

Brooklyn College

Science Research Day

Abstract Book
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PROGRAM

14TH ANNUAL BROOKLYN COLLEGE SCIENCE RESEARCH DAY

9:30 A.M.	POSTER SETUP
10:00-12:00	STUDENT PRESENTATIONS AND JUDGING
12:15 P.M.	REFRESHMENTS IN THE GOLD ROOM
12:30 P.M.	WELCOME AND REMARKS
	PRESENTATION OF AWARDS
	High School Division
	Undergraduate Division
	Graduate Division

ALL ARE INVITED TO LUNCH IN THE GOLD ROOM

PRESENTER KEY

High School - *

Undergraduate - #

Graduate - ^

**PSY – 1 THE USE OF RESEARCH DATA TO TEACH CRITICAL THINKING
IN THE CLASSROOM**

Talia Kripor#¹, Rachel Waltuch#¹, Laraine McDonough^{1,2}, and Louise Hainline^{1,2},
Brooklyn College ¹, and The City University of New York Graduate Center ²

Psychology students studying human development often come to the conclusion that the textbook explanation of children at different ages is what one should expect of all children at those ages. What is difficult to understand is that the textbook and the research on which it is based provides a description of the average mode of behavior. Most textbooks provide very little explanation or examples as to the variability of behaviors that are considered “typical” of children at any given age. To provide undergraduate students with a clearer understanding of the wide range of behaviors expressed at different ages as well as an understanding of how developmental research is conducted, we introduced students to real data recorded on DVD format from an experiment designed to evaluate temperament. The topic of temperament was chosen because it captures two aspects of development that seem counter-intuitive to many students: temperament is highly variable among children and it theoretically undergoes very little change with age. Students discovered how to operationally define a variety of child behaviors and how to formulate and test hypotheses. More importantly, they also learned how results are typically presented and interpreted in terms of ‘averages’, which may not readily capture the behaviors of an individual. This lesson is crucial for the psychology student who will continue their education and practice of psychology by applying principles to individuals or groups revealed through a critical yet thoughtful understanding of research.

This research was supported by an NSF-CCLI grant (0088342)
awarded to Laraine McDonough and Louise Hainline.

**PSY – 2 DEPRIVATION EFFECTS ON NUTRIENT CONDITIONED FLAVOR
ACCEPTANCE AND PREFERENCE IN RATS**

Emma Yiin[^], Karen Ackroff, and Anthony Sclafani, Department of Psychology,
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The postingestive actions of nutrients condition strong flavor preferences in rats and may also stimulate increased flavor acceptance (total intakes). This study determined the impact of food deprivation on flavor preference and acceptance conditioned by intragastric (IG) infusions of glucose. Rats fitted with gastric catheters were food restricted (FR; 2 h/day) or had food ad libitum (AL). Both groups were trained to associate a CS+ solution (bitter or sour) with IG 16% glucose and a CS- solution with water infusions. During one-bottle training, FR rats consumed substantially more CS+ than CS- (49 vs. 8 g/day) whereas AL rats drank only slightly more CS+ than CS- (29 vs. 23 g/day). Both groups displayed strong CS+ preferences in two-bottle choice tests (90%). When the AL rats were food restricted they drank substantially more CS+ than CS- (35 vs. 6 g/day; one-bottle non-reinforced tests) although their CS+ acceptance was not as pronounced as that of FR rats. When both groups had food ad libitum they consumed similar amounts of CS+ which were only slightly greater than their CS- intakes

Behavioral Sciences

in one-bottle tests (25 vs. 20 g/day). Their two-bottle CS+ preference remained strong (90%). Thus, food restriction did not enhance flavor preference learning but increased CS+ flavor acceptance. The post-training changes in flavor acceptance produced by food restriction indicate that it primarily affected the expression rather than the acquisition of flavor acceptance. Nondeprived animals learn to associate flavors with nutrition and increase their flavor acceptance when in energy need even in the absence of nutrient feedback.

Supported by NIH Grant DK-31135

PSY – 3 FLAVOR-FLAVOR CONDITIONING BY SUCROSE AND POLYCOSE COMPARED IN RATS

Kristine Bonacchi#, Karen Ackroff, and Anthony Sclafani, Department of Psychology, Brooklyn College of CUNY, Brooklyn, NY 11210

Animals develop preferences for novel flavors (e.g., cherry) when they are mixed with an already preferred flavor (e.g., sweet) through a process known as flavor-flavor conditioning. We investigated the effectiveness of sucrose and Polycose to support flavor-flavor conditioning in rats. Polycose (a glucose polymer) has a palatable taste to rats that differs from the sweet taste of sucrose. Two groups of rats were trained to drink (23 hr/day) one flavor (CS+, e.g., cherry) mixed into 2% Polycose or 2% sucrose on days 2 and 4, and another flavor (CS-, e.g., grape) mixed into water on days 1, 3, and 5. During training, the rats drank similar amounts of the flavored Polycose and sucrose solutions and much more than they did of flavored water. In two-bottle choice tests with both flavors presented in water, the sucrose group significantly preferred (~70%) the CS+ flavor to the CS- flavor, but the Polycose group displayed no preference (~50%). Yet, in choice tests with 2% Polycose vs. 2% sucrose, the rats consumed equal amounts of the two solutions. These data indicate that, although the tastes of 2% sucrose and 2% Polycose are equally palatable to rats and stimulate drinking to the same degree, they differ in their ability to support flavor-flavor conditioning. Further testing will determine if sweet taste is more effective than “Polycose” taste in reinforcing flavor preferences over a range of concentrations.

Supported by NIH Grant DK-31135

PSY – 4 FLEXIBILITY OF THE PREDATORY BEHAVIOR IN SLIPPER LOBSTERS

Mathew A. Reynolds# and Frank Grasso, Department of Psychology, Brooklyn College of CUNY, Brooklyn, NY 11210

The slipper lobster's (*Scyllarides s.*) morphology allows them to manipulate and open bivalve prey. The dorsal location of the eyes in these lobsters mean they have to rely on their acute chemosensory and tactile senses to accomplish this complex task without the use of vision. According to previous research, the lobster wedges the sharp tips of its walking legs (dactyls) into the lip of the shell and uses the third set of legs to cut the adductor muscle of its prey using a horizontal sweeping motion. We studied this

behavior in *Scyllarides aequinoctialis* with animals, of which some were missing one or more of their ten dactyls. In one instance, the lobster broke the shell and kept the adductor muscle intact, severing it only during feeding. This shell opening technique has not been reported in the crustacean feeding literature. Although there is more research needed in this area, these results demonstrate a greater flexibility of behavior in these lobsters than had previously been thought.

PSY – 5 A COMPUTATIONAL MODEL OF MUSCULAR HYDROSTAT GEOMETRY AND DYNAMICS

Jun Wu[^], Pradeep Setlur and Frank Grasso, Department of Psychology, Brooklyn College of CUNY, Brooklyn, NY 11210

Cephalopods (e.g., octopus and squids) are capable of both fine and forceful manipulation of objects yet lack hard (exo- or endo-) skeletal elements in their appendages. These, and other, animals have evolved muscular systems (termed muscular hydrostats, Kier 1984) which dynamically produce mechanical support and focused force in their appendages (tentacles, arms etc.). There is significant interest in understanding the intelligent control of these systems for robot applications. We have developed mathematical models of octopus muscular hydrostat systems and implemented them in computer simulations written in C++. Developed from first principles these models reliably and accurately reproduce the dynamics cephalopod muscle response (time course, force generation and geometry alteration) observed in physiological preparations of squid muscle. These validated muscular hydrostat models form the building blocks of a computer simulation environment in which the control and dynamics of entire appendages, like octopus suckers and arms, squid tentacles and mammalian tongues can be modeled and studied.

PSY – 6 STIMULUS SPECIFICITY IN NUTRIENT BASED CONDITIONED FLAVOR PREFERENCES

Vincent D. Campese[#] and Andrew R. Delamater, Department of Psychology, Brooklyn College, CUNY, Brooklyn, NY 11210

The present studies examined rats' ability to learn associations between different non-nutritive flavors and different nutrients. On different days, one group of rats was given one flavor (e.g. grape) followed 5 min later by a protein solution to drink (i.e. casein hydrolysate), another flavor (e.g. cherry) followed 5 min later by a carbohydrate solution to drink (i.e. polycose), and a third flavor (e.g. orange) by itself. Another group of rats was trained similarly, however, the flavors were presented after the nutrients rather than before. An aversion to one of the two nutrients was established by pairing the nutrient with LiCl injection. The strength of the associations between the cue flavors and the nutrients was then tested by presenting the two nutrient-paired cue flavors against each other. Animals in both groups displayed a reduced preference for the polycose-paired cue flavor over the casein-paired cue flavor when polycose had been devalued then when casein had been devalued. In a second experiment, intra-gastric infusions of one of the

nutrients were paired with LiCl (a nausea-including agent), and intra-gastric infusions of the other nutrient were paired with NaCl. Subjects were subsequently tested with oral presentations of the infused solutions. The subjects showed no evidence of an oral aversion to the LiCl-paired nutrient. These results support the idea that flavor – flavor associations were learned over a 5 min interval separating the cue flavors from nutrients in the first experiment.

PSY – 7 COORDINATING SPATIAL COGNITION AND SPATIAL LANGUAGE: FLEXIBILITY REQUIRED

Akiko Fuse[^], Laraine McDonough, and Tahel Erez[#], Department of Psychology, Brooklyn College of CUNY, Brooklyn, NY 11210

We examined spatial relational terms in Japanese and English in order to investigate how differences in collecting and coding data can influence our views on the role of language in cognition. Monolingual Japanese-speaking two-year-olds and adults were shown relations such as placing a ring on a pole and were asked to describe the activity. Adults produced 28 different spatial verbs and children produced 17. Tests using the same stimuli by Choi & Bowerman showed that English-speaking adults and children produce 6 and 3 different spatial prepositions respectively. However, verbs contain dynamic information (manner/path of action) whereas prepositions provide static information. We tested English speakers and coded for verb plus preposition combinations to capture categorization of dynamic and static aspects of spatial categories. The results showed no differences in the number of spatial categories produced by English and Japanese speakers; however, responses were significantly less variable among the Japanese speakers. Our next research project examines the number of different responses an individual speaker can come up with in the context of a single spatial relation. Our research shows how difficult it is for speakers to coordinate spatial cognition (best characterized by an analogical kind of representation) with spatial language (best characterized by a propositional kind of representation).

PSY – 8 DEVELOPING TESTS TO EVALUATE PERCEPTION IN PATIENTS WITH BRAIN INJURY

Jean Constant[#] and Daniel D. Kurylo, Department of Psychology, Brooklyn College of CUNY, Brooklyn, NY 11210

It has been found that patients with brain injury often display difficulty with visual perception. Many of these individuals are impaired in organizing parts of a visual scene. Disruption with perceptual organization may interfere with other visual abilities, including identifying faces or common objects. Rehabilitation is being developed to improve perceptual organization in order to improve object recognition. In order to evaluate the effectiveness of such rehabilitation, tests of object recognition are needed. Previous assessments of object recognition (Gollin Incomplete Figures; Mooney Faces Closure Test; Benton Facial Recognition) are individually limited in their scope. Therefore, computerized adaptations of these tests are being developed. Digitized

Behavioral Sciences

photographs are first converted to binary (two-tone) high-contrast images. Images are then manipulated in terms of contrast threshold, color contrast, and visual noise. Sets of objects, which vary in angle of view and lighting, are grouped in categories of faces, common objects, and natural scenes. Subjects are required to match a "standard" to images in a group of similar images. Test difficulty is then adjusted to avoid ceiling and floor effects, as well as to correspond to previous tests. Development of this visual assessment will facilitate rehabilitation, and help improve the treatment and care of patients with brain injury.

Supported by NYC LSAMP research assistance scholarship.

PSY – 9 DOES FAMILY STRUCTURE DETERMINE A CHILD’S FUTURE?

Alona Gluzman* and Milana Pressman*, Research advisor, Mr. Barrington Harvey, James Madison High School, Brooklyn, NY

Based on scientific information about the influence of broken families on the future of their children, we investigated the effect of a family structure on the young adults' future by giving out surveys to teenagers. According our data gathered from Madison high school students and scientific information; we have determined how parents influence on their children in various ways such as teenagers' ambitions on future education, marriage and so on.

PSY – 10 TEXTURE DISCRIMINATION IN MICE

Viktor Nagorny*, James Madison High School, Brooklyn, NY, Department of Psychology, Queens College of CUNY, Queens, NY

Rodents use their vibrissa (whiskers) to discriminate textures similar to the way humans use their fingertips to discriminate rough versus smooth surfaces. The rodent vibrissal system has been proven to be sensitive in discriminating rough versus smooth surfaces. We plan to train mice using food as an incentive on a Y-maze. They will be trained to choose between a rough and a smooth surface. Once the mice are able to complete this task (make the right choice 70% of the time) we will trim their whiskers to half their original length to determine if the length of the whisker is important in this discrimination. These studies will help us understand the mechanisms for texture discrimination in mice.

PSY – 11 EVIDENCE FOR OLFACTORY-CUED COORDINATION OF ANTENNULE BEHAVIOR IN THE SPINY LOBSTER

Garcia Watson# and Frank W. Grasso, Department of Psychology, Brooklyn College of CUNY, Brooklyn, NY 11210

The spiny lobster, *Panulirus agus*, employs an antennular-grooming behavior to keep its primary olfaction organs, the lateral antennules, in good working condition. Barbato and Daniel (1997) demonstrated that L-Glutamate triggers this behavior at high response rates

compared to other amino acids such as Alanine. We plan to use this finding as the basis of our studies of the organization, control and coordination of antellule-mediated olfactory searching. In future studies we plan to classically condition lobsters to associate the Glutamate response with Alanine, as a means to study the antennule control system. We conducted a pilot study, in a single lobster, to investigate the left and right antellule responses to two concentrations of Glutamate and Alanine presented to each antennule separately. The order of stimulus presentation sequence was random with regard to concentration and amino acid type. Our study confirmed the results of Barabato and Daniel (1997): there is a significant effect of amino acid type on antennule grooming behavior $F(1,32) = 24.16, p < 0.01$. We also found a concentration effect on right antellule grooming responses $F(1,32) = 5.48, p < 0.01$ but not left. Further, our results suggest that the behavior of the unstimulated antellule is influenced by stimulation of the other antennule, $r = 0.395^*, p < 0.05$. This implies coordination between the left and right antellules, a finding for which there is no prior evidence. Further experiments are in progress with additional lobsters aimed at establishing a baseline for our planned learning studies.

PSY – 12 THE EFFECTS OF RETROACTIVE INTERFERENCE ON IMPLICITLY ACQUIRED AND IMPLICITLY STORED KNOWLEDGE.

Leib Litman[^], Noam Fischman[^], Ronit Epstein, Melissa Walker, Sama Ahsan, Daniel Raucher and Arthur S. Reber. Department of Psychology, Brooklyn College of CUNY, Brooklyn, NY 11210

The present research aims to ask whether that the mere passage of time serves to consolidate knowledge that was acquired implicitly. Implicit knowledge is distinguished from its opposite—explicit knowledge—in that it is acquired largely without the intention to learn and in the absence of awareness for what has been learned.

Consolidation is the processes whereby memory continues to strengthen after the initial period of acquisition is over. Two avenues of research have in the past provided support that memory consolidates over time: retroactive interference, and distributed learning effects. Studies using the retroactive interference paradigm and the distributed learning procedure demonstrate that with the passage of time a memory becomes more immune interference and also improves.

The results presented here show that knowledge acquired in the sequential reaction time procedure (SRT)—a mostly implicit perceptual motor task-- a) strengthens over time and b) becomes more resistant to retroactive interference over time. While consolidation effects for explicitly (consciously) acquired knowledge have been extensively studied in the past, this study demonstrates, for the first time, that consolidation is not only an important aspect of explicit memory formation but also plays an important role in the formation of implicit memory.

PSY – 13 DIFFERENTIAL EFFECTS OF TRAUMATIC BRAIN INJURY ON IMPLICIT AND EXPLICIT PROCESSES

Noam Fischman[^], Leib Litman, Arthur Reber¹, and Richard Waxman²,
Department of Psychology, Brooklyn College of CUNY, Brooklyn, NY 11210¹, and
Peninsula Hospital Center, Far Rockaway, NY²

It has been theorized that implicit (unconscious) processes are often not as affected by neurological injury as are explicit (conscious) processes (Reber, 1993). In this study implicit learning was assessed using a sequential reaction time (SRT) paradigm. SRT experiments assess subjects' abilities to learn a repeating sequence or a rule generated pattern of light flashes in a spatial array. Subjects get faster at responding to the stimuli as they learn to exploit the underlying rule system used to generate the stimulus display. Explicit functioning was assessed using a variety of standard IQ and memory measures. The current experiment compared implicit and explicit learning ability in a group of Traumatic Brain Injury patients residing at Peninsula Hospital and a control group of Brooklyn College undergraduates. There were no differences between the levels of implicit learning on the SRT procedure. The patient group was, however, profoundly impaired on several assessments of explicit cognitive functions.

ANTH – 1 PRELIMINARY ANALYSIS OF ICELANIC FISHING BOOTHS FROM THE LATE MEDIEVAL PERIOD

Malgorzata Frik[#], **Salena Modugno**[#], **Monika Koczela**[#], and **Konrad Rydzewski-Smiarowski**[#] REU, Anthropology and Archaeology Department, Brooklyn College of CUNY, Brooklyn, NY 11210

The following is a collaborative effort between undergraduate students at Brooklyn College Zooarchaeological Laboratory (City University of New York), who are currently enrolled in a program (Research Experience for Undergraduates) that provides unprecedented amount of research exposure and scholarly cooperation. The group task was to analyze a faunal collection from a fishing booth midden dating to ca. AD 1450. The Akurvik site (4901-1) is situated along the Northwest coast of Iceland on the Reykjarnes peninsula in Arneshreppur. Presented here are the preliminary results of the findings from a dense layer of fish bone that is representative of the possible beginnings of commercial fishing activity in the area. The importance of this site and the research done there is paramount to understanding the early beginnings of heavy commercial exploitation of northern fish stocks in the greater North Atlantic regions.

Biological Sciences

BIO - 1 STEM CELLS

Assaf Babaev*, Science Department, Lafayette HS, Brooklyn, NY 11214

The goals of my stem cell study were to find the nature of stem cells, and what functions they perform in humans. Stem cell research may lead to a cure for cancer and AIDS in future. How will stem cell research and treatment affect our society in the future? What is the scientific consensus regarding stem cell research?

Stem cells are able to develop into many types of cells in the body. They serve as a repair system for the body; they divide without limit to replace other cells, as long as the human being or animal is still alive. Stem cells can replace almost every cell, such as muscle cells, red blood cells, or brain cells.

Stem cells have two Characteristics that make them different from other type of cells. Firstly, they renew themselves for long periods through cell division. Secondly, under certain physiological or experimental conditions, they can be induced to become cells with specializes functions, such as heart muscle cells.

BIO – 2 ESR DATING FOSSIL HERBIVORES FROM SENEZE, FRANCE: A VILLAFRANCHIAN SITE WITH EXTINCT MONKEYS.

Ernest Karabas*, Research Advisors: Bonnie Blackwell¹, and Steven Kaye², Williams College¹, James Madison High School²

Senèze is an important open-air mammalian fossil site in central France. It serves as the type site for the Villafranchian, a geological period which dates to about 3.5-1.2 million years ago. Dates for Senèze remain controversial, but more accurate dates would provide a better understanding about the evolution for the mammals and their paleoenvironmental adaptations. Seven teeth from Senèze were dated using ESR (electron spin resonance). ESR can date fossil tooth enamel ranging from 10,000 to 10,000,000 years in age. One young tooth had been reworked into the fossil layer. The others dated to about 2.6 to 3.3 million years old.

BIO – 3 DESIGN AND CHARACTERIZATION OF REAL TIME RT-PCR PRIMERS FOR HUMAN AND MURINE CYTOKINES, CHEMOKINES AND THEIR RECEPTORS.

Michael Wade#¹, Vishwa Deep-Dixit Ph.D², Ashani Weeraratna Ph.D², and Dennis Taub Ph.D², ²Laboratory of Immunology, National Institute on Aging, GRC, NIH, 5600 Nathan Shock Drive, Baltimore, MD 21224 and ¹Brooklyn College of CUNY, 2900 Bedford Avenue, Brooklyn, NY 11210.

Cytokines and chemokines play a critical role in regulating diverse cellular functions via specific receptors in virtually every organ of body. Aberrant production of these mediators lead to a variety of pathological conditions, including cancer and diseases associated with aging. Accurate quantitation of gene expression of cytokines and chemokines is thus vital for both basic and clinical research. Here, we have attempted to design and characterize a library of intron-exon spanning real time RT-PCR (reverse

Biological Sciences

transcription – polymerase chain reaction) primers that can be used to investigate the gene expression of human and murine cytokines, chemokines and their receptors. Some of the primers designed were evaluated for their effectiveness to quantify gene expression in human peripheral blood mononuclear cells. More accurate measures of cytokine and cytokine receptor expression within diseased tissues and cells may yield valuable information regarding the pathogenesis of various disease states.

Supported by NIH- MARC Grant GM08078

BIO – 4 THE UNICELLULAR GREEN ALGAE *DUNALIELLA*: BIODIVERSITY IN EXTREME ENVIRONMENTS.

Dionne Avery#, Claudeline Louis, Juergen E.W. Polle, Department of Biology, Brooklyn College of CUNY, 2900 Bedford Ave 200NE, Brooklyn, NY 11210, USA

There are currently 23 described species with several subspecies of the subgenus *Dunaliella*. Until recently, morphological and physiological characteristics have been the major criteria for species distinction. Cell morphology depends largely on environmental factors, such as salinity and age of the culture, and because of the great morphological variation even within one species, there has been confusion as to the correct classification of species and subspecies. In addition to morphology and physiology, we employ molecular biological techniques to delineate the *Dunaliella* genus at a species level in order to provide a frame for future baseline studies of biodiversity. We consider the molecular analysis of the number of introns within the 18s rDNA gene, as well as the sequence analysis of the rDNA Internal Transcribed Spacer 1 and 2 regions (ITS1 & ITS2) in order to categorize subspecies and formae within the species *Dunaliella viridis*. For distinction at the subspecies level the secondary structure of ITS2 is being analyzed. The goal of this study is to eventually identify unknown isolates of *Dunaliella*.

Supported by NIH- MARC Grant GM08078

BIO – 5 FORMATION OF SHORT- AND LONG-TERM MEMORY IN FRESHWATER CRAYFISH *PROCAMBARUS CLARKII*

Moses M. Feaster#, Michael S. Barach, Kanwal Gulzar, Zeneta Romney, Oleysya Semchemkova, Inna V. Soybelman, Happy Taslima, Attiyah Zaheer, and Jennifer A. Basil, Department of Biology, Brooklyn College-CUNY, Brooklyn, NY 11210, *Alliance For Minority Participation Program*

Because the freshwater crayfish *Procambarus clarkii* lives in a turbid environment, the use of its tactile sense is heavily relied upon over vision. Crayfish may use their advanced tactile sense in order to escape predators and return to their burrows during nocturnal excursions or during particularly turbid conditions. In our laboratory, crayfish were blindfolded in order to simulate these lightless conditions. We observed their exploratory behavior– which consists of a sustained contact with the arena wall using their antennae– and measured for habituation, a decrease in exploratory behavior in which less contact was made with the arena boundaries after regular exposure to the arena. We will determine whether cooling the crayfish affects habituation by disrupting

Biological Sciences

the learning process and preventing the formation of memories of the arena, which would result in an increase of exploratory behavior (dishabituation) in the successive trial runs. The Pre-trial cooled animals were placed in an ice bath for 20 minutes and warmed up again for 40 minutes before their trials. Post-trial animals were cooled for 20 minutes immediately after their 40-minute trial in the arena. We hypothesize that the post-trial cooled animals will exhibit the greatest amount of dishabituation, as the short-term memories of the spatial configuration of the trial arena would become disrupted due to the immediate application of the cooling treatments; pre-trial cooled animals will have had 23 hours to process those same memories, the prolonged cooling not having an effect on the consolidation of the long-term memories of the arena.

Supported by PSC-CUNY grant to JAB

BIO – 6 INVESTIGATING THE METABOLISM OF PRO-VITAMIN A ACCUMULATION IN *DUNALIELLA SALINA* (GREEN ALGA)

Jasmeen Kaur# and Juergen E. W. Polle, Department of Biology, Brooklyn College of CUNY, Brooklyn, NY 11210, USA

The main purpose of this project is to isolate the entire sequence of a gene of one enzyme of the carotenoid biosynthetic pathway of the green alga *Dunaliella salina*. This enzyme Phytoene Synthase catalyzes the first entry-step of a sequence of reactions of the carotenoid biosynthetic pathway eventually leading to synthesis of β -carotene, which is Pro-Vitamin A. In order to accomplish this task, we used an available cDNA sequence from a database, in this case Genbank (NCBI). This sequence was used for primer design to perform Polymerase Chain Reaction (PCR). Sequencing of the PCR products revealed that the phytoene synthase gene of *D. salina* contains at least three exons and two introns. Once the full sequence is obtained, we will be able to use it for comparative studies with genes of other enzymes in the carotenoid biosynthetic pathway.

BIO – 7 GENETIC ANALYSIS OF FUSION-DEFECTIVE INSERTIONAL MUTANTS USING ARTIFICIAL FUSION TECHNIQUES

Keycharianne Navarro#, Charlene L. Forest and Munevver Aksoy, Department of Biology, Brooklyn College of CUNY, Brooklyn, NY 11210

We are using the green alga *Chlamydomonas* as a model system to study the molecule(s) involved in fertilization, particularly those that actually cause fusion of the gametes. The mating process in *Chlamydomonas reinhardtii*, a unicellular alga involves agglutination followed by an adhesive interaction between organelles located in the plasma membrane. These organelles or “mating structures” are covered by a glycoprotein “fringe”. Once they interact, fusion begins, leading to the formation of a zygote. We have produced fusion-defective mutants that have plasmids inserted in the gene coding for the putative fusion protein and plan to use these mutants to isolate the fusion gene. Unfortunately, because these mutants cannot fuse, we cannot determine if the fusion defect is genetically linked to the insertion. My experiments focus on one of these mutants, created by Tammy La, a master’s students in our lab. The mutant named clone 45, is able to

Biological Sciences

agglutinate, but cannot fuse. This project involves developing methods that will allow us to fuse these mutants with wild type cells, so that we can study their genetics. We are using polyethylene glycol (PEG) to produce diploids, by fusing vegetative cells. We have obtained potential diploids; if they truly are diploids, they will be mating type -. The next step is to mate them with wild type mating type + to determine if the obtained cells are, in fact, diploids. The genetic analysis of diploids will allow us to determine if the mutation is dominant and will allow us to obtain carriers of the mutation that can be used for genetic analysis. In addition, once these techniques are standardized, we can use them to study new mutants, as they are produced.

Supported by NIH- MARC Grant GM08078

BIO – 8 CLONING THE GAMETE FUSION GENE IN *CHLAMYDOMONAS REINHARDTII*

Munevver Aksoy[^] and Charlene L. Forest, Department of Biology, Brooklyn College of CUNY, Brooklyn, NY 11210

We are studying the mating reaction with the goal of isolating and analyzing the gene responsible for gamete fusion. To this end, we have generated fusion-defective mating type minus insertional mutants and are using these mutants to clone the gene. The plasmid pSP124S, containing the *ble* gene, was inserted as a random mutagen using the acid-washed beads transformation technique. Approximately 700 non-mating colonies were isolated and analyzed by phase-contrast microscopy to determine their mating deficiencies. Among the mutants isolated were non-agglutinating mutants, non-motile mutants with low fusion capacity and one motile, fusion-defective mutant, clone 9-5 (cl 5). Cl 5 forms 15 % pairs when mated with the opposite mating type (similar to the pair formation in *gam* mutants). Southern Blot analysis showed 1 insertion for clone-45 (a previously isolated fusion-defective mutant), and 2 insertions for cl 5. While we continue to screen for new mutants, we are now using LMS-PCR and plasmid rescue to identify the genomic sequences flanking the insertion in the genome of clone-45. We will then sequence this flanking DNA and compare it to the gamete/zygote EST library available from the *Chlamydomonas* Genome Center as well as to the full genomic sequence that is now available as a blast database. We then will isolate the wild type gene by screening a *Chlamydomonas* BAC library.

BIO – 9 ISOLATION OF TEMPERATURE-SENSITIVE MUTANTS FOR GAMETOGENESIS IN *CHLAMYDOMONAS*

Nuenyan Lam[#] and Charlene L. Forest, Department of Biology, Brooklyn College of CUNY, Brooklyn, NY 11210

We are attempting to isolate temperature sensitive mutants in the unicellular eukaryote, *Chlamydomonas*, that are defective in gamete formation. Vegetatively growing *Chlamydomonas* cells will form gametes when they are deprived of nitrogen. We are using UV mutagenesis of streptomycin-resistant mating type – (*mt-*) cells followed by streptomycin selection. The selection involves mating the mutagenized cells to

Biological Sciences

streptomycin sensitive, *mt+* cells at the restrictive temperature (34°) and killing all zygotes and unmated *mt+* cells. Potential mutants are then screened at 34° and room temperature and colonies that can mate with *mt+* gametes at room temperature and not at 34° are chosen for further study. These *mt-* mutants will then be mated with *mt+* gametes to determine whether they are inherited in a typical Mendelian fashion and whether they are expressed in both mating types. We will further analyze them, using temperature shift experiments, to determine when during gametogenesis they are expressed.

BIO – 10 IN-SITU HYBRIDIZATION OF AaHR3 IN MOSQUITO MIDGUT AEDES AEGYPTI

Lee Jennifer Cartagena# and James T. Nishiura and Department of Biology,
Brooklyn College of CUNY, Brooklyn, NY 11210

Mosquitoes are the vectors of many viruses and microbes that cause human disease such as Malaria, Dengue fever and West Nile Encephalitis. Great efforts are made to control the population of hematophageous adult mosquitoes by the elimination of mosquito larvae. Chemicals known as insect growth regulators are key larvicidal agents because they interfere with normal mosquito metamorphosis. The juvenile hormone, methoprene, is an insect growth regulator, and it has been shown to block mosquito metamorphosis effectively. The molecular mechanism by which it does so is not known. Our goal is to study the effect that methoprene has on mosquito metamorphic midgut remodeling, and its effect on the transcription of orphan receptor-transcription factor gene. We have discovered that the gene AaHR3 is induced early during midgut remodeling and methoprene blocks this induction. We do not know in which midgut cells this gene is transcribed, and to this end, we used In-Situ Hybridization techniques of probes of AaHR3.

Dissection and fixation of the four-ins tar larvae midgut tissue took place. After increasing the permeability of the tissue's cell membrane, the probe was added followed by incubation in anti-Digoxigenin-AP antibody used as a label. A substrate was added to accomplish color development. Staining of the samples occurred, and data was analyzed. Midgut presented a common pattern of staining in both the gastric ceacal, and the malphigian tubules of the larvae's midgut. The cells located at these regions contain the gene AaHR3. These samples will be further analyzed to ultimately discover methoprene's molecular mechanism.

Supported by: New York St. Louis Alliance for Minority Participation in Research

BIO – 11 TESTING THE ROLE OF THE ARABIDOPSIS ARABINOGALACTAN PROTEIN, AGP17, IN THE ATTACHMENT OF AGROBACTERIUM TUMEFACIENS

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Agrobacterium tumefaciens is a ubiquitous member of the rhizosphere. Under the appropriate conditions *A. tumefaciens* bacteria are able to infect wounded plants and genetically transform plant cells with bacterial DNA. The bacterial DNA transferred into the plant cells codes for plant growth hormone genes, and when expressed these plant

hormones induce the formation of plant cell tumors, referred to as crown gall disease. Previous work from several labs has demonstrated that attachment of the bacteria to plant cells is a requirement for infection and tumor induction, however, neither bacterial adhesins, nor plant-encoded receptors, have been well characterized. A screen of *Arabidopsis* mutants that are resistant to *A. tumefaciens*- mediated transformation identified the *RAT1/AtAGP17* gene as a candidate for encoding a putative attachment site for *A. tumefaciens*. Our lab is interested in testing directly whether the AGP17 arabinogalactan protein serves as a receptor for *A. tumefaciens*. As most plants are believed to express AGP17 and/or related arabinogalactans, it is not feasible to use a plant cell culture system to isolate any potential attachment function conveyed by AGP17. Other members of our lab have circumvented this limitation by expressing the AGP17 protein as a fusion construct in yeast, which do not bind *Agrobacterium* under normal circumstances and do not express any homologues of AGP17. However, arabinogalactans, such as AGP17, are characterized by extensive O-linked sugar modifications on hydroxyproline residues of the peptide backbone. Yeast are most likely unable to add these O-linked sugars to the AGP17 fusion construct as yeast do not have any endogenous arabinogalactan proteins. An alternative to yeast is using species of *Chlamydomonas* or *Volvox* as expression systems, as these green algae do synthesize arabinogalactan proteins, but do not bind *A. tumefaciens* significantly. We are currently preparing to express AGP17 in both *Chlamydomonas* and/or *Volvox*.

BIO – 12 SACCHAROMYCES CEREVISIAE AS A SURROGATE HOST FOR STUDYING A. TUMEFACIENS ATTACHMENT

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Agrobacterium tumefaciens is the causative agent of crown gall disease in plants. It is well established that attachment between the bacterium and the plant cell is required for transformation however the attachment mechanism is not completely understood. The yeast, *Saccharomyces cerevisiae*, is not a natural host of *A. tumefaciens*, and yeast cells are bound very poorly by *A. tumefaciens* relative to suitable plant cell targets. The lack of high affinity receptors and the ease of genetic manipulation, make yeast an ideal negative control cell type in which to test putative receptors for their ability to interact directly with *A. tumefaciens*. We are currently testing whether proteins from *Arabidopsis* are able to promote interaction with *A. tumefaciens* when expressed on the surface of yeast. We are also using biotin to tag *Agrobacterium*'s T-pilus, the component used for attachment to hosts. When mixed with yeast expressing a putative surface receptor, attachment of biotinylated bacterial T-pili can be measured by probing for biotin using FITC-conjugated Neutravidin and then examining the labeled yeast by fluorescence microscopy or fluorescence activated cell-sorting (FACS). FACS will allow interaction to be quantified and will also serve as a high throughput method to detect for attachment with specific plant receptors expressed in yeast.

BIO – 13 PLATELET FUNCTION AND GENOTYPING IN CORONARY HEART DISEASE

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Platelets have been found to be involved in the development of the acute ischemic coronary syndrome. The glycoprotein IIb / IIIa ($\alpha_{IIb}\beta_3$) is known to be the final common pathway in platelet aggregation. The PL^{A2} polymorphism of the glycoprotein IIIa has been associated with acute coronary thrombosis. There is no known correlation between platelet genotype and platelet function as assessed in-vitro. We propose to study platelet aggregation by using low dose agonists as a measure of platelet hyperfunction. We also propose to study whether several polymorphisms are associated with abnormal platelet function observed in patients with coronary heart disease (CHD) as compared to those without CHD. We believe that acute coronary syndrome (ACS) is associated with the increased aptitude of platelets to aggregate. We intend to test whether this can be identified by the response of platelets to agonists in an aggregometer. Flow cytometry will also be used to measure platelet activation. Currently, we are recruiting 125 patients with coronary artery disease (CAD) and acute coronary syndrome (ACS), and 125 control patients. We have performed platelet functional assays at initial presentation and this will be done again in 3 months. Standard platelet aggregation was performed using several agonists. Flow cytometric analysis was also performed. Our results showed increased levels of aggregation in patients with CAD as compared to those without CAD. Our results thus far, suggests that platelet aggregation can be used as a measure of platelet hyperfunction in coronary heart disease since at low dose concentrations of agonists, patients with ACS and CAD have higher levels of platelet aggregation than the control patients. Understanding the relationships between platelet function and platelet polymorphism in relation to CHD can prove to be helpful in the development of drugs to prevent heart disease.

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HNS – 1 EFFECT OF KETOGENIC (“ATKINS”) DIET ON GLUCOSE TOLERANCE IN RATS

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Very low-carbohydrate diets are popularly used for weight control. We investigated their effects on regulation of blood glucose levels in rats previously made obese through dietary means. Obese rats were divided into two groups, one fed a high-protein, high-fat, ~0 carbohydrate diet (Atkin’s Phase 1, K) and the other fed the same number of calories as a low-fat, complex carbohydrate diet (L) for 2 weeks. Intraperitoneal glucose tolerance tests showed impairments in K rats compared with L rats or with ad libitum-fed lean rats on standard chow (C) diet ($p < 0.05$). Body weights of the L and K rats did not differ, but were significantly higher than those of C rats ($p < 0.05$).

The K group was then put on Phase 2 of the Atkins diet (5% of kcal as carbohydrate); the L group continued to receive a matched number of calories of the L diet and the C group

Biological Sciences

received standard chow ad libitum. Glucose tolerance tests, performed after four weeks of feeding, showed no statistically significant difference among the L, K or C groups. Body weights did not differ among groups since L and K rats stopped gaining weight while C rats continued normal weight gain.

These findings show that the Atkins Phase 1 diet impaired glucose tolerance compared to a carbohydrate-containing diet of equal calories. This impairment disappeared once a small amount of carbohydrate was returned to the diet. The study suggests that people on Atkins Phase 1 diet may have abnormal glucose tolerance.

HNS – 2 BIOLOGICAL MONITORING FOR DIOXINS USING ALTERNATIVE TISSUES FOR THE MEASUREMENT OF GENE EXPRESSION

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Dioxins are widespread, non-biodegradable, lipophilic byproducts of combustion, paper manufacturing, and phenoxy-herbicide use. Humans are exposed to a variety of dioxins when they consume fat-containing foods such as milk, meat, and fish. Because people have a limited capacity for metabolism, dioxins gradually accumulate in their adipose tissue over the course of their lifetimes. Even with low incidence rates, environmental exposures may cause illness because everyone is exposed. There is evidence that dioxins cause cancer and other health problems such as altered developmental outcomes including changes in immune and thyroid function. The purpose of this project is to measure the expression of dioxin-inducible genes in human buccal cells. Buccal cells form the lining of the mouth and can be obtained using a brush resembling a toothbrush. Cytochrome P450 1A1 (CYP1A1) and CYP1A2 are dioxin-inducible genes and will be measured in resting buccal cells as indicators of the effect of exposure to environmental dioxins. In addition, CYP1A1 and CYP1A2 will be measured in buccal cells cultured with tetrachlorodibenzo-p-dioxin (TCDD) as an indicator of dioxin responsiveness. CYP1A1 and CYP1A2 will be quantified by reverse transcription-polymerase chain reaction (RT PCR). This method measures gene expression by reverse transcribing the total RNA and amplifying target DNA in the presence of varying amounts of internal standard. The ability to measure the biological response to low levels of dioxins will be useful in identifying highly exposed and/or sensitive individuals.

HNS – 3 ARE FAST-FOOD RESTAURANTS TO BE BLAMED FOR OBESITY?

Sreelakshmi Saikumar*, Sarah Afzaal* and Karmela Deopaul*, Project Advisor: Barrington Harvey, James Madison High School.

Many obese people believe that it's not their fault that they are overweight. Some may blame it on fast-food restaurants that serve high calorie, high fat meals, and super size portions. The research that has been performed to examine data from the ten American states, where the numbers of cases of severe obesity are highest. Menus were studied from six different fast-food restaurant chains, analyzing the total calories, fat content, and portion size. Data was also obtained on average exercise, intensity, and duration for the

populations within these states. Our data suggests that the restaurants alone are not to be blamed for the prevalence of obesity.

PEES – 1 THE EFFECT OF DELAYED MENARCHE ON BONE STRENGTH AND STRUCTURE

Karen Koser^{#1}, Amit Khaeja^{^2}, Roody Dallemand³, Anthony Delli-Pizzi³, Vana Albert⁴, and Vanessa Yingling³, Department of Chemistry¹, Department of Physical Education and Exercise Science³, Department of Health and Nutrition Science², and Midwood High School⁴ at Brooklyn College of CUNY, Brooklyn, NY 11210

Optimizing peak bone mass during late adolescence may be effective in reducing the effects of osteoporosis. Estrogen levels during growth are important factor in the pathogenesis of bone fragility. The delay of menarche and infrequent menstrual cycles decrease estrogen levels during adolescence and decrease peak bone mass. **PURPOSE:** To develop an animal model that will delay puberty and in turn affect peak bone mass. It is hypothesized that a GnRH antagonist would reduce the cortical bone strength. **METHODS:** Female Sprague Dawley rats were assigned into control group (n=5) and a GnRH antagonist group (n=6). Injections (0.2 ml) were given intraperitoneally for 18 days of either saline or GnRH antagonist (100 ug/day) (Cetrotide™, Serono, Inc). All animals were monitored daily for vaginal opening. At 46 days of age vaginal swabs were taken and animals were sacrificed during the proestrus phase of their cycles. Uterine weights were measured. Tibiae and femurs were mechanically tested under 3-point bending at a loading rate of 0.1 mm/s. Cortical area of the tibiae were measured. **RESULTS:** The average age at vaginal opening in the control group was 31.2 (1.5) days of age and the GnRH antagonist group was 36.3 (6.9) days of age. Body weights were similar throughout the protocol. Differences were found in the mechanical variables. **CONCLUSION:** GnRH antagonist given to animals prior to the first estrus cycle significantly decreased the bone strength in the tibiae and femurs, but had no effect on body weight.

ENG – 1 INTERFACING MICROCONTROLLERS WITH THE EXTERNAL WORLD

Steven Tsardounis*, Victor Atlasman*, and Lev Goltseker*, Research Advisor Steven Kaye, Madison High School

The Use of Electrical Electronic ranging and Emmitter/Receiver combinations have made it possible to perform distance measurements from remote locations.

An Ultrasonic Emmitter/Receiver unit has been occurred and interfaced to a microcontroller. A personal computer has been connected to the microcontroller for programming and data output.

Experiments have been performed to determine the accuracy of Distance measurements under laboratory conditions (These measurements have been used/or controlled) A second series of experiments will compare performance of the system when the microcontroller was separated from the computer of way through the internet.

Environmental Studies

ENV – 1 TO KILL OR TO LOVE THE DEER?

Nsenga Adigun#, Melissa Casticone# and Delia Fox#, Micha Tomkiewicz,
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A comparative study was conducted by three college students to determine if deer should be killed or not. Our research indicated that deer are being hunted for several reasons such as food, sport and population control. The major reason why deer are allowed to be hunted is their overpopulation. The size of the population is the determining factor in how many deer are allowed to be killed within states. In spite of the obvious population problem many are opposed to the hunting of deer, arguing that the act of hunting is inhumane.

Because Wisconsin has one of the largest deer populations in the United States our group focused on this state in providing statistics and data to determine the impact that overpopulation of deer has on our environment and well being. We considered in our research what the results would be if there were no human interference with the existing deer population. Our study shows the amount of damage throughout the state that is directly caused by the overpopulation of deer and how this overpopulation affects the livelihoods of Wisconsin's residents. Our group researched other methods of controlling deer populations and how affective and efficient these methods are compared to hunting. It is evident after careful analysis and research of this data that the deer population within the United States poses a significant problem. Our group has concluded that it is absolutely impossible to do nothing about the deer population without allowing them to take over our human habitat. How we go about solving the problem is up to you.

ENV – 2 THE HUNT FOR DOLPHINS.

Katherine Angelucci#, Mikaernst Germain#, Lina Monges#, Louiza Nahomove#, Valerie Strienfelf#, and Micha Tomkiewicz, Education - Environmental Studies, Brooklyn College of CUNY, Brooklyn, NY 11210

A comparative study was conducted by five college students to determine the effects that industrial fishing nets have on the breeding and rapid death of dolphins. Ways to help and improve this rapid death rate were also examined. The group compared statistics from different zones within: the United States, Japan, the Eastern Pacific and the French West Coast, where fish netting caused the highest dolphin death rate. The death rates range from one hundred thousand to six hundred thousand dolphins dying per year, which causes dolphin depletion. The research that the group collected demonstrates the percentage of substantial population versus the death population within these zones. The group carefully examined how these deaths varied in the different zones and established ways to help this recurrent issue. One of these solutions was the law passed in 1972 called the United States Marine Mammal Protection Act. This law established the fact that the fishermen could no longer harm these animals by using their old nets; they had to use new dolphin friendly safety nets. Another way to help out dolphins is by using fish farming techniques to help breed them and take care of them.

After the careful analysis and research this group did - the question is: how can we as individuals help to prevent and save dolphins from being caught in fishing nets. This

Environmental Studies

group has carefully analyzed the data and now it is up to you, the observer, to make the decision if these ways are helpful for the dolphins.

ENV – 3 FISH FARMING A SOLUTION OR JUST ANOTHER PROBLEM?

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Nine hundred fifty million people worldwide rely on fish as their primary source of protein. In addition, ocean fisheries and fish-related industries sustain the livelihoods of some 200 million people. These numbers are much too high to sustain on an industry that is slowly going bankrupt.

These companies hide the fact that the fishing practices are unsustainable, both economically and ecologically. The money made has helped to build a technologically advanced global fishing fleet of over 23,000 ships weighing more than 100 tons each year.

However our world's oceans are being depleted at an alarming rate. Three fourths of oceanic fisheries are fished at or beyond their sustainable numbers. There is a big decline in production in the North Atlantic Ocean, of many popular fish species, cod, tuna, and flounder have decreased by half within the past 50 years, even though fishing efforts tripled.

As fish harvests from the ocean are declining, production of fish from farms (aquaculture) is booming because it is the only viable way to get fish.

However there lies the problem. Even though fish farming is the only alternative of ocean fishing it has many negatives of its own, such as, biological organic and chemical pollution.

The question now becomes how we can improve these fish farms because in the very near future we will need them. Scientists believe that aquaculture, when done correctly, can provide more benefit than harm, and that scientists and economists can offer critical improvements to a rapidly expanding industry. This is why in our research we will look for ways to address the problems facing fish farms so they can be a more viable means of fishing.

ENV – 4 ENVIRONMENTAL JUSTICE IN PROSPECT PARK?

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A comparative study was conducted by a group of students to determine if there was an issue of Environmental Justice in Prospect Park. The 2000 United States Census, pictures and surveys taken were all used as data to investigate Environmental justice in the park. Our group compared the two sections of the park; the underdeveloped insufficiently maintained Flatbush section of the park versus the more elaborate and highly maintained Park Slope section of the park. The group found inadequacies in the quality of the

Environmental Studies

amenities, the quantity and availability of the facilities, and the overall disparity in the care and maintenance of the facilities within the park.

The group took into account the quantity, quality and availability of the number of water fountains, benches, bathrooms, trashcans, lampposts, entrances, the kind of fencing used as well as the conditions of these facilities.

A spokesperson for the Parks and Recreation Department claimed “ any difference in the two sides of the park is strictly due to a higher volume of visitors and less space to accommodate them in the Flatbush area”. We have found evidence to disprove this statement.

Now how can we apply this information to make significant changes so that the question of Environmental Justice in Prospect Park is resolved? Our proposal to the New York City Parks and Recreation Department and the surrounding communities is that in light of these findings they endeavor to make the park into one park and adequately repair and maintain the areas of concern.

ENV – 5 WHY SHOULD WE INVEST MONEY INTO THE GOWANUS CANAL?

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The Gowanus Canal was constructed in 1848. It was built to transport goods. Today very few industries still use it to transport goods. The canal was very polluted and there was a horrendous odor that came from it. The New York State Legislature authorized the construction of the flushing tunnel with a propeller to bring in freshwater from the buttermilk channel and to flush the stagnant waters out. The propeller eventually broke down and the canal went back to the way it was. The question that our group has come up with is "Why should we invest money into the Gowanus Canal?" There are pros and cons to the question. The pros are, by putting money into the canal it opens up the door to create housing and jobs. The canal can decrease the amount of harm to the environment limiting the use of trucks by businesses being able use the canal to transport goods. The community also benefits from the renovation of the canal by bringing in more diverse population into the area. Investing money would help make the water cleaner which will increase the presence of sea life. The cons to investing money into the canal are that it won't be maintained and the canal would go back to its unsanitary ways because of the increase of population around the area. Investing money into the canal might increase the value of the property in the area and might drive out the residents that were in the area for a long time.

ENV – 6 DOES GROUND LEVEL OZONE INFLUENCE THE NUMBER OF PEOPLE DIAGNOSED WITH MELANOMA?

Mergim Pilku* and Blerona Pilku*, Research adv. Steven Kaye, Madison High School

Ground level ozone is recognized as a pollutant. It results from the presence of Nitrogen Oxide in the atmosphere. As ozone reduces UV penetration, it has been hypothesized that the reduction in ground level ozone, achieved by cleaning up the air, may contribute to increased rates of skin cancer.

This study compares the number of people diagnosed with Melanoma over a specific period of time and the average amount of ground level ozone during the same period. The data shows a correlation between the ground level ozone and the number of people diagnosed with melanoma. This study suggests a potential negative impact resulting from improved air quality.

CHEM –1 POLYSULFANE ANTITUMOR AGENTS FROM BENZYNE. AN ODD-EVEN ALTERNATION FOUND IN THE STABILITY OF PRODUCTS

Edyta M. Brzostowska[^], and Alexander Greer, Department of Chemistry and The Graduate Center, Brooklyn College of CUNY, Brooklyn, NY 11210

Benzyne is shown to add elemental sulfur and give rise to compounds similar to those previously isolated from a marine organism. A computational and experimental study to account for the distribution of products is presented. Odd-membered *o*-C₆H₄S_x rings (x = 1 to 8), except x = 1 which suffers from ring strain, have enhanced stability compared to even-membered rings. The acquisition of “odd-even” data sheds new light revealing patterns on polysulfane stability, structure, and fragmentation.

CHEM – 2 TRANSPORT PROPERTIES OF THERMORESPONSIVE POLYMERIC GELS MODIFIED WITH COLLOIDAL GOLD NANOPARTICLES.

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Transport properties of thermoresponsive poly-N-isopropylacrylamide (NIPA) hydrogels modified with gold colloids were determined by electroanalytical techniques - steady state voltammetry and chronoamperometry with Pt disk microelectrodes. Gold nanoparticles of various sizes in the range from 2.6 to 60 nanometers were synthesized by way of chemical reduction and introduced to NIPA-gels during the polymerization process. These materials were characterized by UV-vis spectroscopy and transmission electron microscopy. 1,1'-Ferrocenedimethanol was used as the electroactive probe. Such polymeric systems undergo discontinuous reversible volume phase transition in response to temperature increase. As the result up to 90% of solvent is released from the polymeric matrix. Diffusion coefficients of electroactive probe in swollen gels and in expelled solutions were determined. It was found that diffusion coefficients of Fc(MeOH)₂ in swollen neat NIPA and NIPA-gel modified with gold nanoparticles are identical within experimental error and they are approximately 10 – 30 % smaller than those in aqueous solutions. Concentration of Fc(MeOH)₂ in expelled solutions was up to 30 % smaller than in swollen gel. Chronoamperometry was used to determine concentrations and diffusion coefficients of Fc(MeOH)₂ in gels reswollen after the phase transition. Distribution of probe molecules between gel and expelled solution was also calculated.

CHEM – 3 DNA CLEAVING AGENTS RELATED TO THE NATURAL PRODUCT LEINAMYCIN

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The natural product leinamycin possesses a spiro fused 1,2-dithiolan-3-one 1-oxide heterocycle. Previous work focused on an attractive through-space S-O interaction in leinamycin. The present work examines the efficiency of polysulfane product generation

Physical Sciences

measured for thiol reactions with *ortho* and *para* substituted 1,2-dithiolan-3-one 1-oxides by GCMS and NMR spectroscopy. Thiol containing acetonitrile water (7:3) mixtures give an incomplete decomposition of the benzodithiolanone-oxide ring based on the substitution pattern. The results show that it is possible to understand effects in structure and reactivity of dithiolanone-oxides to provide new design concepts for this class of DNA-cleaving agents.

CHEM – 4 PHOTOCLEAVAGE OF PLASMID DNA BY FUSED AROMATIC SULFOXIDES UNDER ANAEROBIC AND AEROBIC CONDITIONS

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The ability of aromatic sulfoxides [dibenzothiophene sulfoxide, 1,2-benzodiphenylene sulfoxide, and 2,5,7,10-tetra(*t*-buty)diacenaphtho-[1,2-*b*:1',2'-*d*]thiophene sulfoxide] to photochemically induce strand breaks in plasmid DNA has been studied under anaerobic and aerobic conditions. DNA cleavage is monitored by the conversion of closed circular pUC19 DNA (form I) to the nicked (form II) and linear forms (form III) using densitometer digital imaging of ethidium stained gels. In water acetonitrile (10:1) mixtures the single-strand cleavage is efficient and does not require an alkaline reaction workup. A comparison of the strand scission in the presence and absence of molecular oxygen suggest the aromatic sulfoxides or sulfide by-products are not efficient sensitizers for $^{1}O_2$ generation under the conditions. The effect of solvent deuteration further supports the lack of involvement of $^{1}O_2$ in a sulfoxide sensitized photooxygenation reaction. The results are interpreted in terms of a sulfoxide photodeoxygenation via oxygen atoms in the buffered aqueous solution. We will present details on the mechanism leading to strand breakage and characterize the nature of the intermediate involved in the photodeoxygenation reaction with aromatic sulfoxides.

CHEM – 5 PHYSICAL ORIGINS OF NATURAL PRODUCT SYMMETRY: WHY NATURE PREFERS DIMERS

Nathan Sandalow# and Mark N. KobraK, Department of Chemistry, Brooklyn College of CUNY, Brooklyn, NY 11210

Recent statistical analyses by Greer and co-workers have revealed that small molecular natural products often possess a high degree of bilateral symmetry. The ubiquity of such dimeric molecules across a wide range of organisms and metabolic pathways suggests an evolutionary advantage to this configuration. We propose that the origin of this phenomenon is the cancellation of electrostatic dipole moment in the molecule inherent in the dimerization process. The synthesis and utilization of molecular species in a biological system invariably involves manipulation by enzymes. Binding to the active site of an enzyme involves a transition from water, a high dielectric solvent, to an environment of low dielectric constant. Reduction of the solute dipole moment weakens electrostatic coupling to its environment, reducing the free energy cost associated with

Physical Sciences

enzyme binding. We present an analytic model for the system based on dielectric continuum theory.

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CHEM – 6 *IN VITRO* REPRODUCTION OF ANOMALOUS MICROCRYSTALLINE FEATURES OBSERVED IN ARCHAEOLOGICAL SOIL SAMPLES

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Previous studies have revealed the presence of anomalous microcrystalline features in soil samples recovered from different archaeological sites. The origin of these features has been the subject of some debate. Techniques such as Proton Induced X-ray Emission (PIXE) and electron microprobe analysis have shown that these features are composed of varying ratios of calcium, iron and phosphate ions. We present the results of computer analysis comparing these ratios with those for previously characterized compounds, and find several synthetic analogs to the observed features. We have also begun experiments designed to reproduce the observed features in the laboratory, and discuss preliminary results of these studies.

Supported by NIH- MARC Grant GM08078

CHEM – 7 THE EFFECT OF ETHER FUNCTIONALITIES ON THE PROPERTIES OF PYRROLIDINIUM IONIC LIQUIDS.

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The term “ionic liquid” refers to a novel group of molten salts that are liquid at room temperature. Ionic liquids hold promise as an economical and environmentally safe class of organic solvents. In the design of ionic liquids, lower viscosities are sought to facilitate rapid and efficient reactions, and to improve the liquid’s handling properties for industrial applications. The purpose of this project was to determine whether the replacement of alkyl substituents by ethers would lower the melting points and viscosities of the pyrrolidinium-based ionic liquids. To this end, a number of novel pyrrolidinium ionic liquids were synthesized and characterized. Above all, the incorporation of an ether (ROR) branch proved successful in producing the advantageously lower melting points and viscosities.

Further work to be carried out on these pyrrolidinium complexes by researchers at BNL will include pulse radiolysis investigations to offer insight into the reactivity of solvated electrons and other species in these new media.

CHEM – 8 ELECTROANALYTICAL STUDIES IN POLYELECTROLYTE SOLUTIONS AND GELS: INVESTIGATION OF TRANSPORT OF SMALL NEUTRAL MOLECULES IN GEL-FORMING SOLUTIONS

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Mass transport in solutions depends on a number of factors, including internal organization of the solution and the nature of intermolecular interactions. In this work we study transport of a neutral probe molecules of 1,1'-ferrocenedimethanol (FcOH) in aqueous solutions of poly(acrylic acid) (PAA), and the effect of a pH induced sol-gel transition on transport phenomena in PAA solutions. Upon titration with a strong base, the ionization degree of a weak polyacid increases. This leads to changes of its conformation, and consequently, formation of a gel. The reorganization of macromolecules of PAA is strongly pronounced by changes of the viscosity of a solution, which we monitor using rotational viscometer. As a measure of mass transport properties of PAA systems, the diffusion coefficient of a probe molecule, FcOH, and its changes as a result of titration were determined using voltammetry with microelectrode. The results from PAA solutions and gels were compared with those from simple highly viscous solutions of sucrose. It has been demonstrated, that formation of the polyacrylate gel leads to organization of the internal structure of the medium. Formation of channels filled with a solvent and facilitating mass transport within polymeric network of the gel has been suggested, as opposed to very viscous solutions without such internal structure. Determination of diffusion coefficients of simple molecules has been proposed as a useful methodology to monitor gelation process in macromolecular systems.

CHEM – 9 SYNTHESIS AND CHARACTERIZATION OF THYMIDINE (6-4) THYMIDINE PHOTOLESION

Julianne Caton-Williams[^] and Zhen Huang, Department of Chemistry, Brooklyn College of CUNY, Brooklyn, NY 11210

The ultraviolet (UV) component of sunlight is one of the major sources of DNA damage in all organisms. This component has mutagenic, carcinogenic and lethal effects. The main products in DNA exposure to UV radiation are the 6-4 photoproducts and the *cis-syn* dimers occurring at dipyrimidine sites on DNA. The dimers formed in the most significant quantity are the *cis-syn* cyclobutane dimer of two thymidine bases and the corresponding 6-4 photoproducts. The (6-4) photoproduct was shown to be more mutagenic than the *cis-syn* dimer. It is important to understand the biochemistry and structure of this (6-4) photolesion and to study the DNA repair mechanism. Therefore, synthesis of oligonucleotides containing this lesion has brought much to our focus at this initial stage. In this study, we have synthesized a thymidine (6-4) thymidine photolesion via a synthetic route to first obtain the thymidine-thymidine dinucleotide. This dinucleotide was irradiated for several hours to form the lesion. The lesion was purified on ion exchange HPLC and characterized using 1D NMR (¹H, ³¹P, ¹³C) and 2D NMR (COSY, HSQC, NOESY, HMBC), UV/Vis and mass spectroscopy. The yield of the photolesion was 80%.

CHEM – 10 NOVEL SYNTHESIS OF PYRIMIDINONE

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We have developed a new synthesis for preparation of pyrimidinone by the reduction of 5'-dimethoxytrityl 3'-trimethylsilyl 2-(1,2,4 triazole)-thymidine (4 triazolopyrimidinone) with NaBH₄, which largely simplifies. Pyrimidinone is a compound employed in research because of its fluorescent properties in DNA and RNA studies. In a previous synthesis of pyrimidinone, 4 triazolopyrimidinone underwent a direct substitution of the 2(1,2,4 triazole) with hydrazine which was then oxidized to yield the desired product (1). It was found in our lab that pyrimidinone may be achieved through a direct reduction of 4-triazolopyrimidinone. The fluorescent nature of pyrimidinone allows it to be easily identified when it is incorporated in a oligo-deoxyribonucleotide, as a powerful tool and probe in biochemical research (2). Additionally, 5-substituted 2-pyrimidinone 2'-deoxyribonucleoside analogs are suspected to have anti-herpes simplex virus activity in cells (3).

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CHEM – 11 SIMPLE DETECTION OF SPECIFIC RNA IN TOTAL RNA

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We are, here, developing a novel method for a direct detection of fingerprint RNAs in RNA mixture, such as viral and bacterial RNAs in RNA samples, or specific mRNAs in total RNA that can lead to accurate identifying of diseases and microorganisms, including viruses and other pathogens in relatively short time. This method is fundamentally different from those existing methods: it does not require reverse transcription, PCR, in vitro transcription, gel electrophoresis, and probe hybridization. This direct RNA detection could be employed on a microchip technology to make a simple, rapid, accurate, sensitive, high-throughput, and cost-effective gene monitoring that would be

ideal for point-of-care disease diagnosis, food microbial contamination detection, and pathogen detection in biodefense.

On the basis of DNA polymerase-catalyzed RNA extension on DNA template, natural property of DNA polymerases, Dr. Huang and Szostak developed a RNA 3'-labeling method. (1) Though the total mRNA has been labeled in total RNA using poly(T) template, (2) the labeling of individual mRNA was a challenge due to the 3'-common sequences, such as 3'-untranslated region (3'-UTR) and 3'-poly(A) tail in eukaryotic organisms. These 3'-sequences need to be removed in order to perform the selective labeling. Unlike DNA restriction endonucleases, RNA endonuclease capable of selectively cutting RNA is not readily available. Fortunately, RNase H can be used as an "RNA endonuclease" in the presence of the DNA guiding sequence as RNase H is capable of cutting RNA in a RNA/DNA duplex. (3) In addition, RNase H doesn't digest RNA/RNA duplex, including RNA/2'-Me-RNA helix. Therefore, we have designed 5'-DNA-2'-Me-RNA-3' hybrid template, where DNA and 2'-Me-RNA sections function as the guiding sequence and protecting sequence, respectively, and the DNA sequence also serves as the template for Klenow extension. This template allows the polymerase extension and labeling of the digested RNA immediately following the RNase H cleavage on the RNA/DNA duplex. (4)

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CHEM – 12 ENZYMATIC SYNTHESIS OF DNA AND RNA CONTAINING SELENIUM AT THE PHOSPHATE BACKBONE

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The derivatization of DNA and RNA with suitable heavy atoms is a challenging problem in the field of nucleic acid X-ray crystallography. One approach to address this problem is to incorporate nucleotides containing specific heavy atoms covalently into DNA or RNA. We report here a novel study on the enzymatic synthesis of DNA and RNA harboring the selenium functionality at a non-bridging position in the phosphate backbone. To develop this method, we first synthesized, characterized and purified nucleoside triphosphates containing selenium at the α -phosphate (NTP α Se), such as TTP α Se, UTP α Se, and ATP α Se. We then investigated their suitability for the enzymatic synthesis of DNA and RNA *via* primer extension and *in vitro* transcription using the Klenow DNA polymerase and the T7 RNA polymerase, respectively. The results indicated that both diastereomers of TTP α Se were recognized equally by the Klenow DNA polymerase, while only one diastereomer of ATP α Se was recognized by T7 RNA polymerase. The results were confirmed by the resistance of these phosphoselenoate DNA and RNA to exonuclease digestion.

* This work was in part supported by the graduate LS-AMP Fellowship and the MAGNET Dissertation Fellowship.

CHEM – 13 SYNTHESIS OF 5'-TRIPHOSPHATE-4-SELENOTHYMIDINE AND SUBSEQUENT ENZYMATIC INCORPORATION INTO DNA

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The determination of 3-D structures of biological molecules by X-ray crystallography is accomplished through phase determination, which is facilitated by derivatization of such molecules with heavy atoms. The objective of this study was to replace base oxygen atoms of DNA with selenium atoms for subsequent use in X-ray crystallography. We proceeded by first synthesizing thymidine containing selenium at position four of the base. The product was then chemically triphosphorylated and confirmed by ¹H NMR, ³¹P NMR, and high-resolution mass spectroscopy. Polyacrylamide gel electrophoresis with a ³²P labeled primer indicated that the modified nucleotide was utilized by DNA polymerase and gave full length DNA, but unmodified TTP was used more rapidly. The presence of the modified DNA was confirmed by resistance to exonuclease digestion and ultraviolet absorption at 365 nm.

GEO – 1 PROFILING THE JUAN DE FUCA RIFT AT AXIAL VOLCANOES

Adnan Ismailov^{*}, research advisor: Steven Kaye, James Madison High School

Axial volcano is located on the Juan de Fuca rift 250 miles from the argon coast. It is the most active geologic cite on the rift. Starting in the 1980's, studies have been conducted at the cite to measure geologic activity and to study the rich biological colonies that inhabit the area near the hydro thermal vents.

The research now being conducted will examine the topography of axial volcano. Data was obtained using sonar and was plotted onto submarine topographic maps. Profiles were prepared to study the topography of the volcano slopes and adjoining rift zones.

Index

A

- Adigun, Nsenga *ENV-1* 18
Afzaal, Sarah *HNS-3* 15
Aksoy, Munevver *BIO -8* 11
Albert, Vana *PEES-1* 16
Alsaidi, Mohammed *CHEM-11* 26
Angelucci, Katherine *ENV-2* 18
App, Kelly *ENV-3* 19
Atlasman, Victor *ENG-1* 17
Avery, Dionne *BIO-4* 9

B

- Babaev, Assaf *BIO-1* 8
Basyuk, Helen *BIO-11* 12
Bonacchi, Kristine *PSY-3* 2
Bryan, Dionne *ENV-4* 19
Brzostowska, Edyta *CHEM-1* 22

C

- Campese, Vincent *PSY-6* 3
Carrasco, Nicolas *CHEM-12* 27
Cartagena, Lee Jennifer *BIO-10* 12
Casticone, Melissa *ENV-1* 18
Caton-Williams, Julianne *CHEM-9* 25
Constant, Jean *PSY-8* 4

D

- Dallemand, Roody *PEES-1* 16
Delli-Pizzi, Anthony *PEES-1* 16
Deopaul, Karmela *HNS-3* 15
Dubreze, Loy *ENV-4* 19

E

- Erez, Tahel *PSY-7* 4

F

- Facciola, AnnMarie *ENV-5* 20
Feaster, Moses *BIO-5* 9
Fischman, Noam *PSY-12* 6
Fischman, Noam *PSY-13* 7
Fox, Delia *ENV-1* 18
Frik, Malgorzata *ANTH-1* 7
Fuse, Akiko *PSY-7* 4

G

- Germain, Mikaernst *ENV-2* 18
Gluzman, Alona *PSY-9* 5
Goltseker, Lev *ENG-1* 17
Grange, Andre *CHEM-6* 24
Gulish, Yelena *ENV-3* 19

H

- Halpert, Rachel *ENV-3* 19
Harrigan, Noyes *CHEM-13* 28
Horowitz, Susan *ENV-5* 20
Hillocks, Yolanda *BIO-13* 14

I

- Ismailov, Adnan *GEO-1* 28

K

- Karabas, Ernest *BIO-2* 8
Kaur, Jasmeen *BIO-6* 10
Kazimierska, Ewa *CHEM-2* 22
Khaeja, Amit *PEES-1* 16
Khaneja, Amit *HNS-1* 14
Koczela, Monika *ANTH-1* 7
Koser, Karen *PEES-1* 16
Kouroupos, Tiffany *ENV-5* 20
Kripor, Talia *PSY-1* 1

L

- Lam, Nuenyan *BIO-9* 11
Litman, Leib *PSY-12* 6
Louis, Tanya *ENV-3* 19

M

- Malizia, Alaina *ENV-4* 19
Masiak, Michal *CHEM-8* 25
Modugno, Salena *ANTH-1* 7
Monges, Lina *ENV-2* 18
Monize, Merla *ENV-4* 19

N

- Nagornyy, Viktor *PSY-10* 5
Nahomove, Louiza *ENV-2* 18
Navarro, Keycharianne *BIO-7* 10

Index

P

Pilku, Blerona <i>ENV-6</i>	21
Pilku, Mergim <i>ENV-6</i>	21
Pressman, Milana <i>PSY-9</i>	5

R

Reynolds, Mathew <i>PSY-4</i>	2
Rydzewski-Smiarowski, Konrad <i>ANTH-1</i>	7

S

Saikumar, Sreelakshmi <i>HNS-3</i>	15
Sandalow, Nathan <i>CHEM-5</i>	23
Sawwan, Nahed <i>CHEM-3</i>	22
Shakya, Sharmila <i>CHEM-4</i>	23
Shalom, Isaac <i>CHEM-10</i>	26
Soni, Kalpana <i>BIO-12</i>	13
Strienfelf, Valerie <i>ENV-2</i>	18

T

Torres, Jose <i>ENV-4</i>	19
Toth, Dawn <i>ENV-3</i>	19
Toussaint, Heather <i>HNS-2</i>	15
Trofimovsky, Elina <i>CHEM-7</i>	24
Tsardounis, Steven <i>ENG-1</i>	17

V

Varela, Andrea <i>ENV-5</i>	20
-----------------------------------	----

W

Wade, Michael <i>BIO-3</i>	8
Waltuch, Rachel <i>PSY-1</i>	1
Watson, Garcia <i>PSY-11</i>	5
Wauchope, Orrette <i>CHEM-4</i>	23
Wu, Jun <i>PSY-5</i>	3

Y

Yiin, Emma <i>PSY-2</i>	1
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Legend:

<u>ANTH</u>	<u>Anthropology</u>
<u>BIO</u>	<u>Biology</u>
<u>CHEM</u>	<u>Chemistry</u>
<u>ENG</u>	<u>Engineering</u>
<u>ENV</u>	<u>Environmental Studies</u>
<u>HNS</u>	<u>Health and Nutrition Science</u>
<u>PEES</u>	<u>Physical Education and Exercise Sciences</u>
<u>PSY</u>	<u>Psychology</u>
<u>GEO</u>	<u>Geology</u>