dioxin-like pollutants.

This project has IRB Approval from the Brooklyn College Human Research Protections Program. Supported by: PSC CUNY 64233-00 42

HNS – 10 ASSOCIATION BETWEEN SEXUAL MATURATION AND TYPE 2 DIABETES RISKS: A SYSTEMATIC REVIEW

Linda Agyemang (UN), Jung Won Min, MS, PhD, Youfa Wang MD, PhD

Center for Human Nutrition, Dept of International Health, Bloomberg School of Public Health, Johns Hopkins Univ.

The secular trend in early onset of sexual maturation (SM) continues in most populations worldwide. Findings from studies examining the associations between SM and type 2 Diabetes (T2D) and insulin resistance are mixed. The purpose of this study is to examine the association between SM and T2D risks using T2D and its indexes insulin, HOMA, and insulin sensitivity based on published papers. A systematic search of PubMed and Embase identified 23 relevant studies (Jan 1990- July 2011), including 9 follow-up and 14 cross-sectional studies meeting our inclusion criteria. Data were extracted for each study on: study design, sample characteristics (e.g., age, sex, race/population, and sample size), and the quantitative association estimates (e.g., odd ratio) between SM and T2D risks. All 23 studies were conducted among Europeans or Americans; 5 studies were in adults, 18 in children. Overall 16 studies and part of 4 studies provided some evidence in supporting our hypothesis that early SM was associated increased T2D risks: those who had early age at menarche were more likely to have higher level of insulin and HOMA in adolescents. However, significantly higher T2D risk with earlier age of menarche was reported only in middle aged adults (odd ratios ranged 1.2 to 1.4), but not in old people over 60 years among 6 follow-up studies. SM stages indicated by Tanner stages (1 to 5 - close to adults) were associated with significantly increased risk of prediabetes in 1 cross-sectional study (odd ratio=6.2 [2.4-15.6]); and the level of insulin and HOMA in 11 (>90%) of 12 studies (1 follow-up and in 11 cross-sectional studies). Lower insulin sensitivity across Tanner stage was reported in 6 of (>74%) 8 studies (3 follow-up and 5 cross-sectional studies). Inconsistency was observed in the associations between SM and T2D risks by gender (females showed association), but not varied by obesity, race/population, or family history of T2D. There are good evidence supporting an association between early SM and increased T2D risks.

ENV – 1 TRACE ELEMENT CHEMISTRY OF MODERN SHARK TEETH AND IMPLICATIONS FOR SHARK TOOTH GEOCHRONOMETRY

Jesse John (GRAD), David. E. Seidemann, John. A. Chamberlain, Zhongqi Cheng Jr., Department of Earth and Environmental Sciences, Brooklyn College, CUNY, NY 11210, USA Faculty mentor

The hard parts of marine organisms take on the Sr isotopic composition of the seawater in which they form. We have determined the average trace element concentration in the dentine and enameloid of teeth from a variety of coastal, inshore and pelagic shark species: *Galeocerdo cuvier*, *Carcharhinus limbatus*, *Carcharias taurus*, *Carcharhinus leucas*, *Prionace glauca*, *Isurus oxyrinchus*, *Carcharhinus brevipinna*, and *Hexanchus griseus*. Teeth were collected from the jaws of recently deceased individuals of these species. The trace element concentrations of interior and root dentine and cusp enameloid for these teeth were analyzed using the inductively coupled plasma mass spectrometer housed in the Environmental Science Analytical Center. The concentrations for these shark teeth ranged from 1 to 10 ppm for Ba, Ni, Mn, and Vn; 10 to 100 ppm for Al, Zn, and Cu; and 1000 to 3000 ppm for Sr. REE and U values were <1 ppm. The trace element concentrations of enameloid did not significantly vary from species to species. Dentine, which is much more porous than enameloid, showed greater variation. We interpret the uniformity in composition of enameloid across species to mean that the life habits of the animals we tested, and their food sources were sufficiently broad to have exposed our sharks to average conditions of oceanic chemistry. Similarly, the trace element composition of well-preserved fossil shark teeth may be indicative of the average trace element concentration in ancient oceans. Detecting such variations might prove helpful in improving the reliability of isotopic dates obtained for fossil shark teeth.

ENV – 2 FACTORS AFFECTING THE QUANTITY AND QUALITY OF STORMWATER RUNOFF AROUND THE ACADEMY OF URBAN PLANNING CAMPUS, BUSHWICK, NY.

Amaris Brignoni , Rosa Gomez (HS), Shaquille Bryan, Leslie Cohetero, Daysha Settle, Julio Reynoso, Francisco Perez, Bernardo Nunez Silverio, Susannah Ceraldi

In urban areas, run-off water from storms can cause flooding, sewage overflows, and pollution of local waterbodies (NYC, 2008). Students investigated this issue on a local scale by conducting a stormwater survey of their campus. Spatial mapping techniques, physical calculations, and laboratory procedures were used to determine how the types of surfaces and pollutant sources around their school contributed to both the quantity and quality of local stormwater. Results showed that over 50% of the school campus was impervious, which would lead to nearly 200,000 gal. of runoff water during a typical storm (as based on the NY state stormwater design manual). One of the main pollutants associated with stormwater around the campus was yard waste, which was found to contribute excess nitrogen and phosphorous to runoff water. Students will use this information to look for opportunities for best management practices such as rain gardens, rain barrels, and litter control around their campus.

ENV – 3 INVASIVE AND NATIVE PHRAGMITES : CAN HUE DISTINGUISH BETWEEN THEM?

Margo Harary (HS) and Steven Kaye, Magen David Yeshivah Celia Esses High School, Brooklyn, NY

The publication of a field guide for distinguishing between native and invasive Phragmites publicized the existence of a native variety of Phragmites australis. This guide was based on research

identifying both morphological and genetic variations between the two varieties. The literature also identified the native variety as potentially endangered.

Phragmites has been targeted for eradication in many natural area wetlands both because it has been identified as an invasive exotic and because it may create monoculture environments. Massive eradication programs have been performed in Canarsie and Marine Parks in Brooklyn, NY without taking into consideration whether the phragmites were invasive or native.

The existing literature and observations identify color as a technique for distinguishing between them. A test was performed on digital photographs using RGB analysis in Photoshop.

The results demonstrated that photographic techniques may prove to be a valid method for distinguishing between invasive and native strains of phragmites. Additionally, the telephone interviews revealed that members of the NRG were unaware of the characteristics that distinguish between the native and non-native varieties and also harbored prejudice against these plants regardless of their origin.

ENV – 4 RELATIONSHIP OF PRECIPITATION TO CLOUD PROPERTIES FROM A NATIONAL STORM TRACKER DATABASE

Joshua Wadler (HS) and Glenn Elert, Midwood High School, Brooklyn, NY 11210

Historically, precipitation is one of the hardest things to predict. To predict precipitation accurately there has to be a reliable model of the atmosphere's moisture content and vertical motion fields which are hard to observe. Therefore, we looked to use other variables in order to produce an accurate precipitation forecast. To determine a relationship between atmospheric variables and their effect on precipitation, 200 tracks were collected using Storm Tracker 3. After all the storms were analyzed the only variable to show a strong correlation with precipitation was starting average infrared temperature.

The warmest clouds' infrared temperature (240-260 K) showed a linear relationship with the ending precipitation of a storm. The higher the infrared cloud top starting temperature, the more precipitation was being produced as the track was ending. The reason for this is when clouds were this warm at the beginning of a track they were in the growth stage. The storms had a lot of potential to become mature thunderstorms. As they did grow, they began to produce higher amounts of precipitation that were predictable based on the linear equation.

After testing these findings using a new set of seventeen storms that fit the infrared cloud top temperature range, the average ending precipitation and average predicted precipitation were different by .34 mm/hr. This shows in the cases where a cloud top starts out in the 240K to 260 K range, a weather forecaster can fairly accurately predict the precipitation that will be occurring at the end of the storm.

ENV – 5 COMPARITIVE ANALYSIS — ENVIRONMENTAL REGULATION IN DEVELOPED CITIES: NEW YORK CITY AND SINGAPORE

Michelle D. Mecca (UN), Professor Micha Tomkiewicz, Environmental Studies Program, Brooklyn College-CUNY, Brooklyn, NY 11210

The goal of this study is to provide an extensive analysis of existing environmental infrastructure in two similar, yet very different societies — New York City and Singapore. By using historical background and The United Nations Development Programme Report, we found full-spectrum examination of the governmental agencies in both places. Within the sovereign city-state of Singapore, the National Environmental Agency (NEA), was examined as the main source of environmental legislation and enforcement. Within the United States' city of New York City, the

Environmental Protection Agency (US EPA) was examined as the main source of environmental legislation. The difference between the two areas is that existing in the independent city-state of Singapore, the NEA is the sole agency responsible for all environmental protection legislation and enforcement and is held accountable for all actions taken, for example the Energy Efficiency National Partnership is an agency of the NEA. In New York City, a city that is a part of the democracy of the United States of America, the EPA acts only as the federal entity of the environmental legislation that exists within the area--- New York City's legislation is also effected by agendas of state and local government, as seen directly by Mayor Michael Bloomberg's PlaNYC. Using the provided information, one has examined the differences and similarities of the environmental legislation and the methods used to pass the legislation within the two different governmental structures. Such comparison of the two systems can help us better understand functioning environmental legislation.

ENV – 6 HOW CHLORINE AFFECTS THE GROWTH OF DUCKWEED

Ellis Fronerberger (HS) and Dr. Brett Branco, Brooklyn Academy of Science and the Environment

For the research project that will be done, the question being asked is, “how does chlorine affect the growth of the duckweed?” Duckweed is an aquatic plant that is commonly located in Prospect Park. It is known for being a reliable source of highly concentrated nitrogen. This plant grows very rapidly in small clusters or fronds and it has the ability to triple its own body weight within one week in very hot and humid climates (summer months). This small, bright green plant floats freely on the surface of water. The species of duckweed that grows in Prospect Park is normally a bright green color when it is a young plant. As it begins to mature, it changes color turning dark green, then reddish going into dark brown the more it matures.

For the experiment that will be done, there will be six cups, each cup containing 190 ml of nutrient enriched water. Three of the cups will have the duckweed sitting in water whilst the other three will contain the same amount of chlorine in ppm that new York city tap water does (0.02 ppm). All of the plants are put under a six hour light cycle. For a few weeks, the growth, color, and overall appearance and condition of the Azolla plants will be monitored and documented to form a proper conclusion on the effect of chlorine on the growth of the Azolla plant

ENV – 7 THE GEOGRAPHY OF CENTRAL PARK

Mitchell Eng (HS), 29 Fort Greene Place, Brooklyn, NY 11217

Glaciers are commonly known as pieces of slow moving ice that drift over the landscape. However, these masses of compacted snow and ice are the cause for the geography that we see today in Central Park, located in Manhattan, New York. The method of seeing the geography change was by locating and measuring striations that were found on outcrops throughout Central Park. A compass was used to measure how many degrees the striation was aligned from true North. A simpler way of observing glacial activity was by looking for erratics that would be deposited from the traveling glaciers. Erratics could be identified if their composition is not similar to the composition of the nearby outcrop. The research shows that there was certainly glacial activity and it appeared to indicate that the glaciers were drifting towards the Northwest. For future research, there can be experiments conducted to see what other locations in the Northeast were affected by glaciers.

ENV – 8 WHICH HOUSEHOLD SORBENTS REMOVE OIL FROM WATER MOST EFFICIENTLY

Steven Villegas (HS) and Janice Baranowski

Oil spills tend to have a devastating effect on wildlife and water. Oil spills can be cleaned in many ways, one of these being with sorbents. There are many sorbents that are thrown away that could be used to clean up oil from water. Scientists are trying to determine which households and commonly used sorbents are more effective at cleaning oil from water. Ten different household and commonly used sorbents were tested to see which was the most effective. The results for this experiment showed that the most effective sorbents are polypropylene pads, sawdust, and straw. If the most efficient sorbents could be collected throughout the nation, they could be used in nets to help clean up oil spills. Future research could examine modifications of these sorbents in order to be more efficient, how long to have them in water for optimum oil collection, and even a social experiment of how many people would donate these sorbents to oil spill cleanup crews.

ENV – 9 TRACKING NOISE POLLUTION LEVELS IN THE NEW YORK CITY SUBWAY SYSTEM

Nicole Barbier, Mellisa Leggard (HS), Marg Ely StPierre, Roodby Lapointe, Malgorzata Frik, Remy Rovelli, Julius Buh-Mbi and the students of Julius Buh-Mbi's 11th grade Chemistry class

Many New Yorkers ride the subways daily sometimes for many hours at a time, and expose themselves to high amounts of excess noise. This much exposure to loud sounds can lead to permanent hearing loss. This project focuses on trying to find out if the noise levels experienced in the subway system are at healthy levels, and to figure out which stations may pose the greatest risk. The selected subway lines were the D, N, Q, and B, 2, 3, 4 and 5. A decibel noise level meter was used to collect the data. Three groups of students were formed, each riding a different train line to the last stop and back, starting at Atlantic Avenue. The measurements were taken on each subway line between each stop, every 30 seconds, in order to be able to calculate the amount of time that passes. The highest and the lowest values were recorded, and the average was calculated. Measurements were also taken at major stops. With the data, a map was created in order to display which areas are hazardous and which are not, in order for commuters to make healthier decisions on their choice of train. The collected data revealed that for the most part, the noise is at a healthy level. However, at certain stops, the noise level was significantly higher, and can reach unhealthy levels. Using the results of this study, areas of potential health risk are exposed, and precautionary measures can be taken to prevent permanent hearing loss.

Supported by GK-12 "City as Lab" NSF-DGE 0638718

ENV – 10 CARBON DIOXIDE EMISSION VERSUS INTAKE: A COMPARATIVE STUDY

Jamal Thompson, Jose Brunard (HS), Cassandre Celus, Cassandra Hyppolite, Remy Rovelli, Malgorzata Frik, Julius Buh-Mbi and the students of Julius Buh-Mbi's 11th grade Chemistry class

An investigation was conducted to determine whether the amount of CO₂ emitted by humans and cars is in balance with the amount of CO₂ that can be sequestered by local trees. To do this, two areas in two different neighborhoods were selected, one on the blocks surrounding ITAVA, and the other just south of Prospect Park. To gather data, tape measures were used to get the circumference and apparent height of the trees on the selected blocks. The weight of the tree was then calculated, along with how much CO₂ each can sequester. Then, categories were created to separate cars into 5 types, based on size and gas mileage. Each block was observed for 15 minutes, where each car was counted and categorized. From this data, the average amount of CO₂ being emitted by each car on each block was calculated. Finally, Census data was used to determine the population density of the

selected areas, to determine the average amount of CO₂ being emitted by humans. Humans show practically no impact compared to cars. Through analysis of the data, it was determined that the trees more than make up for the amount of CO₂ being emitted by cars and humans. The two neighborhoods showed about the same proportion of CO₂ being emitted versus being sequestered. However, many other factors were not taken into account, including idle cars, electricity production, different traffic patterns, and would significantly add to the amount being sequestered.

Supported by GK-12 "City as Lab" NSF-DGE 0638718

ENV – 11 A PIEZOMETER METHOD FOR QUANTIFYING STORMWATER CAPTURE BY STREETSIDE BIOSWALES

Tarik A. Zarrouk (GRAD), Zhongqi Cheng, Department of Geology, Brooklyn College –CUNY, Brooklyn, NY 11210, and John McLaughlin, New York City Department of Environmental Protection, Flushing, NY 11373

Streetside bioswales are being evaluated for their performances in runoff capture in a pilot program within the New York City Green Infrastructure Plan. Measuring stormwater capture volume in small streetside bioswale systems is challenging because (1) any pipes and meters serve as flow restrictor which compromises flow rate thereby artificially decreasing capturing efficiency; (2) leaves, litters and sediments coming with the runoff often clog the system and further restrict the flow. A monitoring scheme based on water levels in shallow piezometer wells has been developed. Known volumes of water from hydrants are used to check the accuracy of such a method. In an Enhanced Tree Pit system, stormwater infiltrates the overlying soil and is temporarily stored in the stones, recycled glass or chamber. The net capture thus can be calculated by totaling three components: change in storage volumes in the media and in soils, as well as the volume drained (lost) to the subsurface native soils during the period (compensated volume). For Streetside Infiltration Swales, storage volume only includes the saturation in soils. Theoretically when the native soil infiltration rate is far less than the surface infiltration rate (4-10 inches per hour), surface soil becomes the rate limiting factor for runoff capturing and the piezometer method yield relatively accurate results. In cases where the subsurface native soil has high infiltration rates, the net storage change is small and leads to larger uncertainty in the quantification of capture volume using the piezometer method.

ENV – 12 ESTIMATING CARBON CREDITS FOR BIOSWALES

Argie Miller (GRAD), Jillian Macchiarella, Tarik Zarrouk, Zhongqi Cheng, Brooklyn College of the City University of New York, Brooklyn, New York, 11210

Atmospheric carbon is estimated to be increasing worldwide by approximately 2600 million metric tons annually. Urban forests have the potential to substantially reduce atmospheric carbon dioxide (CO₂) by sequestering it directly into soils as biomass, as well as indirectly by reducing energy demand in buildings. However, some studies showed that national urban forest average carbon storage density is less than half that of natural forest stands (25.1 tC/ha, compared with 53.5 tC/ha). Trees grown in stormwater capturing systems (a.k.a., green infrastructure) are substantially different than typical urban forest trees in that they are not short of water supply and therefore usually have larger and denser canopies. The leaves are also recycled in situ rather being disposed elsewhere. The preliminary study uses simple models to estimate the carbon credit potential of these trees as part of the green infrastructure, in comparison to typical street trees and natural forest canopies. Actual field measurements will be conducted within the next few years. Such data will be useful for sustainable urban planning. If the urban canopy is developed and used to its potential, soils in these tree pits could potentially sequester a significant amount of atmospheric CO₂, soil and root systems

would assist purification of storm runoff and most importantly, atmospheric temperatures caused by Urban Heat Island (UHI) effect would be significantly mitigated.

ENV – 13 UNDERSTANDING HYDRAULIC FRACTURING

Mikhail Meyerovich (UN), Professor Zhongqi Cheng, Environmental Studies Program, Brooklyn College-CUNY, Brooklyn, NY 11210

Hydraulic Fracturing, also known as hydraulic “fracking,” has been a subject of intense debate in recent years. By pumping specially blended liquid down a well into subsurface rock units with pressures that are high enough to fracture the rock, a network of interconnected fractures are created. These fractures allow faster movement of oil and gas into the wellbore. This method facilitates the recovery of oil and natural gas from formations that geologists once believed were impossible. Natural gas is considered the cleanest fossil fuel, producing about half as much carbon dioxide as the energy-equivalent amount of coal. Hydraulic fracking provides a promising and affordable source of energy that likely can sustain the energy needs for decades. The environmental effects of this method, however, are of concern by many people. Based on limited evidences, some have argued that such practice could pollute surface and ground waters, threaten air and soil quality, and lead to earthquakes in the surrounding area. However, state regulators and industry representatives claim that the process is environmentally sound. US EPA (Environmental Protection Agency) is currently conducting a comprehensive study to assess the potential hazards of hydraulic fracking. The initial findings will be released to the public in 2012 while the final report won't be published until 2014. In the meantime, some regulations have already been established to protect the surrounding environment based on several known risks of fracking.

ENV – 14 WATER QUALITY ANALYSIS IN NEW YORK CITY'S PUBLIC WATERWAYS

Anaelle Amy¹, **Chris Young**¹ (HS), Akeem Dear¹, Inique Francois¹, David Johnston¹, Greg Barord^{2,3}, Lilja Nielsen^{2,3}¹, Brooklyn Academy for Science and the Environment High School, ²Brooklyn College, ³CUNY Graduate Center

A comparison was conducted of the water quality of public waterways in the five boroughs of New York City. The hypothesis was that the closed water systems would be more polluted than the open water systems due to size and the lack of continual inflow. One site was tested in each borough, with fourteen water quality tests conducted at each site. Parameters tested included nitrate, turbidity, pH, dissolved oxygen, etc. The research started with open water systems, which are water systems that flow in to the ocean. The open water systems considered were Brooklyn Bridge Park and Pier 40 in Manhattan. The last three sites, High Rock Park in Staten Island, Van Cortlandt Park in the Bronx, Flushing Meadows Park in Queens, were all closed water systems which don't flow into the ocean. Finally the data from sites was compared to each other to find out which site was the healthiest ecosystem and provided the best habitat for its living organisms. The result was that Brooklyn Bridge Park was the ecosystem with the best water quality and therefore would be the best living environment. Testing the pollution level in public waterways is important because many organisms depend on these habitats. If testing discovers that contamination levels are too high, then action can be taken to reduce the pollution to that area.

ENV – 15 KEEPING OUR BROWNSVILLE COMMUNITY ALIVE: THE CARBON FOOTPRINTS OF CARS AND TREES IN OUR COMMUNITY

Jamie Bernard, Patrice Brown (HS), Tahiem Hilliard, Tessa Kingston, Chantinie Britton, Jivaro Mordaunt, Malik Orr, Micha Tomkiewicz

The GK-12 science research class of Teachers Preparatory School in Brownsville focused on research related to global warming. It is important for the community to know if there are enough trees in the neighborhood to compensate for CO₂ emissions of cars and people. To test this hypothesis, the carbon footprints of cars and the sequestration of CO₂ of trees in the neighborhood were calculated and compared. An approximate four-block radius around Teachers Preparatory School was chosen as the study area with about 200 trees measured. The total CO₂ sequestration of the trees was compared to CO₂ emissions created by population density and local traffic. The cars in the study area emit different levels of CO₂ each day into the air. By using clickers a variety of vehicles were counted at specific locations and times within the 4-block radius. The carbon footprint was then calculated for each car type and combined into one total value. The carbon footprint of population density was determined from the 2010 census. Overall, it was found that the number of trees in the neighborhood do not compensate for the carbon footprint resulting from people and cars. To lower the carbon footprint people can walk, carpool, bike, or take the bus when possible.

ENV – 16 LEAD IN CHICKEN EGGS FROM CONTAMINATED URBAN BACKYARDS: PRELIMINARY RESULTS

Lumena Louis (UN) and Zhongqi Cheng, Department of Earth and Environmental Sciences, Brooklyn College CUNY, Brooklyn, NY 11210

Chicken eggs from three sources were analyzed for lead (Pb) using a Microwave Oven Assisted Acid Digestion Method followed by determination by an Inductively Coupled Plasma Mass Spectrometer. Three eggs of each were collected from two urban backyards in Brooklyn, where soil test showed lead levels of 1227 ppm and 2816 ppm, respectively. Three more eggs, as control samples, were purchased from Costco – these were presumably from chicken raised in suburban farms where soil is not known to be contaminated (usually <50 ppm). Eggs were boiled in water and then albumen, yolk and shell were manually separated for analysis. While the Pb in control eggs was non-detectable (<0.01 ug), the three eggs from the most contaminated yard on average had 7.5 ug of total Pb, just above the recommended daily uptake limit for children by FDA (7 ug/day). In this case, the yolk contained the majority of lead (90%) in the egg. For eggs from the less contaminated yard, on average each egg contained 0.3 ug of total Pb. The amount of Pb in the yolk (0.06 ug) was less than that in the albumen. Thus, soil contamination probably affects the Pb levels more in the yolk than in the albumen. It should also be noted, however, that the concentrations of Pb and total Pb showed significant variation among duplicate eggs, suggesting other factors influencing Pb accumulation in eggs, in addition to the background soil Pb levels.

ENV – 17 THE EFFECT OF ELEVATED CARBON DIOXIDE LEVELS ON NITROGEN FIXATION AND GROWTH IN *AZOTOBACTER CHROOCOCCUM*.

Mariya Germash (HS), Edward R. Murrow High School.

Rising levels of CO₂ may cause changes in the essential nitrogen fixation of bacteria. This experiment tested the effect of 1,000,000ppm, 50,000ppm, and current levels of CO₂ on nitrogen fixation and growth in *Azotobacter chroococcum*. This was done by adding CO₂ inside Petri dishes with mannitol

special agar, incubating for 74h, and testing the average nitrate produced in each group. I hypothesized that in 50,000ppm and 1,000,000ppm CO₂, *A. chroococcum* would fix less nitrogen and grow less than in conditions of no added CO₂. I was unable to test my hypothesis because I found that mannitol special agar reduces or converts nitrate, so even if any nitrate was produced, I would not have been able to detect it. Future studies should use nitrogen-fixing bacteria which grow on broth.

ENV – 18 POLLUTION IN THE GOWANUS CANAL

Isabella Tafa (HS), Edward R. Murrow High School

To see if the Gowanus Canal was polluted we tested water, soil, and sediment samples and compared the C:N ratio. After testing the water we compared all three sites and found that our hypothesis, that the Gowanus Canal was polluted since the C:N ratio was very high. To prove that Gowanus Canal could not sustain life we exposed *Daphnia magna* to the site water samples and found that all of the daphnia had died. Further studies could be done to see what affect this polluted water has on the surrounding environment.

ENV – 19 TREES OF PROSPECT PARK, THEN AND NOW – A COUNT OF THE TREES THAT HAVE SURVIVED SINCE 1902

Kyle Roberts (HS) Joy-Anne George, Peter Ogunwale, Nickeshia Rumble and Rasheed Webber – STAR Early College School

In 1902 Leslie Harmon Peet published Trees and Shrubs of Prospect Park, a species by species account of the trees in Prospect Park; the goal of our study is to determine how many of those trees remain over 100 years later. Based on preliminary visits during the summer of 2010, we made a hypothesis that approximately 50% of the trees that were listed in 1902 still survive. We also made a hypothesis that the ratio of surviving trees of the genus *Elmus* would be lower due to the effects of Dutch Elm Disease. We studied Peet's map and species descriptions then made visits to the area of Prospect Park from Long Meadow to the Grand Army Plaza Entrance to identify the species of trees and compare them with the map provided in the publication by Peet. We also collected additional data on the trees such as GPS location and current photographs.

PHYSICS – 1 INVESTIGATION OF GRAPHITE’S SURFACE USING NANOSURF EASYSCAN 2 SCANNING TUNNELING MICROSCOPE

David Cuffari (GRAD), Odingo Mitchell, Minh Nguyen, Mim Nakarmi, and Zhiheng Liu

The Scanning Tunneling Microscope (STM) was first invented in 1981 by Gerd Binnig and Heinrich Rohrer. The STM exploits the quantum mechanical effect of tunneling: the classically forbidden transmission of a particle through a potential barrier with an energy greater than the particle. When a conductor with an atomically sharp point is placed within nanometers of a conducting surface, a tunneling current of electrons will be formed if a bias voltage is applied across the two materials. Rastering the tip over a given area can produce topological information about the conducting surface when the current or the tip-to-surface distance is held constant. This method of imaging can be used to observe the atomic structure and generate spectroscopic data of conducting materials. The Nanosurf easyScan 2 STM was used to image the surface of Highly Oriented Pyrolytic Graphite (HOPG). The easyScan software provided a convenient interface for controlling the STM tip’s current, distance, and bias voltage. Atomic resolution was achieved allowing the measurement of the lattice constant and atomic spacing of HOPG. Images of HOPG surface structure produced by the STM will be presented. These preliminary measurements can be used as a bench mark for future experimental work.

PHYSICS – 2 ELECTROMAGNETIC SUBMERSIBLE GLIDER

Jonathan Cohen, Albert Manopla (HS), Steven Kaye, Magen David Yeshivah High School, Brooklyn, NY 11223

Experimental vehicles were developed that have the ability to sail for long distances underwater by rising and falling through the water column as wings create forward motion. As these vehicles mimic the science experiment known as a Cartesian diver, the original idea that was developed was to create a neutral buoyancy vehicle that would submerge when its weight increased and rise when its weight decreased. This concept could be used to test the development of a wing or “fin” that would ensure forward motion as the vehicle rises and sinks. Mahmoudian and Woolsey described the design and development of a vehicle which operates under these principles, and creates forward motion. Woithe et al. identified autonomous vehicles as playing a major role in marine research. They utilized a vehicle called “The Slocum Glider” to demonstrate the feasibility of experimental concepts. A non-powered model was prepared with density lower than one and released in a tank of water. Various fin designs were tested and it was determined that a curved wing such as found on an aircraft provided the optimal amount of forward motion. Additional work is ongoing and we plan to test our prototype in the near-future.

PHYSICS – 3 MULTIPLE SPIN COHERENCES AND THE TIME EVOLUTION OF A MAGIC ECHO

Steven S. Morgan¹ (GRAD), Vadim Oganessian² and Gregory S. Boutis¹,¹Brooklyn College, Department of Physics Brooklyn, NY 11210, ²College of Staten Island, Department of Engineering Science and Physics

It has recently been shown that long-time spin decays in solids have a universal form, independent of the initial spin configuration, i.e. after a spin echo or a free induction decay (FID). In order to probe the many body dynamics and the efficiency of a magic echo sequence we have performed experiments to study the evolution of multiple spin correlations during the FID as well as during different magic echoes. Our experimental results in adamantane show a similar long-time overlap in the signal decays, even though the magic echoes’ initial behaviors are different. In our

measurements of the multiple spin correlations we observe a similar evolution for the FID and for different magic echoes. Our experimental data suggest that there is a similar convergence in the long-time portion of the multiple spin signal decays. Because the multiple spin coherences are measured in the x-basis they do not correspond to a specific number of coupled spins, but are mixed among coherence orders with at least that many spins. Experimental measurements of the multiple spin correlations probe beyond the single-spin decays, yielding important information because, for instance, the higher-order multiple spin correlations have not yet peaked by the time the single-spin decays reach the asymptotic regime. Lastly, this work highlights simulations as well as analytical calculations which suggest that the variations in the magic echoes are due, at least in part, to finite pulse width effects.

Supported by NIH SC1GM086268-04

PHYSICS – 4 PROBING DYNAMICAL CHANGES IN ELASTOMERS INDUCED BY MAGIC ANGLE SPINNING

Odingo Mitchell¹(GRAD), Cheng Sun² and Gregory S. Boutis^{1,1}Department of Physics, Brooklyn College of the City University of New York,²Dalian Institute of Chemical Physics, Chinese Academy of Sciences

The centripetal force on the sample caused by high spinning frequencies in magic angle spinning nuclear magnetic resonance will produce a strain which is known to cause noticeable effects on microscopic structure. In this work we investigate the ¹³C T_{1ρ} relaxation times to study induced dynamical changes on natural rubber due to sample spinning. A ¹³C direct polarization experiment was implemented to measure the T_{1ρ} times at two different RF field strengths for all the carbon moieties in natural rubber as a function of the spinning speed. The experimental values of the T_{1ρ} times are used to extrapolate the correlation times which represent the fluctuating dipolar fields experienced by the ¹³C spins, pertaining to the overall motions of the carbon nucleus and neighboring protons. Our results demonstrate that the overall carbon correlation times decrease with increasing the spinning frequency as expected, based on simple entropy arguments, while the ¹³C chemical shifts appear to not vary significantly. These findings may have practical implications for experimentally probing the dynamical and structural heterogeneity of complex elastomers, such as elastin or spider silks, by magic angle spinning nuclear magnetic resonance.

Supported by NSF LSAMP

PHYSICS – 5 PRELIMINARY ¹³C, ²H NMR STUDIES OF SERINE AND WATER DYNAMICS IN NEPHILA CLAVIPES DRAGLINE SILK

Obehi T. Ukpebor^{1,2}(GRAD), Anup Shah¹, Emmanuel Bazov³, and Gregory S. Boutis¹,¹Department of Physics, Brooklyn College of the City University of New York,²Department of Physics, Hunter College of the City University of New York,³Midwood High School at Brooklyn College

Spider silk is a protein fiber spun by spiders composed of complex protein molecules. Spider dragline silk is a flexible lightweight fiber that possesses remarkable mechanical properties comparable to that of high synthetic performance fibers. Dragline spider silk from the *Nephila Clavipes*, a species of the golden orb weaver, contains two proteins with distinct characteristics: major ampullate spidroin 1 (MaSp1) and major ampullate spidroin 2 (MaSp2). Each protein has unique motifs that control the tensile strength and elasticity that are believed to be responsible for the extraordinary mechanical properties. In this poster, we highlight results from a preliminary ¹³C and ²H NMR study on *Nephila Clavipes* silk fibers. Our current focus is on the thermal properties of the serine residues, and dynamics of water. Molecular dynamics based simulation studies of [GPGSG]₅ mimetic peptide,

indicate an inverse temperature transition and dynamics of water similar to that of elastin as the temperature is raised from 20 to 40oC. Simulations (table provided below) show evidence of an increase in sidechain contacts and peptide hydrogen bonds, concomitant with a decrease in localized water over a temperature range of 5oC to 40oC. Using deuterium 2D T1-T2 Inverse Laplace Transform NMR, we performed measurements of the dynamics of water in the silk as a function of temperature; our data seem to qualitatively agree with our simulation findings.

Supported by NSF LSAMP

PHYSICS – 6 AVERAGE HAMILTONIAN ANALYSIS OF PULSE ERRORS IN AN EIGHT PULSE-SPIN COUNTING EXPERIMENT

Yelena Zelenova (GRAD), Steven W. Morgan, and Gregory S. Boutis, Department of Physics, Brooklyn College of the City University of New York

Spin counting NMR is a well known experimental technique that allows for determining the size and time evolution of networks of dipolar coupled nuclear spins. The method typically involves implementing an eight-pulse multiple pulse sequence whose effective Hamiltonian, to zeroth order of the Magnus expansion, is the double quantum Hamiltonian. In this work, we report on an average Hamiltonian treatment of pulse errors i.e. phase transients, phase errors and finite pulse width artifacts, as well as offset effects. Our analysis demonstrates that only pulse flip errors and phase errors contribute to the zeroth and first order terms of the Magnus expansion respectively and may significantly modify the many-body spin dynamics under the multiple pulse sequence. Preliminary data on adamantane are highlighted demonstrating the effects of the various errors in terms of degradation of signal intensity and artifacts in the multiple quantum spectra.

PHYSICS – 7 ANALYSIS OF RUBIDIUM ATOMIC STRUCTURE BY DIODE LASER SPECTROSCOPY AND SATURATED OPTICAL ABSORPTION SPECTROSCOPY

Omer Nazir (GRAD), Christopher Wing, Zhiheng Liu, Mim Nakarmi, Department of Physics, Brooklyn College – CUNY, Brooklyn, NY 11210

Rubidium is an important metallic element for its wide applications in research and industry such as manufacturing photocells. It is crucial to understand its atomic structure. Saturated absorption spectroscopy is a powerful optical technique to eliminate Doppler broadening and reveal true information of electronic transitions in the rubidium atoms. A tunable diode laser is employed to excite the rubidium atoms in a glass cell. By varying the current injection to the diode and angle of the grating on the external cavity, we tuned the diode laser to a narrow band of wavelength around 779 nm, corresponding to the electronic transition energy of the rubidium atoms. Strong fluorescence from the rubidium atoms was observed. We used an optical pump-and-probe technique to eliminate the Doppler broadening and measure the saturated absorption spectrum featuring extremely narrow absorption lines only limited by the lifetimes of the electronic energy levels in the rubidium atoms. The Helmholtz coils on the cell assembly provided us the means to study the effect of a varying magnetic field on the absorption signal. We found that increasing the magnetic field would reduce the signal strength. The absorption coefficient of the rubidium atoms decreases as a result.

PHYSICS – 8 TWO-BOX DAISYWORLD MODEL—THERMODYNAMIC ANALYSIS OF A SIMPLIFIED ENVIROMENTAL SIMULATION

Moshe C. Silverstein (UN), Christopher Wing, Prof. Micha Tomkiewicz, Prof. Nicolas Giovambattista, Department of Physics, Brooklyn College-CUNY, Brooklyn, NY 11210

The goal of this study is to develop a computer simulation for environmental thermodynamics capable of isolating key aspects of planetary heat management and the role of organisms on the planet's surface. The model we use is the Two-Box daisyworld system which replicates a planetary surface covered by two species of plant life capable of absorbing or reflecting heat in predetermined specified amounts. As the planet gradually heats up, *daisies* grow and die in such a fashion as to prolong habitable conditions on the planet's surface. The program, written in C++, uses a '*periodic boundary condition*' technique to simulate a complete closed surface by assigning a grid that uses the first column as the last column of the lattice, and so to for the rows. This technique allows for simulation over the complete planetary surface, unlike previous models that used only a portion of the grid with a buffer zone. This simulation can then be used to introduce complex organisms such as humans who control daisy growth by harvesting daisies in a predetermined fashion. Principal components of thermodynamic functions such as entropy can then be studied, with the hope that optimal results can be evaluated with real-world conditions.

CIS – 1 ULTRASOUND NAVIGATION SYSTEM FOR AUGMENTING NXT ROBOT CONTROL

Maksym Stetsyuk (UN) and T. Raphan, Department of Computer Science, Brooklyn College-CUNY, Brooklyn, NY 11210

The overall goal of this project is to develop an intelligent interface for navigating a swarm of agents (NXT robots). The subgoals were to: 1) Develop the serial interface between the LEGO NXT Brick and a microcontroller, the Arduino Uno, that is attached to the NXT robot. The microcontroller communicates with a RF and ultrasound receiver that is also attached to the robot. 2) Develop a transmitter interface, which manages four wireless ultrasound beacons that monitor the position of the robots. 3) Develop the receiver interface, which is attached to the robot and receives and processes the RF and ultrasound pulses. 4) Develop an algorithm for computing the robot's absolute position in the arena, based on the received data.

In this project, we developed, built and tested various components of ultrasound navigation system. The purpose of the system is to compute the robot's position based on the difference between times of arrival of RF and ultrasound pulses. Beacons, with Piezo-electric transducers, were located at four corners of the arena. These transmit RF and ultrasound pulses via the beacons to NXT robots, which have RF receivers and Piezo-electric transducers. The coordinates of the agent are sent to a host computer via a serial interface over Bluetooth. The Bluetooth communication protocol has already been tested. We have also built the hardware for the RF and ultrasound communication. Once the navigation system for the robotic swarm is complete, we will be able to develop the algorithms for the swarming behavior.

CIS – 2 FORMAL LANGUAGE THEORY APPLIED TO GAME APPS

Ali Hussain A. Al Ali (GRAD) and Jim Cox, Department of Computer and Information Science, Brooklyn College-CUNY

The Chomsky hierarchy of generative grammars, their corresponding formal languages, and the computational resources required to recognize syntactically correct "sentences" of these languages has been well studied in computer science. The theory has been applied to many areas, most notably

natural language processing, programming language compiler design, and circuit design. The state space and transitions of many interactive computer games can be described by formal languages. When this description is a *regular* grammar, the game can be programmed in highly efficient manner, using the well known techniques developed for lexical analysis programs. This is especially important for game apps since mobile phones have limited power and processing capacity. By contrast, *context-free* languages require more computational resources to recognize and the general recognition problem for *context-sensitive* languages is believed to be infeasible. In this project a popular sequence matching game, Jewels, was extended to 3 dimensions. It is shown that the game can still be described by a regular grammar. This description was used to efficiently implement the new game app. We will show the results of our implementation. Additionally, the conditions under which the state space description of a similar game will no longer be regular, but will instead require a context-free grammar for its description, are studied.

CIS – 3 COMPARATIVE ANALYSIS OF DIFFERENT RANGE SENSORS FOR MOBILE AND SOCIAL ROBOTS

Karen C. Aragon¹, Michael Costantino² (UN), Simon Parsons^{1,3} and Elizabeth Sklar^{1,3}

¹Dept of Computer & Information Science, Brooklyn College, The City University of New York, 2900 Bedford Avenue, Brooklyn, NY 11210

²Dept of Computer Science, The College of Staten Island, City University of New York, Staten Island, NY 10314

³Dept of Computer Science, The Graduate Center, City University of New York, 365 Fifth Avenue, New York, NY 10016

This experiment provides an accuracy analysis of depth data obtained from Microsoft's Kinect sensor and Hokuyo's Aist URG laser sensor. Both range sensors are mounted on top of an iRobot Create for mobility. To determine the error percentage, depth data collected from the sensors were compared to actual distances within an enclosed arena at 5_ intervals and at 1 ft intervals along a linear path, with maximum length at 10ft. To analyze the sensors' application towards Human-Robot-Interaction systems, data was collected to determine the accuracy of detecting a human hand at various speeds. If the collected data from the Kinect is sufficiently accurate, developers, researchers, hobbyists are given an attractive low-cost alternative to explore and create sophisticated Human-Robot-Interactive systems.

Funding for the work described here has been provided by the National Science Foundation under grant CNS #08-51901 and by PSC-CUNY Award #64630-00-42.

CIS – 4 PATH-PLANNING FOR MULTI-ROBOT COORDINATION

Apollo Namalu¹ (UN), **A. Tuna Ozgelen²** (GRAD), Simon Parsons^{1,2} and Elizabeth Sklar^{1,2}

¹Dept of Computer & Information Science, Brooklyn College, The City University of New York, 2900 Bedford Avenue, Brooklyn, NY 11210

²Dept of Computer Science, The Graduate Center, City University of New York, 365 Fifth Avenue, New York, NY 10016

The key component to utilizing the potential in a team of robots is coordination. Poor coordination among multiple robots coupled with noisy and dynamic environments within which robots operate while executing assigned tasks make for deteriorating performance of robot operations. This research project focuses on improving the performance of robots by extending a path-planning protocol to coordinate a team of robots. The new protocol will be used in cases where paths intersect causing a possibility of robots colliding. In this setting, the robots receive auction calls from auction-manager and send back bids in-terms of newly generated paths for the auction-manager to

determine which robot will take which path. To begin with, the approach will be experimented on two robots and then the number of robots will be gradually increased.

Funding for the work described here has been provided by the National Science Foundation under grants CNS #08-51901 and IIS #11-17000.

CIS – 5 LOCALIZATION USING QUICK RESPONSE (QR) CODE TAGS

Ibraheem Ibraheem¹, **Sahat Yalkabov**² (UN), Simon Parsons^{1,3} and Elizabeth Sklar^{1,3}

¹Dept of Computer & Information Science, Brooklyn College, The City University of New York, 2900 Bedford Avenue, Brooklyn, NY 11210

²Dept of Computer Science, City College, City University of New York, 160 Convent Avenue, New York, NY 10031

³Dept of Computer Science, The Graduate Center, City University of New York, 365 Fifth Avenue, New York, NY 10016

The goal of this project is to study the feasibility of using QR code tags for robot localization. The feasibility will be determined experimentally by measuring the accuracy of the decoding of QR tags at various distances, angles and image resolutions. The robot used in this experiment is the Surveyor Blackfin, which has an on-board camera. The resolution of the camera image used is 320x240 pixels. The QR tags, 15.5cm x 15.5 cm, have been positioned on the wall of a constructed robot arena. Determining the feasibility of using QR tags for localization will afford robots a greater degree of autonomy. In a large scale multi-agent system, robots can use QR tags to localize on their own much like the way humans localize by reading street names and building numbers.

Funding for the work described here has been provided by the National Science Foundation under grant CNS #08-51901.

CIS – 6 COMPARING TWO ALGORITHMS FOR IDENTIFYING ROBOTS

Jenny Wan¹ (UN), **J. Pablo Munoz**² (GRAD), Simon Parsons^{2,3} and Elizabeth Sklar^{2,3}

¹Dept of Computer Science, City College, City University of New York, 160 Convent Avenue, New York, NY 10031

²Dept of Computer Science, The Graduate Center, City University of New York, 365 Fifth Avenue, New York, NY 10016

³Dept of Computer & Information Science, Brooklyn College, The City University of New York, 2900 Bedford Avenue, Brooklyn, NY 11210

The goal of this research project is to compare two different algorithms used to identify robots. Both algorithms use data from an overhead camera to find the robots, but the difference is one method needs to gather data from only a few points in the image to determine the identity of the robot. This allows for quick identification, but in the process, may sacrifice accuracy, due to factors like the speed that the robot is traveling or noise in the images sent from the camera. The other method would require additional calculation and thus more time, but can improve the accuracy. The goal is to determine by how much the second algorithm would actually increase the accuracy and whether this increase is worth the increase in calculation time.

Funding for the work described here has been provided by the National Science Foundation under grant CNS #08-51901.

CIS – 7 APPLICATION OF A VFH-LIKE ALGORITHM ON A SIMPLE ROBOT PLATFORM

Jonathan Hernandez¹ (UN), Aisha Green² (UN), J. Pablo Munoz³ (GRAD), Simon Parsons^{3,4} and Elizabeth Sklar^{3,4}

¹Dept of Computer Science, Queens College, City University of New York, Flushing NY 11367

²Dept of Mathematics & Computer Science, Lehman College, City University of New York, Bronx NY 10468

³Dept of Computer Science, The Graduate Center, City University of New York, 365 Fifth Avenue, New York, NY 10016

⁴Dept of Computer & Information Science, Brooklyn College, The City University of New York, 2900 Bedford Avenue, Brooklyn, NY 11210

This research project explores application of a complex algorithm for real-time obstacle avoidance to simple mobile robot systems. The algorithm explored is the Vector Field Histogram Algorithm (VFH), and a simplified version was implemented in order to gain a better understanding of the VFH algorithm and the limitations of implementing such an algorithm on a small, simple robot platform. Thus this project involves evaluation of a simplified VFH-like algorithm using the LEGO NXT. The experimental set up involves running an algorithm that follows these steps: (1) The ultrasonic sensor of the NXT robot reads the distance to its surroundings by turning 360 degrees in fixed degree increments. (2) Based on these readings, the algorithm computes the angle with the largest distance to an obstacle. (3) The robot then steers towards this angle, and continues moving forward in this direction until the sensor detects when the robot is within 30 cm of an object. The robot stops and repeats these steps indefinitely. Experimental results are presented.

Funding for the work described here has been provided by the National Science Foundation under grant CNS #08-51901.

CIS – 8 HOW TO INTERACT WITH A TEAM OF ROBOTS

Farah Abbasi¹, Eric Schneider³ (UN), J. Pablo Munoz², Susan L. Epstein^{2,3}, Simon Parsons^{2,4} and Elizabeth Sklar^{2,4}, ¹Dept of Computer Science, The College of Staten Island, City University of New York, Staten Island, NY 10314

²Dept of Computer Science, The Graduate Center, City University of New York, 365 Fifth Avenue, New York, ³Dept of Computer Science, Hunter College, City University of New York, 695 Park Ave, New York, ⁴Dept of Computer & Information Science, Brooklyn College, The City University of New York,

2900 Bedford Avenue, Brooklyn, NY 11210

This research project involves analyzing a scenario in which a human interacts with a team of heterogeneous robots through a software interface. The goal is to evaluate what are the most important features that a graphical interface should have to allow an efficient communication between the user and the robots. Some of the issues to consider when developing this graphical user interface are the representation of the robots in the interface, and what actions the user has to take to interact with the robots. The representation might vary depending on the number of robots or their capabilities. The actions that the user can take depend on which situations the robots are facing. Results are presented from a small user study in which the usability of the interface is evaluated.

Funding for the work described here has been provided by the National Science Foundation under grants IIS #11-17000 and CNS #08-51901 and by City University of New York Collaborative Incentive Research Grant #1642.

CIS – 9 FIREWALL CONFIGURATION: AN APPLICATION OF MULTIAGENT METALEVEL ARGUMENTATION

Zimi Li², Ali Raza Syed² (GRAD), Andy Applebaum¹, Karl Levitt¹, Simon Parsons^{2,3}, Jeff Rowe¹ and Elizabeth Sklar^{2,3}, ¹Dept of Computer Science, University of California, Davis, CA 95616 ²Dept of Computer Science, The Graduate Center, City University of New York, 365 5th Avenue, New York, NY 10016, ³Dept of Computer & Information Science, Brooklyn College, City University of New York, 2900 Bedford Avenue, Brooklyn, NY 11210

Firewalls are an important tool in the provision of network security. Packet filtering firewalls are configured by providing a set of rules that identify how to handle individual data packets that arrive at the firewall. In large firewall configurations, conflicts may arise between these rules. Argumentation provides a way of handling such conflicts that illuminates their origin, and hence can help a system administrator understand the effects of a given configuration. We look in particular at the use of a system of metalevel argumentation for firewall configuration, showing how it makes conflicts and their origins especially clear, and showing how different instantiations of a metalevel argumentation system provide alternative ways to resolve conflicts.

CIS – 10 MODULATING AGENT BEHAVIOR USING HUMAN PERSONALITY TYPE

Jordan Salvit¹ (GRAD) and Elizabeth Sklar^{1,2}
¹Dept of Computer Science, The Graduate Center, City University of New York, 365 Fifth Avenue, New York, NY 10016 ²Dept of Computer & Information Science, Brooklyn College, The City University of New York, 2900 Bedford Avenue, Brooklyn, NY 11210

A prototype model is presented that demonstrates the idea of modulating agent behavior using human personality type. The psychological theory of personality type known as the Myers-Briggs Type Indicator (MBTI) is applied here. The MBTI theory defines four dichotomies to explain how individual humans differ in the ways that they perceive their environment, interact with others, and make decisions based on these traits. MBTI is integrated into a simple agent architecture and the resulting variations in behaviors are demonstrated in a simplified multiagent simulation environment. Experimental results illustrate that each personality type produces very different outcomes, distinct for and characteristic of its MBTI classification.

CIS – 11 GIS AND EPIDEMIOLOGY

Rehab Uosef (GRAD) and Daniel Kopec, Brooklyn College.

GIS (geographic information system) is a system used to capture, store and manipulate spatial data. This data can be reported analyzed and leveraged in almost all, if not all, areas of study. This becomes a very useful system when making decisions. These systems are interactive and easily interfaced with other systems. For this project I will focus on the implementation of GIS in the study of epidemiology. Epidemiology looks at patterns and characteristics of health related “events” that occur in particular populations and analyze what their causes might be or what influences the society, environment, or other surroundings may have on these “events”. Specifically in the study of epidemiology I will be focusing on the area of infectious disease. I will be giving an overall introduction into what is currently happening in this area. As well as explore case studies and scenarios relevant to monitoring and capturing spatial data of infectious diseases using GIS and the patterns found. These patterns and trends provide insight into what causes and influences the spread or infestation of infectious diseases as well as how to possibly control it.

MATH – 1 A RELATIONSHIP BETWEEN QUADRATIC CHARACTER AND REPEATING DECIMALS

Junda Huang (HS) and Steven Kaye, James Madison High School, Brooklyn, NY

The theory of quadratic residue is an old and important topic in number theory. Finding an algorithm to determine the quadratic character of a modulo p has been the focus since Gauss's first researches presented in *Disquisitiones Arithmeticae*. There exists a relationship between the repeating decimals of a/p , where p is an odd prime, and the quadratic residues modulo p . If a and b have the same quadratic characters mod p , then in certain bases, the decimal representation of a/p can be obtained by rotating the decimal representation of b/p . If 2 is a primitive root mod p , then the quadratic character of mod p can be determined by evaluating the fraction a/p and comparing it with $1/p$ in base 4. This can also be generalized to other bases of perfect squares (9, 16, 25, etc.).

ENG – 1 MAGNETIC MASS DRIVER EXPLORATIONS

Yoni Hadar (HS) and Steven Kaye, Magen David Yeshiva H.S., Brooklyn, N.Y. 11214

For the past 20 years researchers have explored the issue of mining on the moon (Moon colony) by using a mass driver to send objects from the moon's surface into orbit. The traditional mass driver used magnetic repulsion to accelerate objects along a track. The recent development of ion engines for powering "unmanned space craft" combined with the successful harvesting of solar energy, in space have renewed interest in the use of various types of accelerators both for space craft propulsion and the acceleration of masses beyond the gravitational pull of earth.

This question has been investigated in depth since the 1980s when Dr. Oneill proposed the use of a mass driver for the launching material off the moon. Additional authors including Dr. Belbruno, from Princeton University have demonstrated the feasibility of accelerating masses of 600,000 tons per year up to 2400 m/sec with 92% accuracy, from the surface of the moon. This has also become a political issue since presidential candidate Gingrich proposed to reignite NASA and establish a moon colony and new propulsion systems.

To demonstrate the concept of electric acceleration, a demonstration model has been constructed using multiple capacitors to build a high voltage electrical charge using a small power source.

Experiments have been conducted on several coil designs to determine the optimal combination of coil length and coil density to provide the most efficient launch.

Initial experiments have shown that when the coil is energized from the capacitors, a strong magnetic field is generated in the coil providing an immediate magnetic field in the steel projectile within the coil. This magnetic field repels the magnetism in the coil providing powerful thrust, to the object being launched. The variables under investigation include total capacitors on the circuit, the number of turns in the coil, the diameter of the coil wire, and the composition of the object being launched. It is also proposed that capacitor driven coils may be used to direct the "exhaust" from an ion reaction engine to control thrust and flight direction in future space craft.

CHEM – 1 QUANTUM MECHANICAL INVESTIGATION OF AQUEOUS DESFERRIOXAMINE B METAL COMPLEXES: TRENDS IN STRUCTURE, BINDING AND SPECTROSCOPY

Bonnie I. Kruff (GRAD), Ricky Yam, James M. Harrington, Owen W. Duckworth, Andrzej A. Jarzecki

Desferrioxamine B (DFOB) is a commonly studied model representing siderophore behavior and is a primary interest in this project. A systematic investigation is launched across first row transition metal DFOB complexes in their 2+ and 3+ oxidation states. Structural and electronic changes detectable by spectroscopic techniques are examined in three coordination shells: a chelation core of oxygens locally coordinated to the metal (first shell), three hydroxamate groups (second shell), and the remaining backbone atoms (third shell). These coordination shells aid extraction of critical information relating to changes in geometry and vibrational spectra of the complexes. Experimental structural parameters are characterized using extended X-ray absorption fine structure (EXAFS) spectroscopy. Fourier transform infrared-attenuated total reflectance (FTIR-ATR) spectroscopy provides vibrational data. Density functional theory (DFT) calculations are used to interpret these spectroscopic measurements. Correlative relationships are drawn between measured stabilities and experimental parameters: this includes bond distances, diagonal force constants, coupling constants, vibrational frequencies, and disordering of the complex core.

CHEM – 2 SYNTHESIS OF NEW HETEROMETALLIC TI-AU₂ THIOLATO COMPOUNDS AS POTENTIAL ANTITUMOR AGENTS

Yozane Hokai (GRAD), Monica Carreira and María Contel

We have prepared a new heterometallic Ti-Au₂ complex containing both phosphine and thiolato ligands which can serve as a potential chemotherapeutic agent for prostate and renal cancers. In our research laboratories we had previously prepared the heterometallic precursor [Ti{η⁵-C₅H₄(CH₂)_nPPh₂AuCl₂}₂]¹ which displays high cytotoxicity against HeLa human cervical carcinoma and DU-145 human prostate cancer cell. We modified this compound, by substitution of the chlorides on the gold(I) by thiolato ligands (**1-3**). In this way, we expect to increase the stability and improve the antitumor properties of these heterometallic complexes.

CHEM – 3 THE REACTION OF HYDRAZONE WITH SINGLET OXYGEN WITH AN AIM TOWARD DRUG-DELIVERY VIA THE PHOTORELEASE OF NITROSO COMPOUNDS.

Benjamin Rudshteyn (UN), Álvaro Castillo, Ashwini Ghogare, and Alexander Greer, Greer Department of Chemistry, Brooklyn College (CUNY), Brooklyn, NY 11210

Singlet oxygen (¹Δ_g O₂) reacts with himalkenes via a [2 + 2] pathway to produce 1,2,3-dioxazetidine or via an 'ene' reaction to form an allylic hydroperoxide. The reaction of ¹O₂ with the C=N bond of the hydrazone is analogous to the reaction of ¹O₂ with alkenes. To that end, the reaction ¹O₂ with methylenehydrazine, the simplest hydrazone, has been studied computationally with G4 theory and density functional theory. Computations were used to assess whether concerted or stepwise reactions took place. Local Fukui functions and MO coefficients were used to clarify the oxidative cleavage mechanism. The results predict that the C=N is oxidatively photo-labile under harmless visible light (a distinction previously limited to alkenes) and that the reaction proceeds through zwitterionic intermediates and preferable reaction at the carbon of the C=N bond. Supported by National Institute of General Medical Sciences of the NIH.

CHEM – 4 CYCLOADDITION REACTION WITH VINYLKETENE IRON (0) COMPLEX TOWARDS SYNTHESIS OF CATECHOL DERIVATIVES

Mohamed Adnan (HS) and Glenn Elert , Department of biochemistry, Long Island University, Brooklyn, New York 11201

An anti-cancer catechol was produced by synthesizing vinylketene and an alkyne. Catechol complexes often have anticancer properties that are essential as a precursor for anticancer medicine. The preparation of complex catechols is extremely difficult because the starting materials required to make them are expensive. Also, most catechols take over eight steps to synthesize, but synthesis was simplified to four steps. Often organometallic reagents can be used in organic syntheses. Catechols can be made using economical alternatives that have a favorable cost to yield ratio. The alternative would be to cyclize a specific ketone with an alkyne to produce the catechol with decent yields. The cyclization product of the vinylketene complex and the chloro ethynyl trimethyl silane both represent possible economical alternatives for producing a wide variety of highly substituted catechol derivatives.

CHEM - 5 TRYPTOPHAN-GLUTAMIC ACID DIPEPTIDES: THEIR CONFORMATIONS

Moshe Nathan (UN), Laura Juszczak, PhD

Tryptophan is one of the main chromophores in proteins, and as such it is important to learn how its spectrum is affected by its neighboring amino acids. Here the effect of a neighboring glutamic acid on its spectral properties is examined through molecular dynamics simulations and quantum mechanical calculations. The relationship between the calculated properties and the fluorescence spectra is extremely valuable, because with this information we might be able to use the simple, quick, and widely available techniques of UV-vis and fluorescence spectroscopy to find out much more information on all proteins containing tryptophan, which accounts for almost all the known proteins.

CHEM – 6 SPECTROSCOPIC CHARACTERIZATION & CALCULATION OF INDOLE DERIVATIVE 1La AND 1Lb TRANSITIONS

Xianwei Meng¹(UN), Azaria Eisneberg¹, Trisheena Harricharan² and Laura Juszczak¹,
¹Department of Chemistry, Brooklyn College/CUNY, Brooklyn, NY 11210; ²Department of Biochemistry, The Graduate Center/CUNY, Fifth Ave., New York, NY

Although tryptophan is a natural probe of protein structure, interpretation of its fluorescence emission spectrum is complicated by the solvent sensitivity of 1La, one of two transitions. Additionally, theoretical calculations show that a point charge adjacent to either ring of the indole chromophore can shift the emission maximum. The survey of indole derivatives to be presented shows that methyl substitutions on the pyrrole ring effect 1La and 1Lb energies in tandem while benzyl ring substitutions with electrophilic groups lift the 1La/1Lb degeneracy. Calculated ground state dipoles for 13 indole derivatives and transition dipoles, 1La and 1Lb for indole and 5-hydroxyindole are illustrated. The effect of pyrrole and benzyl ring substitution as characterized by absorption, fluorescence excitation and emission spectroscopy, will be presented and discussed.

CHEM – 7 THE CALATASE MECHANISM OF MYCOBACTERIUM TUBERCULOSIS CATALASE-PEROXIDASE, KATG: A COMPUTATIONAL INVESTIGATION

Sanchez M. Jarrett (UN) and Andrzej A. Jarzecki, Department of Chemistry, Brooklyn College-CUNY, Brooklyn, NY 11210

Catalase-peroxidase (KatG) is a dual heme enzyme essential in *Mycobacterium tuberculosis* (*M.tb*). It is the sole catalase present in *M.tb* and its mechanism is still not fully understood. A key structural element found exclusively in all KatG enzymes is a distal side adduct of covalently bound Met²⁵⁵-Tyr²²⁹-Trp¹⁰⁷ (MYW) side chains. This adduct harbors a catalytically competent radical during the enzyme's turnover.

The aim of this study is to investigate the role of the uniquely structured MYW adduct and key factors that might control formation of a MYW radical, its spin population and the role of a mobile Arg⁴¹⁸ residue. We applied the molecular electronic structure calculations using a popular Density Functional Theory. We have been able to establish a better understanding of the unique relationship between spin population and structure of the MYW adduct and to identify the long distance "on/off" interaction with a mobile Arg⁴¹⁸ residue as an imperative factor in stabilization of the high-spin heme state, and consequently inducing the dissociation of molecular oxygen.

CHEM – 8 γ -HYDROXYBUTENOLIDE CASCADE PROCESSES: SYNTHESIS OF COMPACT AND STEREOCHEMICALLY RICH MULTICYCLIC LACTONES.

Alberto Munoz (UN) and Prof. Ryan P. Murelli, Department of Chemistry, CUNY-Brooklyn College, Brooklyn, NY 11210

γ -Hydroxybutenolides are structural moieties found in various natural products that have the potential to serve as highly valuable synthons toward complex molecular targets. It is our belief that many of these reactions may be biomimetic, or imitate how some of these multicyclic lactones are made in nature. Our ongoing research is broadly aimed at studying the reactivity of γ -hydroxybutenolides and developing synthetic methods that leverage it. Our current work has yielded results such that a strong Lewis acid such as trimethylsilyl trifluoromethanesulfonate in an inert solvent such as dichloromethane facilitates a cascade between γ -hydroxybutenolides and electron-deficient aromatic aldehydes that form a stereochemically rich spirocyclic acetal with complete diastereoselectivity. We are currently optimizing the reaction conditions including, but not limited to, exploring various stoichiometric scenarios and fully understanding the mechanism at which we obtain our product. Our long-term goals are aimed at both furthering the potential of this reaction by gaining absolute stereochemical control and applying this methodology in a target-oriented synthesis of a biologically relevant compound.

CHEM – 9 SPECIFIC BINDING OF SINGLET OXYGEN PRODUCING PHOTSENSITIZERS TO TELOMERIC DNA FOR LOCALIZED TUMOR DESTRUCTION.

Allie Sulh, Angelina Radionova (UN), Yasemin Kopkalli, and Lesley Davenport, Department of Chemistry, Brooklyn College of CUNY, Brooklyn, New York 11210.

Studies have shown that the reactive singlet oxygen (¹O₂) species can effectively destroy cells. The aim of our studies is to target the binding of ¹O₂ producing photosensitizers to telomeric DNA, which is elevated in tumor cells. Many photosensitizers, such as methylene blue, can produce ¹O₂ upon irradiation with long-wavelength laser light. In these studies we have examined the binding of methylene blue to double stranded calf thymus DNA (ctDNA) to evaluate DNA damage on ¹O₂ production. To produce ¹O₂ a solution of 10 μ M methylene blue in 100 mM Tris buffer at a pH of 7.5

was prepared. Detection of $^1\text{O}_2$ was achieved by adding the Singlet Oxygen Sensor Green Reagent (SOSG) to the test solution. In the presence of $^1\text{O}_2$, SOSG emits a green fluorescence detected using a spectrofluorimeter. Singlet oxygen production, achieved by irradiation of methylene blue using a CW diode laser (669 nm; 1W), was found to maximize between two to ten minutes of irradiation. Binding of methylene blue to ctDNA has allowed us to examine the effect of $^1\text{O}_2$ production on the DNA. Possible DNA damage was assessed using circular dichroism measurements. Future studies will focus on binding of $^1\text{O}_2$ producing photosensitizers to telomeric DNA as a possible delivery vehicle into tumor cells.

CHEM – 10 INVESTIGATION OF LEAD COORDINATION IN PROTEIN: STATISTICS AND COMPUTATIONAL STRATEGY

Inna Bakman, Muhammad Y. Mutawakkil (GRAD), Andrzej A. Jarzecki, Department of Chemistry, Brooklyn College-CUNY, Brooklyn, NY 11210

Lead poisoning is a common environmental disease. The commonly accepted view on the poisoning mechanism attributes lead's toxic effects to its unique coordination preferences that destabilize the proper proteins forms and effectively disrupt their functions in living tissue. However, lead coordination preferences in protein environment and a mechanism of poisoning at a molecular level is still not fully understood.

We have launched our investigation by a systematic screening of protein structures deposited in the Protein Data Bank and performing a simple statistical analysis on lead coordination and its common ligands. This initial investigation allowed us to focus on two lead-loaded proteins; recombinant vertebrate calmodulin (CaM) and yeast 5-aminolaevulinic acid dehydratase (ALAD). CaM is a calcium-binding protein that modulates the activities of several other proteins in eukaryotic cells. ALAD is a zinc-binding enzyme that catalyzes the condensation of two 5-aminolevulinic acid molecules in heme biosynthesis. These lead-poisoned structures represent common coordination preferences of Pb^{2+} in sulfur-rich environment (*tri*-coordinated domains) and oxygen-rich environment (*penta*- and *hexa*-coordinated domains). We have applied electronic structure calculations at the level of a popular Density Functional Theory to refine the X-ray structures and to investigate the electronic factors that might play major role in stabilization and formation of these domains.

CHEM-11 BINDING OF METHYLENE BLUE WITH CALF-THYMUS DNA AS A TEST FOR A MICROPLATE DNA BINDING ASSAY

Matthew Lee, Jenny Bartov (UN), Yasemin Kopkalli and Lesley Davenport
Department of Chemistry, Brooklyn College-CUNY, Brooklyn, NY, 11210

Guanine-rich telomeric sequences located at the ends of chromosomes can form four-stranded intramolecular G-quadruplexes in vitro. This structure inhibits the activity of the enzyme telomerase, which is found in tumor cells and is thus a potential target for new chemotherapeutics. The overall long-range goal of our studies is the development of a sensitive microplate fluorescence-based assay for screening the binding of potential quadruplex interactive ligands (QIAs) that can promote folding of telomeric DNA to the quadruplex conformation. As a test system, for use in characterizing optimal assay conditions, a series of methylene blue (MB) dilutions ($0.5\text{-}2.6 \times 10^{-6}$ M) were used to correlate microplate pathlength with test sample volumes for accurate ligand concentration estimations using Beer's Law. In addition, we are currently evaluating the well-characterized binding of methylene blue (MB) with calf thymus duplex DNA (ctDNA) for testing the micoplate assay method. Using UV-spectrophotometry, the binding of MB to ctDNA was monitored through wavelength shifts in its absorption spectrum after equilibration with MB for 2 minutes. Using a Scatchard Plot, we have

determined the binding constant for MB with ctDNA. Future studies focus on adapting the MB-DNA system for evaluation of the micro-plate assay method for ultimately screening quadruplex binding ligands.

Supported by NIH 5SC3 GM095437-01

CHEM – 12 EFFECT OF MOLECULAR CROWDING ON THE UNFOLDING OF DUPLEXED AND QUADRUPLEXED DNA

Aaron Hope (UN), Yasemin Kopkalli and Lesley Davenport, Department of Chemistry, Brooklyn College of CUNY, Brooklyn, New York 11210.

Relatively high concentrations of biomolecules within cells are able to exist under highly crowded conditions in their functional conformation. *In vitro*, such conditions (typically $\sim 100\text{mg}\cdot\text{mL}^{-1}$ for proteins) can result in aggregation and precipitation, providing a challenge for studying macromolecular conformation and dynamics under more native crowded conditions. The aim of these studies is to examine the effects of crowding on the folding characteristics of duplex and quadruplexed DNA. Quadruplexed DNA (qDNA) found at the end of telomeric DNA is an effective inhibitor for telomerase, an enzyme which plays a significant role in tumorigenesis. Hence, effects of cellular crowding on the folding of qDNA could play a critical role in modulating telomerase activity. Recent studies have reported that Ficoll 70 can serve as an appropriate *in vitro* crowding agent. We have examined the effects of increasing Ficoll 70 concentrations on the thermal unfolding/melting behavior of calf thymus duplex DNA (ctDNA) and found an increase ($\sim 0.6^\circ$) in its melting temperature (T_m) together with a broadening of the melting profile. These data suggest that the unfolding of ctDNA, which comprises of a relatively high proportion of G \equiv C triple hydrogen bonds, is stabilized under crowding conditions combined with enhanced folding co-operativity. Future studies will focus on examining crowding effects on the folding/unfolding equilibrium of quadruplexed DNA.

CHEM – 13 COMPETITION MINI-DIALYSIS ASSAY TO DETERMINE BINDING SELECTIVITY OF PORPHYRINS TO G-QUADRUPLEXED DNA.

Martha B. Dua-Awereh (UN) and Lesley Davenport, Department of Chemistry, Brooklyn College, 2900 Bedford Avenue, Brooklyn, NY 11210

Telomeric G-quadruplexes are guanine-rich sequences that form stacked G-tetrads stabilized by the presence of a cation. Telomeric G-quadruplexed DNA has been shown to inhibit telomerase activity, an enzyme linked to 85% of cancers. Thus G-quadruplexes provide a potential target for drug binding and delivery. Porphyrins can promote or stabilize the formation of the DNA quadruplexes. The aim of this study is to design a micro-competition dialysis assay to evaluate the binding selectivity of a range of porphyrins for quadruplexed DNA *versus* duplex DNA, using a buffer control solution. A $1\mu\text{M}$ solution of the test porphyrin, N-methyl mesoporphyrin IX (NMM), was prepared to evaluate the micro-competition binding assay method. The binding selectivity of NMM to $75\mu\text{M}$ of calf thymus DNA (duplex DNA) or $75\mu\text{M}$ of quadruplexed DNA samples was evaluated by dialysis using a Pierce Biotechnologies 0.1 mL Slide-A-Lyzer Mini Dialysis device (100 μL volumes). After stirring for 24 hours, the concentrations of porphyrin bound to the dialyzed DNA samples were determined using UV spectrophotometry. Our results indicate and confirm previous reports of the selective binding preference of NMM for quadruplex DNA over duplex DNA. The results also indicate that the Slide-A-Lyzer Mini Dialysis device is an effective tool for determining binding selectivity of small molecules to micromole concentrations of quadruplexed DNA.

Supported by NIH 5SC3 GM095437-01.

CHEM – 14 INTRACELLULAR ASSOCIATION OF MYCOPLASMA HOMINIS WITH TRICHOMONAS VAGINALIS

Mert Kemal Keceli, Joanne Tan(HS), Dr. Nigel Yarlett, Department of Chemistry, Pace University, New York, NY 10038

Trichomonas vaginalis and *Mycoplasma hominis* share a stable intracellular relationship. The objective of the present research is to examine the connection between the two via the metabolism of ornithine. Three assays were used to conclude the results. They were Lowry-protein assay, OAT (Ornithine Aminotransferase) assay and OAT assay using ninhydrin method. We performed these assays on *M. hominis*, *T. vaginalis* and *T. vaginalis* infected with *M. hominis*. The presence of *M. hominis* in *T. vaginalis* resulted in approximately double the enzyme activity than in *T. vaginalis* alone when the protein levels were equalized, thus *M. hominis* upregulated the enzyme activity of OAT, resulting in additional substrate for ATP production by *T. vaginalis*.

CHEM – 15 ROLE OF SODIUM-HYDROGEN EXCHANGERS, NHE9 AND NHE6, IN MEMBRANE PROTEIN TRAFFICKING

Lukman Solola (UN), Anniesha Hack¹, Kalyan Kondapalli¹, Rajini Rao

¹Departments of Physiology Johns Hopkins University School of Medicine, 725 N. Wolfe Street, Baltimore, MD 21205, USA

Na⁺/H⁺ exchangers, NHEs, are cellular antiporters that contribute to the maintenance of ion homeostasis in mammalian cells. NHE6 and NHE9 are localized to endosomal membranes where they control pH by creating a leak pathway for the expulsion of protons in exchange for sodium and potassium. The aim of this project is to investigate the roles of NHE6 and NHE9 in the pH-dependent recycling of transferrin. Previous studies have shown that knocking down NHE6 alone does not alter luminal pH, possibly due to overlapping functions of NHE6 and NHE9. Preliminary data in our lab show when NHE6 is knocked down, levels of NHE9 increase. We will be using shRNA to create both single and double knockdowns of mouse NHE6 and NHE9. Relative levels of NHE6 and NHE9 will be measured and verified using RT-PCR and qPCR. Since the intracellular movement of transferrin is pH dependent, we hypothesize that knocking down both NHE6 and NHE9 will affect trafficking of the transferrin receptor complex. We will measure steady state transferrin uptake using flow cytometry in both single and double knockdowns.

INDEX

**The names of main authors are underlined*

A

<u>Abbasi, Farah</u> CIS - 8	37
<u>Aboudi, Carolyn</u> PSY - 8	4
<u>Adnan, Mohamed</u> CHEM - 4	41
<u>Agyemang, Linda</u> HNS - 10	22
<u>Al Ali, Ali Hussain A.</u> CIS - 2	34
Alhabbab, Ghada	13
Allawaj, Abdalla	13
Altintas, Onur	13
Amirkulova, Parvina	2
<u>Amu, Ishmael</u> BIO - 9	13
<u>Amy, Anaelle</u> ENV - 14	28
Applebaum, Andy	38
<u>Aragon, Karen C.</u> CIS - 3	35
<u>Asia, Sahira</u> PSY - 1	1
<u>Avidan, Jack</u> HNS - 3	19
Axen, Kathleen	18, 20
Axen, Kenneth	18, 20

B

<u>Badiner, Elina</u> BIO - 19	17
<u>Bakman, Inna</u> CHEM - 10	43
Baranowski, Janice	4, 19, 26
<u>Barbier, Nicole</u> ENV - 9	26
Barord, Greg	28
<u>Bartov, Jenny</u> CHEM - 11	43
Bazov, Emmanuel	32
<u>Bernard, Jamie</u> ENV - 15	29
<u>Beytelman, Igor</u> PSY - 18	8
<u>Bojko, Monica L.</u> HNS - 9	21
Boutis, Gregory S.	31, 32, 33
Branco, Brett	25
<u>Brignoni, Amaris</u> ENV - 2	23
<u>Britan, Igor</u> BIO - 15	16
Britton, Chantinièce	29
<u>Brown, Patrice</u> ENV - 15	29
<u>Brunard, Jose</u> ENV - 10	26
Bryan, Shaquille	23
Buh-Mbi, Julius	26

C

Cadiz, Chonn	13, 14
<u>Cai, Jun Ye</u> BIO - 6	12
Campese, Vinn	6
<u>Cantillo, Samuel</u> HNS - 4	19
Carreira, Monica	40
Castillo, Álvaro	40

Celus, Cassandre	26
Ceraldi, Susannah	23
Chamberlain, John. A.	23
<u>Chen, Amy</u> HNS - 5	20
Chen, Rosa	17
Cheng, Zhongqi	23, 27, 28, 29
<u>Chin, Matthew</u> PSY - 19	8
<u>Chin, Tianna</u> BIO - 13	15
Chirico, William J.	13
Christolin, Jessica R.	13
Chua, Elizabeth F.	4, 5, 6
Clarke, Steven	20
Cohen, Cinder	4, 5
<u>Cohen, Jonathan</u> PHYSICS - 2	31
Cohetero, Leslie	23
Contel, María	40
<u>Costantino, Michael</u> CIS - 3	35
Cox, Jim	34
<u>Cuffari, David</u> PHYSICS - 1	31

D

Davenport, Lesley	42, 43, 44
<u>Davis, Jamon</u> BIO - 1	10
<u>Dayen, Daniel</u> PSY 10	4
Dear, Akeem	28
Delamater, Andrew	6
Déloné, Naomi	16
<u>Dennis, Janeil A.</u> PSY - 4	2
<u>Derman, Rifka C.</u> PSY - 13	6
Di Angelis, Faith	1, 2, 18
Djabbarkhodjaev, Anvar	13
<u>Dolce, Rachele</u> BIO - 11	14
Dorta, Aisha	16
<u>Dua-Awereh, Martha B.</u> CHEM - 13	44
Duckworth, Owen W.	40

E

Eisneberg, Azaria	41
Elert, Glenn	20, 24, 41
El-Haddad, Rita W.	7
<u>Eng, Mitchell</u> ENV - 7	25
Epstein, Susan L.	37
Eskine, Kendall J.	8

F

<u>Fatima, Itrat</u> BIO - 3	11
<u>Feder, Pearl</u> BIO - 17	17
Forlano, Paul	10, 11

Francois, Inique	28
Francois, Rebecca PSY - 7	3
Frik, Malgorzata	26
Fronerberger, Ellis ENV - 6	25
Fung, Raymond	14

G

Garcia, Beberly PSY - 7	3
George, Anne	30
Germash, Mariya ENV - 17	29
Ghogare, Ashwini	40
Giovambattista, Nicolas	34
Gomez, Rosa ENV - 2	23
Grassman, Jean A.	20, 21
Greer, Alexander	40
Griffith, Jordan PSY - 6	3

H

Hack, Anniesha	45
Hadar, Yoni ENG - 1	39
Hamaoui, Maurice	15
Harary, Margo ENV - 3	23
Hardin, Curtis D.	4, 5
Harper, Marianna A.	20
Harricharan, Trisheena	41
Harrington, James M.	40
He, Qi	13, 14
Hernandez, Jonathan CIS - 7	37
Hilliard, Tahiem	29
Hokai, Yozane CHEM - 2	40
Hope, Aaron CHEM - 13	44
Hossain, Lima BIO - 16	16
Huang, Junda MATH - 1	39
Hyppolite, Cassandra	26

I

Ibikunle, Opeyemi PSY - 10	4
Ibraheem, Ibraheem CIS - 5	36

J

Jackson, Christina C.	2
Jackson, Desmond	14
Jarrett, Sanchez M. CHEM - 7	42
Jarzecki, Andrzej A.	40, 42, 43
Jiang, Tammy BIO - 5	12
Jimoh, Olajumoke M. HNS - 1	18
John, Jesse ENV - 1	23
Johnson, Khadjiah	2
Johnston, Adam	8

Johnston, David	3, 28
Joseph, F.	17
Juszcak, Laura	41

K

Kabariti, Bella PSY - 16	7
Kacinik, Natalie A.	7, 8
Kasmani, Ambar	18
Kaur, Kalvinder	2
Kaye, Steven	4, 7, 19, 23, 31, 39
Keceli, Mert Kemal CHEM - 14	45
Kharmaj, Amina BIO 18	17
Khudoynazarova, Makhzuna PSY - 5	2
Kim, Jeanny PSY - 14	6
Kim, Spencer	10
Kingston, Tessa	29
Knaut, Holger	12
Knights, Kaymisha D HNS - 8	21
Kolod, Betty	17
Kondapalli, Kalyan	45
Koon, Kevin BIO - 6	12
Kopec, Daniel	38
Kopkalli, Yasemin	42, 43, 44
Kopyt, Morris	13
Krasavina, Ekaterina PSY - 12	4, 5
Kruft, Bonnie I. CHEM - 1	40
Kuo, Yu-Fu HNS - 6	20
Kurochkin, Philip BIO - 4	11

L

Lapointe, Roodby	26
Lee, Matthew CHEM - 11	43
Leggard, Mellisa ENV - 9	26
Levilev, Dassy HNS - 7	20
Levitt, Karl	38
Levy, Joey HNS - 3	19
Li, Zimi CIS - 9	38
Lipke, Peter	14
Liu, Zhiheng	31, 33
Locquet, Juliane	18
Lombardi, Danielle	16
Lombert, Dannette PSY - 6	3
Louis, Lumena ENV - 16	29

M

Macchiarella, Jillian	27
Magee, Michael	8
Malkin, Larry BIO - 19	17
Manashirova, Arzu	18
Manopla, Albert PHYSICS - 2	31
Mansky, Robert BIO - 17	17
Masud, Wajeh PSY - 2	1

McAusland, Thomas	8
Mecca, Michelle D. ENV - 5	24
Mendelsohn, Jessica BIO - 17	17
Meng, Xianwei CHEM - 6	41
Meyerovich, Mikhail ENV - 13	28
Miller, Argie ENV - 12	27
Min, Jung Won	22
Mitchell, Odingo	31
Mitchell, Odingo PHYSICS - 4	32
Mordaunt, Jivaro	29
Moreira, Adam	17
Morgan, Steven S. PHYSICS - 3	31
Morgan, Steven W.	33
Munoz, Alberto CHEM - 8	42
Munoz, J. Pablo CIS - 6	36, 37
Mutawakkil, Muhammad Y. CHEM - 10	43
Muth, Theodore	15, 16, 17

N

Nadeem, Bilal HNS - 4	19
Nadeem, Zaineb BIO - 7	12
Nakarmi, Mim	31, 33
Namalu, Apollo CIS - 4	35
Nathan, Moshe CHEM - 5	41
Nazir, Omer PHYSICS - 7	33
Ng, Yu Tun PSY - 3	2
Nguyen, Minh	31
Nielsen, Lilja	10, 28
Nuruddinkhod, Zakirhodjaev	15

O

Oganesyan, Vadim	31
Ogunwale, Peter	30
Orr, Malik	29
Ozgelan, A. Tuna CIS - 4	35

P

Pappas, Carrie A.	4, 5
Parsons, Simon	35, 36, 37, 38
Perez, Francisco	23
Persaud, Elizabeth R.	5
Persaud, Elizabeth R. PSY - 11	4, 5
Petersen, Christopher L. BIO - 2	10
Petrovicheva, Anna	16
Polle, Juergen	17
Pressoir, Wendell	3, 10

R

Radionova, Angelina CHEM - 9	42
---	----

Ramazani-Salima, Yolande	15
Rao, Rajini	45
Raphan, T.	34
Registe, S.	17
Reiter, Benjamin HNS - 2	18
Reynoso, Julio	23
Rivera, Madison PSY - 7	3
Roberts, Kyle ENV - 19	30
Rodriguez, Isabel V. PSY - 15	7
Rovelli, Remy	26
Rowe, Jeff	38
Rudshiteyn, Benjamin CHEM - 3	40
Rumble, Nickeshia	30
Ryan P. Murelli	42

S

Sadiq, Fahad	13
Saint-Dic, Rudy BIO - 18	17
Salem, Doha HNS - 2	18
Salvit, Jordan CIS - 10	38
Samu, Delfina PSY - 9	4, 5
Samuel, Tashana	3
Sarango, Brian E. BIO - 6	12
Saxena, Anjana D.	12, 15
Seidemann, David. E.	23
Settle, Daysha	23
Shah, Anup	32
Shaheed, Saboor	13
Siboonruang, Tana PSY - 10	4
Silverio, Bernardo Nunez	23
Silverstein, Moshe C. PHYSICS - 8	34
Singh, Shaneen	11
Sisneros, Joseph	10, 11
Sklar, Elizabeth	35, 36, 37, 38
Solola, Lukman CHEM - 15	45
Starr-Glass, Lolly PSY - 15	7
Steinberg, Adina BIO - 14	15
Stetsyuk, Maksym CIS - 1	34
StPierre, Marg Ely	26
Sulh, Allie CHEM - 9	42
Sun, Cheng	32
Syed, Ali Raza CIS - 9	38

T

Tafa, Isabella ENV - 18	30
Tan, Joanne CHEM - 14	45
Thomas, Paul	13
Thompson, Jamal ENV - 10	26
Timothy, Miky	10
Tobias, Abraham HNS - 3	19
Tomkiewicz, Micha	24, 29, 34

U

<u>Ukpebor, Obehi T.</u> PHYSICS - 5	32
<u>Uosef, Rehab</u> CIS - 11	38

V

<u>Villegas, Steven</u> ENV - 8	26
---------------------------------------	----

W

<u>Wadler, Joshua</u> ENV - 4	24
<u>Wan, Jenny</u> CIS - 6	36
Wang, Youfa	22
Webber, Rasheed	30
Whitchurch, Elizabeth	11
Wing, Christopher.....	33, 34

X

<u>Xiao, Shu</u> BIO - 12	15
---------------------------------	----

Y

<u>Yalkabov, Sahat</u> CIS - 5	36
Yam, Ricky	40
<u>Yang, Emilee</u> BIO - 8	13
Yarlett, Nigel	45
<u>Ye, Amanda</u> BIO - 8.....	13
<u>Yong, Emily</u> HNS - 4	19
<u>Young, Chris</u> ENV - 14	28
<u>Young, Gavin X.</u> PSY - 17	8

Z

Zarrouk, Tarik	27
<u>Zarrouk, Tarik A.</u> ENV - 11	27
<u>Zelenova, Yelena</u> PHYSICS - 6	33
<u>Zhou, Jacinda</u> BIO - 8	13

LEGEND:

- BIO** – Biology
- CHEM** – Chemistry
- CIS** – Computer Science
- ENG** - Engineering
- ENV** – Earth and Environmental Science
- HNS** – Health and Nutrition Science
- MATH** – Mathematics
- PHYSICS**
- PSY** – Psychology