

Brooklyn College

**Science
Research
Day**

Abstract Book
2003

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PROGRAM

13TH ANNUAL BROOKLYN COLLEGE SCIENCE RESEARCH DAY

9:45 A.M.	POSTER SETUP
10:00-12:00	STUDENT PRESENTATIONS AND JUDGING
12:15 P.M.	REFRESHMENTS IN THE GOLD ROOM
12:30 PM	WELCOME AND REMARKS
	PRESENTATION OF AWARDS
	High School Division
	Undergraduate Division
	Graduate Division

ALL ARE INVITED TO LUNCH IN THE GOLD ROOM

Presenter Key

High School *

Undergrad #

Graduate ^

PSY-1. LATERALIZED OLFACTORY LEARNING IN SPINY LOBSTERS

Michael Suchovicki# and Frank W. Grasso, Department of Psychology, Brooklyn College-CUNY, Brooklyn, NY 11210

The goal of this study is to get a better understanding of lobster brain functional organization relating to their antennule flagellum. Lobster antennules (specifically the aesthetasc tufts on the lateral flagella) are primarily used for chemosensory functions. Our experimental design attempts to answer whether learning acquired on one side of the brain through one lateral antennule can influence the behavior of the contra-lateral antennule. Twelve spiny lobsters (*Panulirus argus*) are being studied in a traditional Pavlovian conditioning paradigm. We expect that this experiment, informed by knowledge of spiny lobster neuroanatomy, will enable us to identify (or at least narrow the field of) brain regions that are utilized for chemosensory learning in lobsters.

PSY-2. BAYESIAN NETWORKS, PHOTO-ORIENTATION AND NAVIGATION EFFICIENCY

Jonathan G. Zatz* and Frank W. Grasso, Department of Psychology, Brooklyn College-CUNY, Brooklyn, NY 11210

We studied the effectiveness of Bayesian decision-making processes on robot orientation efficiency. We developed a robot control system in the interactive C programming language and implemented it in a commercially available Rug Warrior Pro robot. This control system used information provided by the robot's two photosensors and infrared proximity sensor for guidance. Sensor information cued three discrete robot behaviors: move forward (MF), steer toward the highest light intensity (SL), and avoid obstacles (AO). The Bayesian network selects the most suitable behavior (MF, SL or AO) based on the sensor data and prior experience. The control system adapts its behavior selection based on Bayesian likelihood estimates. We contrast this self-organizing system with a static control system. We hope that by using this scheme the robot will discover for itself the most efficient navigation strategy in a light-tracking task.

PSY-3. ACQUISITION OF GLUCOSE CONDITIONED FLAVOR PREFERENCE IN RATS

Cheryl Nissenbaum#, Emma Yiin, Karen Ackroff, and Anthony Sclafani, Department of Psychology, Brooklyn College-CUNY, Brooklyn, NY 11210

Rats learn to prefer flavors paired with intragastric (IG) infusions of glucose. The present study examined how quickly rats can acquire this preference. 11 rats were trained in two experiments with 30-min sessions to associate a flavored saccharin solution (CS+) with IG infusions of 16% glucose and a different flavored saccharin solution (CS-) with IG water infusions. The first experiment exposed the rats to the CS- for four sessions, the CS+ for one session, followed by another CS- session. Then the animals were given a two-bottle CS+ vs. CS- test. This was followed by 5 training cycles of CS-, CS+, CS+ vs. CS-. Overall, the rats consumed more CS+ than CS- in two-bottle tests, but a significant CS+ preference did not occur until the fourth testing. The second experiment

conditioned the rats with new flavors by exposing them to the CS- for one session and the CS+ for one session (in a counterbalanced order), followed by a two-bottle test. This cycle was repeated 5 times. Overall, the rats consumed more CS+ than CS- and the preference was significant for tests 1 and 3-6. The first experiment failed to show that a preference can be acquired with one exposure to the CS+. In the second experiment, with experienced rats, a significant flavor preference was obtained after only one training trial with each CS flavor. These data demonstrate that rats learn to prefer flavors based on their nutritional consequences at a rate that approaches that observed in flavor aversion learning.

Supported by NIH Grant DK-31135

PSY-4. FAT-CONDITIONED FLAVOR PREFERENCES IN FOOD RESTRICTED AND NON-RESTRICTED RATS

Emma Yiin[^], Karen Ackroff, and Anthony Sclafani, Department of Psychology, Brooklyn College-CUNY, Brooklyn, NY 11210

The present study investigated the role of deprivation state on fat-conditioned flavor preferences. Twenty-four female rats fitted with gastric catheters were divided into food restricted (FR) and food ad libitum (AL) groups. Animals were trained to associate one flavored solution (CS+) with intragastric (IG) infusions of 7.1% corn oil and another flavored solution (CS-) with IG water infusions. Intakes and infusions were limited to 7 ml during the 8 1-bottle training sessions. Flavor preference for the CS+ vs. CS- was assessed by 2-bottle tests. In the first experiment the rats were fed a low-fat diet and both FR and AL groups displayed a weak preference for the CS+ over the CS-. In Experiment 2, the rats were fed a high-fat diet, which is known to facilitate preference conditioning by fat, and they were given two training cycles with new CS flavors. At the end of training, the FR and AL groups displayed similar strong preferences for the CS+ in the two-bottle tests conducted under their original deprivation state. The CS+ preference remained unchanged with the test deprivation state of the two groups was reversed. These results confirmed prior data showing that deprivation state has little effect on carbohydrate-conditioned flavor preferences (Ackroff & Sclafani, 2001). Together, these results indicate that animals need not be hungry to learn about the nutritional consequences of foods.

Supported by NIH Grant DK31135.

PSY-5. THE EFFECTS OF DEPRIVATION ON FRUCTOSE-CONDITIONED FLAVOR-FLAVOR PREFERENCES IN RATS

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Flavor-flavor preferences can be learned when a target flavor is paired with an attractive (palatable) flavor. Prior work indicates that flavor-flavor preferences conditioned by the sweet taste of saccharin are independent of hunger level. The present study used fructose, which has a palatable sweet taste but only weak postingestive reward effects, to further assess this claim. Food restricted rats were trained with two flavored solutions: a 0.05 %

saccharin solution and a highly preferred mixture of 8% fructose and 0.2% saccharin. Cherry and grape conditioned stimulus (CS) flavors were added to these solutions. In daily 1-h training sessions the rats received one of the flavored solutions; cumulative intakes of the two solutions were equated prior to preference testing. The rats were then given a two-bottle choice between the CS flavors in water, when they were maintained on food-restriction and after ad-libitum feeding. The rats preferred the fructose-paired flavor whether tested deprived (70%) or ad lib (62%). Then they received additional one-bottle training sessions prior to a second preference test, with the CS flavors mixed in 0.2 % saccharin. The rats again preferred the fructose-paired flavor whether tested deprived (75%) or ad lib (66%). This experiment supports the notion that flavor preferences conditioned by sweet taste are independent of hunger level at the time of testing. The flavor associated with the preferred taste of fructose was chosen even when tested in the absence of sweet taste, and was expressed even when the animals were tested in the absence of food restriction.

Supported by NIH Grant DK3115

PSY-6. COMPUTER SIMULATION OF ODOR SOURCE TRACKING IN AN ANIMAT WITH A SINGLE SENSOR

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Odor plume tracking in turbulent aquatic environments is a difficult problem faced by foraging marine animals. The plume tracking strategy used (by a real or simulated animal) will produce differential success in finding the source of a plume. We predicted that an animat's (computer simulated animal) tracking performance will improve when it uses memory of the effectiveness of past movements to guide its decisions compared to an animat that makes instantaneously decisions. This prediction is not assured in the intermittent plume conditions generated in turbulent flow. A simulation program was written in C to test this memory hypothesis. The program consisted of two main parts. The first simulated a uniform, non-turbulent environment in which concentration declined monotonously from the source (located at (0,0) in the simulated environment. The second simulated the odor tracking mechanisms (animat), one with memory for past success and one without. Results indicate better performance for the non-memory mechanism. This may be due to the simple, non-turbulent environment. Future simulations will examine these strategies under noisy conditions, in which we expect the memory mechanism to yield better success.

PSY-7. CATEGORIZATION OF JAPANESE SPATIAL TERMS BY MONOLINGUAL JAPANESE-SPEAKING CHILDREN AND ADULTS

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

According to our traditional views, cognitive universals allow for easy acquisition of simple spatial terms in all languages. However, it has since become apparent that across languages children easily learn spatial relational terms of widely different forms.

The present research examines acquisition of Japanese spatial terms to be compared with previous research on English and Korean. The production of Japanese spatial terms by monolingual Japanese-speaking children and adults was assessed using an elicited production task. We used the same or similar objects used by Choi & Bowerman who examined production of spatial terms in Korean and English. For example, the experimenter shows a child a ring and a pole and then begins to demonstrate placing the ring on the pole. The experimenter asks the child, "See the ring and the pole? Now can you tell me what I did with these objects?" and the child is then encouraged to respond to the question. We tested monolingual Japanese-speaking two-year-old children (N = 8) and adults (N = 20) using this same technique.

Considerable agreement between the words produced by adults and children was found; however, disparities suggest that children are parsing larger spatial categories than adults, a finding consistent with studies on Korean and English. These data show that languages differ more dramatically than can be easily accounted for by our traditional theories. Another difference involves the manner in which each language grammaticizes the relations tested (e.g., prepositions v. verbs).

PSY-8. TESTING A PHYSIOLOGICAL MODEL OF PERCEPTUAL GROUPING BASED UPON ADJACENCY AND STRING LENGTH OF COMMON ELEMENTS.

Shaya I. Klechevsky# and Daniel D. Kurylo, Department of Psychology, Brooklyn College-CUNY, Brooklyn, NY 11210

Perceptual grouping allows neural representations of separate stimulus elements to become integrated across the cortical surface. Separate possible patterns of grouping compete for assignment, which is guided by relationships among stimulus elements. Because stimulus elements are systematically represented on the cortex, an analysis of stimulus metrics may be used to determine underlying mechanisms by which cortical circuits assign grouping patterns. For grouping by similarity, binding of elements is based upon relationships among elements with common stimulus features (e.g., color). A preliminary model was developed in which the sum of adjacent common elements for one grouping pattern needs to exceed adjacencies of a competing pattern by a critical value. An analysis was then made to determine if string length of adjacent elements contributes an additional weighting factor to binding strength. To test this, perceptual measurements were made for stimuli with unconstrained string length, as well as stimuli with limited string length, but identical occurrences of adjacencies. Stimuli with limited string length produced elevated perceptual thresholds. These results indicate that longer sequences of adjacent elements enhance perceptual binding strength. These results are consistent with the distribution of long-range pyramidal cells which serve to integrate activity across the cortex.

PSY-9. SPARED IMPLICIT LEARNING FUNCTIONS IN BRAIN DAMAGED PATIENT POPULATIONS.

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One of the hallmarks of stroke, traumatic brain injury and other assaults on the brain is that such standard behaviors as memory, problem solving, and judgment are compromised. However, recent work suggests that functions that are carried out automatically, that is without conscious control, may survive such cortical insults. This study was designed to explore this possibility. Ten outpatients from Traumatic Brain Injury clinic at Peninsula Hospital participated in the study over a five-day period. The patients suffered from a variety of cortical insults ranging from stroke to closed head injuries. Most have clear evidence of frontal lobe damage.

All patients were run through two tasks designed to examine unconscious or *implicit* cognitive functions, an Artificial Grammar Learning (AGL) paradigm and a Sequence Reaction Time (SRT) task. In the AGL procedure participants work with a series of letter strings constructed according to a set of rules (the “artificial grammar”). Later, they are asked to classify novel letter strings as to whether they follow the rules. In the SRT task subjects press a button as soon as a target stimulus appears on a screen. Like the AGL task, the target pops up in particular locations based on a complex rule. In these experiments healthy subjects typically learn with little or no conscious awareness of the actual rules.

Despite the fact that these patients all show significant loss of cognitive functions as assessed by standard neurocognitive tests, significant levels of implicit learning were found on both tasks. The suggestion is that the implicit system and its underlying neuroanatomical structures, remain largely intact in the face of neurological insult.

PSY-10. ABSENCE OF TOP-DOWN INFLUENCE ON PERCEPTUAL GROUPING BY SIMILARITY

Jennifer Cohan[#] and Daniel D. Kurylo, Department of Psychology, Brooklyn College-CUNY, Brooklyn, NY 11210

A void exists in research on top-down influence on perceptual organization. Although perceptual organization is generally thought to be a relatively low-level automatic process, contemporary research on early cortical sensory processing emphasizes feedback circuits from extrastriate areas that modify receptive fields based upon context. Such mechanisms are well suited to bias grouping assignment of stimulus elements, particularly with complex or bi-stable stimuli. To test this prediction, a cue-probe paradigm was used. This technique has been used previously to study enhancement effects of expectancy on sensory detection thresholds. On each trial, subjects viewed a clearly visible set of lines, oriented either vertically or horizontally (cue). Following a brief delay, subjects then viewed a grid of colored squares in which the same colors were aligned either vertically or horizontally (probe). Subjects then indicated the orientation

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of the cue and probe, respectively. Across trials, the color coherence of the probe was progressively reduced until the stimulus became bi-stable, thereby establishing the grouping threshold. On 67% of trials, the cue was in the same orientation as the probe (valid), whereas the cue and probe were inconsistent on 33% of trials (invalid). Grouping threshold for valid and invalid trials did not differ significantly, indicating an absence of top-down influence with these conditions. These results are consistent with the theory (Kurylo 1997, 2003) that certain forms of perceptual organization are established by algorithms intrinsic to local circuitry that are responsive to physical metrics of stimulus elements.

PSY-11 Measurement of Vergence and Accommodation Using Digital Photography

Susan Fraymovich#, Helen Basyuk#, Inna Soybelman, Stella Domenech, Martin J. Scanlon, Louise Hainline, Department of Psychology, Brooklyn College-CUNY, Brooklyn, NY 11210

Past research in our laboratory at Brooklyn College has shown that early screening for refractive errors in infants can be beneficial. The original system employed standard 35 mm film to photograph subjects' eyes, while they were focusing on real targets at set distances. While the older system generated useful results, the system had drawbacks that could be improved upon by the use of new technology. The new device now implements a digital camera rather than film, integrating optics that generate virtual targets. Our poster shows that computer based alterations of images from the new device give results consistent with the old film-based system for accommodation. Results for vergence are more problematic.

ANTH-1 Finnbogastadir: North-Western Icelandic Subsistence Analyzed Through an Archaeological Perspective

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The archaeofaunal collection from Finnbogastadir, a rescue archaeology project, provides a translinear look into the consumption and trade patterns, as well as the general lifestyle at this early-modern, Northwestern Icelandic farmsite. Through analysis and metric reconstructions, along with historical background research, a picture of an Icelandic fish curing-production and consumption site is made clear. The archaeofauna includes bones representing the gadid family along with smaller traces of other marine fish, domesticates, marine mammals, birds and mollusks. The presence of cut and butchered cow and sheep bones provide hints towards daily lifestyle and economic classification, while the presence of marine mammal and bird remains provide a more comprehensive understanding of coastal subsistence and life on an early-modern Icelandic farm.

Project generously funded by the NSF-REU Program

ANTH-2 GJOGUR, A FISHING FARM SITE IN NORTH WEST ICELAND, ZOOARCHAEOLOGICAL ANALYSIS

Yekaterina Krivogorskaya#, Research Experience for Undergraduates, National Science Foundation, Brooklyn Zooarchaeology Laboratory, Brooklyn College, City University of New York

The goal of this study is to analyze faunal remains from the excavations of the Gjogur farm, North West Iceland, to better understand the economy of this rural fishing farm that is thought to date back to settlement period in Iceland (ca AD 874), as well as change through time and effect of land and resource management on the environment. Iceland has a rich fisheries history, with evidence for subsistence fishing and local level exchange of prepared fish products. The geographic location of Iceland as well as the data from this project indicates that fishing and marine mammal exploitation were major supplements to farming in Iceland.

In addition to the laboratory analysis, written sources have been consulted for data interpretation as well as historical context of the site. The Gjogur site represents a chronological sequence that can tell us a great deal about usage of the farm from settlement period to modern days. The data obtained in this study is representative of other fishing farm sites in Iceland, like Finnbogastadir and Akurvik, and can be contrasted with more urban sites like Tjarnagata.

SPEECH-1 THE ASSESSMENT OF VERBAL WORKING MEMORY IN AMERICAN AND HUNGARIAN CHILDREN WITH SPECIFIC LANGUAGE IMPAIRMENTS: THE IMPACT OF SYNTACTIC COMPLEXITY AND SENTENCE LENGTH ON LANGUAGE COMPREHENSION

Valeriya Katsnelson#, Shlomit Azimov# and Dr. Klara Marton, Department of Speech Communication Arts & Sciences, Brooklyn College-CUNY, Brooklyn, NY 11210

Specific Language Impairment (SLI) is defined as difficulty with expressive and receptive language in the absence of other diagnostic features (Botting & Conti-Ramsden, 2001; Montgomery, 2002). Verbal working memory (VWM) correlates with several language processes in children, including sentence comprehension (Daneman & Carpenter, 1980). The first goal of this study was to examine how children's VWM performance on a Nonword Repetition Task varies when syntactic complexity and sentence length changes, focusing on the differences between Hungarian and American children with SLI. The question is whether one group will be more affected by the growth in sentence length, while the other by the growth in sentence complexity due to the differences in the morphemic systems of the two languages. Second, we compared the differences in VWM performance of Hungarian children with SLI and children with typical language development (TLD) to the differences in performance between American children with SLI and TLD, when syntactic complexity and sentence length vary. We hypothesized that the deterioration in VWM performance with increased syntactic complexity and sentence length is equally greater for children with SLI than for their typically developing peers, for both the Hungarian and American subjects.

Four groups of children participated in this study: American children with TLD, American children with SLI, Hungarian children with TLD, and Hungarian children with

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SLI (ages: 7-10 years). Our tasks combined the traditional nonword repetition tasks and sentence comprehension using sentences that differed in length and complexity. The results revealed that the American children with SLI performed more poorly than both the American and Hungarian children with TLD, but did not differ from the Hungarian children with SLI due to difficulties with simultaneous processing. However, syntactic complexity had a larger effect on performance accuracy than the sentence length on the American children, whereas sentence-length played a more important role than sentence complexity in the Hungarian children's performance.

BIO-1 SYNTHESIS OF A MODEL OF THE ABC RINGS OF THE AZICEMICIN ANTIBIOTICS.

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A new structural class of the antibiotics *Azicemicins A* and *B* were isolated from the culture broth of the strain MJ126-NF4, which was closely related to *Amycolatopsis sulphurea*. *Azicemicins A* and *B* have moderate growth inhibiting activity against Gram-positive bacteria and mycobacterium. They are characterized by the angucycline ring system containing specific functional groups: the carbonyl groups at C1, C6, the hydroxyl groups at C3, C12b, and the aziridine group at C3.

We are working on the development of a convenient and efficient method for the synthesis of a model of the ABC ring of *Azicemicins A* and *B* using an intermolecular Diels-Alder reaction of an Isobenzofuran. 2,5-Dimethoxybenzoic acid **1** was converted to *N,N*-diethyl-2,5-Dimethoxybenzamide **2** by treatment of its acyl chloride with diethyl amine. *N,N*-Diethyl-2-formyl-3,6-dimethoxybenzamide **3** was synthesized by treating the 2-lithio derivative of **2** with ethyl formate.

The dienophile segment was synthesized by coupling 2-lithio-1,3-dithiane **4** with (*R*)-glycidyl tosylate **5** generating the epoxide **6** which was directly converted to 2-[(2*S*)-2-hydroxy-4-pentenyl]-1,3-dithiane **7** by treatment with vinyl cuprate. The hydroxyl group on **7** was then protected as the benzyl ether. As a result, 2-[(2*S*)-2-*p*-Methoxybenzyloxy-4-pentenyl]-1,3-dithiane **8** was formed.

We have successfully synthesized the two fragments required for the intramolecular Diels-Alder reaction leading to the ABC ring model of the *Azicemizings*.

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BIO-2 TACTILE LEARNING IN CRAYFISH: THE EFFECTS OF FLOW

Kerian V. Service# and Yevgeniy Voloshchuck#, Laboratory of Dr. J. Basil, Department of Biology, Brooklyn College, CUNY. Brooklyn NY 11210.

The American freshwater crayfish, *Procambarus clarkii*, is equivalent to its Australian counterpart, *Cherax destructor*, in occupying similar niches (often turbid water) and exhibiting similar tactile behavior- habituation (reduction in exploratory behavior) when placed in a test arena daily for 40 min trials exceeding 4 days, and dishabituation (immediate increase in exploratory activity) when the environment is altered. These observations came from experimental testing carried out in a no-flow environment. Since *Procambarus clarkii* inhabit aquatic environments where flow is a factor (such as streams), the sense of flow in a particular direction (in addition to tactile information) may be used by the animals as a cue in mapping their environment. To test the above hypothesis, in an ongoing experiment the crayfish's environment was reversed relative to flow. Animals were introduced into a 40 x 44 x 17 cm mesh arena containing a short triangular partition projecting 11cm inward from the midpoint of one of the short walls. For one 40-min trial a day, for 4 days, each animal was placed in the arena with the triangular projection on the downstream end of the arena. On the fifth day, the animal was introduced into the arena that was turned so that the triangular partition was on the upstream wall. We used the time they spent exploring the triangular wall as a measure of their habituation and dishabituation to the arena.

BIO-3 Investigating the attachment mechanism of *Agrobacterium tumefaciens* using *Saccharomyces cerevisiae* as a surrogate host.

Betty Noel# and Dr. Theodore Muth

Department of Biology, Brooklyn College CUNY, Brooklyn, NY 11210

Agrobacterium tumefaciens is the causative agent of crown gall disease in plants. *A. tumefaciens* transfers a piece of its DNA (T-DNA or transfer DNA) from its Ti (tumor-inducing) plasmid into host plant cells where it is incorporated into the plant DNA. Genes coding for plant growth hormones are present in the T-DNA. When these growth hormones are expressed in plant cells infected by *A. tumefaciens* it causes the cells to grow out of control and form tumors. *A. tumefaciens* uses a type IV secretion complex, which is coded by the VirB operon, to move the T-DNA out of the bacteria and into the host cell. The attachment of *A. tumefaciens* to host cells is essential for an infection to be established. The attachment between the bacterium and the plant cells is initiated by a loose attachment step, followed by a second, stronger, interaction mediated by cellulose fibrils. Although several bacterial factors have been identified as being required for attachment to take place, the specific interactions between host and pathogen attachment components have yet to be described. The mechanism for transfer of the T-DNA into host cells, following attachment, is also not understood with a great degree of detail. We are looking for attachment factors on the surface of the plant cell. A vitronectin-like protein expressed in plant cells may be involved in the attachment of *A. tumefaciens* to these cells. Vitronectin is an adhesion protein found in the extracellular matrix of animal epithelial cells. It has also been identified as an attachment site for several bacterial pathogens. An arabinoglactan protein that when mutated is resistant to *Agrobacterium* transformation, Rat 1, has also been found.

We hypothesize that the poor transformation efficiency exhibited by yeast is in part because *A. tumefaciens* are unable to attach well to the yeast cells. We are trying to test this hypothesis in two ways. The first is by expressing vitronectin at the surface of yeast and measuring whether this enhances attachment interactions. The second way is to express the arabinoglactan protein on the surface of yeast and to measure whether it enhances attachment interactions. We will express vitronectin and Rat1, separately, in the pYD1 expression vector (Invitrogen) that targets the protein to the surface of the yeast cells. We will then use a fluorescence activated cell sorting (FACS) protocol, and a biological "panning" assay, to determine whether vitronectin or Rat1 expressed on the surface of yeast enhances attachment interactions.

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BIO-4 GENETIC ANALYSIS OF FUSION-DEFECTIVE INSERTIONAL MUTANTS USING ARTIFICIAL FUSION TECHNIQUES.

Keycharrianne Navarro#, Munevver Aksoy and Charlene L. Forest, Department of Biology, Brooklyn College-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 student in our lab. The mutant named clone 45, is able to 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 attempt to produce either zygotes, by artificially fusing gametes, or diploids, by fusing vegetative cells. Genetic analysis of germinated zygotes would allow us to determine if the fusion gene and insertion are linked, while analysis of diploids will, in addition, allow us to determine if the mutation is dominant. In addition, once these techniques are standardized, we can use them to study new mutants, as they are produced.

BIO-5 CLONING A GAMETE FUSION GENE USING INSERTIONAL FUSION-DEFECTIVE MUTANTS

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

Our goal is to isolate the gene responsible for gamete fusion in *Chlamydomonas reinhardtii*, a unicellular, eukaryotic green algae. My project involves generation and analysis of fusion-defective mutants and then using these mutants to clone the gene. A streptomycin resistant strain, CC-275 *sr-u-2-23 mt*⁻, was used in generation of mutants. The plasmid pSP124S, containing the *ble* gene, was inserted as a random mutagen using the acid-washed beads transformation technique. The mutants were selected using the streptomycin selection procedure and were analyzed with phase-contrast microscopy. Approximately 700 non-mating colonies were isolated and experiments were done to find the mating deficiencies in these mutants. Also isolated were non-agglutinating mutants and non-motile mutants with low fusion capacity. I isolated one motile fusion-defective mutant, clone 9-5. Clone 9-5 forms 15 % pairs when mated with the opposite mating type (similar to the pair formation in *gam* mutants). We have tried to fuse, clone-45 (a fusion-defective mutant isolated by a previous student, Tammy La) using the PEG fusion procedure, but have not been able to produce viable zygotes. Southern Blot analysis showed 1 insertion for clone-45, and 2 insertions for clone- 9-5. We are now using LMS-PCR to identify the genomic sequences flanking the insertion in the mutant's genome. After PCR, we will sequence this flanking DNA and compare it to gamete/zygote EST library available from *Chlamydomonas* genome center as well as the full genomic sequence which is now available as a blast database.

BIO-6 STUDY OF SUPPRESSORS OF MUTATIONS IN YEAST ANAPHASE MOTOR PROTEINS.

Yolanda M.N Hillocks#, MARC Program and Dan Eshel, Department of Biology, Brooklyn College- CUNY, Brooklyn, NY 11210

Microtubules and their associated motor proteins are involved in several important processes in the eukaryotic cell including chromosome segregation in mitosis and meiosis, transport of vesicles and organelles and the movement of cilia and flagella. Recently, we performed a genomic screen to identify genes that, when overexpressed, can suppress mutations in the yeast anaphase microtubule motors Dyn1p and Cin8p (Steinberg-Neifach and Eshel, *Mol. Gen. Genet.* 264,2000,300-305; Steinberg-Neifach and Eshel, *Biol. Cell* 94,2002,147-156). One of the suppressing clones identified in this screen, #281, has a genomic insert of 7.5 kb from the yeast chromosome XIII containing three open reading frames (ORF). One is the gene FCP1 that encodes for a TFIIF (transcription factor IIF) interacting component and the other two are hypothetical ORFs not yet studied. We have designed a scheme to digest plasmid #281 with various restriction enzymes before re-ligation. The resulting plasmids in which one or two genes are deleted by these treatments are presently being re-transformed into *dyn1 cin8* yeast cells in order to pinpoint the specific suppressor gene in this clone. Previously, we have demonstrated that other suppressors identified in the same screen act through stabilization of microtubules. Identification and characterization of the specific suppressor in clone #281 and understanding the mechanism by which it suppresses the above mutations will contribute to our knowledge on microtubule regulation in cells. The discovery of novel proteins that directly or indirectly affect microtubule stability may also be beneficial for the design of future drugs for cancer therapy that target microtubules in affected cells.
Supported by NIH/NIGMS MARC Program GM08078

BIO-7 The Nautilus Pompilius's Using Of Its Senses

Bahctinova Iryna.

Research Advisor: Mr. Steven Kaye

Abstract/Hypothesis

The creature known as the *Nautilus pompilius* that lives now in the tropical waters all over the world is found in fossils from thousands of years before, it still didn't really change. The animal saved the same abilities and the sensory system as many centuries ago. This keeps the scientists constantly wondering about the complicated senses of the *Nautilus pompilius* those move the animal through the difficulties and the dangers of the outside world all this time. This incredible "living span" caught my eye and made me be interested in working with the *Nautilus pompilius*. My first work from the last year "the Habituation of *Nautilus pompilius*" especially inspired my research, as I got to know how amazing the behavior and the possibilities of these animals are. This year I am interested in uncovering the senses by which the *Nautilus pompilius* habituate to humans and recognizes the different persons from one another. So I tried to test every other sense the *Nautilus* has, as 1) vision, by handling the *Nautilus* in the dark room and videotaping its

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behavior to see if it can recognize my presence; 2) then olfactory sense (the sense of taste and smell) by having the rubber gloves on while handling the Nautilus to see if the Nautilus can recognize the presence of human being and to distinguish between the two humans handling it (with the different odor present) without being able to feel the smell through the rubber gloves; 3) The last left is the touch sense, if the Nautilus can notice the slightest differences in the motion of the hand to distinguish between the humans. The experiments are also conducted to see the differences in the usage of the senses by the youngsters and the aged Nautiluses as those were proven to be less reactive than the others from the last year's project of mine, never known why.

The hypothesis is: The most important sense that the nautilus pompilius uses in the habituation process is the touch and olfactory sense. The young and the old Nautiluses can have less developed or already less reactive senses. I strongly suspect also that the Nautiluses have some kind of chemical communication by excreting the chemicals in the water when reacting to something and the other animals in the same tank as the tested one can detect the presence of the human or become distressed before being tested themselves through the chemicals in the water released by the tested animal. The older and younger animals can have difficulties in the analyzing the source of the chemicals and the meaning of them.

Although the reason of such "loss of the communication" is unknown, it probably would be the topic of my research in the future while I would love to continue with the work on the wonderful and in a sense surprising creature-the *Nautilus pompilius*.

BIO-8 SYNTHESIS OF THE MODEL OF ABC RINGS OF THE ANGUCYCLINES

Tony Nicolas and M.Julieth Ballesteros#, Department of Physical and Biological Sciences, New York City College of Technology-CUNY, 300 Jay Street, Brooklyn New York 11201

The Angucyclines are an important class of natural products. In addition to synthetically challenging structures they possess a broad spectrum of biological properties. The construction of the ABC ring fragment constitutes one of the major challenges in the synthesis of the natural products. We are pursuing a synthesis of the ABC ring system of the Angucyclines through a Diels-Alder reaction of an Isobenzofuran fragment with an allene sulfone in order to establish the BC ring system. A subsequent RCM step will complete the closure of ring A.

The preparation of the phthalide precursor to the Isobenzofuran diene was accomplished by the coupling of *N, N*-diethyl-2-formyl-3,6-dimethoxybenzamide with 2-lithio-2-(2-butenyl)-1,3-dithiane followed by acid catalyzed cyclization. The aldehyde (5) itself was prepared in four steps from 2, 5-dimethoxybenzoic acid via its acyl chloride. Treatment of the acyl chloride with diethyl amine furnished the diethyl benzamide derivative, which was converted to the required aldehyde by ortho lithiation followed by treatment with DMF. The dithiane derivative involved in the synthesis of the phthalide was obtained from the coupling of 2-lithio-1,2-dithiane with 4-bromobutene.

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The allene sulfone dienophile was synthesized by the reaction of an propargyl alcohol derivative with trichloromethanesulfonyl chloride followed by oxidation of the resulting allene sulfoxide to the corresponding sulfone.

The Isobenzofuran-allene sulfone Diels-Alder reaction establishes the BC ring System. The RCM is the next synthetic step for closing the A ring.

Founded by NIH, MBRS-R25GM59165-04

Participant in RISE and AMP program

BIO-9 PATTERNS OF FORAGING AND COMMUNAL NEST BEHAVIORS OF NATURALIZED MONK PARAKEETS

Mujinga Martineau#, *Basil Laboratory, Department of Biology, Brooklyn College-CUNY, Brooklyn, NY 11210*

Monk Parakeets are naturalized parrots that came from South America and have established themselves in the U.S. , some on Brooklyn College campus. They are highly social, building conspicuous, enclosed communal nests that are large and contain many isolated chambers. Parakeets also rely on group dynamics while foraging (Total Time= time feeding + time scanning + time fighting). In order to study cooperative foraging, we first located the nests throughout campus (twelve nests) and focused on seven. We visited these nests at different times of day, observing each nest for 5 min. For each nest, we recorded the number of birds flying in, flying out, time in, time out, and temperature. Nest 4 was the most active of all. Temperature has a major impact on the group activity of parakeets. For instance, on warmer days there was more activity than colder ones. In the future, we will continue to study basic parameters of the entire population and then examine group foraging interactions on a smaller scale.

BIO-10 The Effect of Herbal Substances on Daphnia

Adeel Mohammad* Advisor : Mr. Steven Kaye
James Madison High School

Problem: How do herbal products affect the heart rate of Daphnia?

Hypothesis: There are certain stimuli that increase the heart rate of daphnia, while certain are depressants. We have tested green tea, with the results that the tea was a stimulus, but not by much.

Procedure: We started with a culture of daphnia Magnus that we had to contain in a very specific environment. Everything had to be kept in a very specific range, including the ph and temperature. They feed off algae and since algae need a lot of sunlight, we had to leave them in sunlight. Next, for final preparation, we made a strong solution of green tea by putting a bag into 10 g of water and keeping it like that over the weekend. This made the green tea solution very strong and good enough to use for the tests.

Then we took the daphnia and putting it in a plain water solution on a slide, and under a high-powered microscope we counted its heart rate (beats per min) 10 times. We recorded the data. Our green tea solution consisted of only one tea bag left over a period

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of one week. Then we tested it using the herbal product of green tea solution that we made before. We used 1 ounce of water for every drop of green tea to make our solution. We put that same daphnia, able to test only a few in a short period, into the solution and again counted the heart rate. We did 10 trials of each with one-minute intervals for each daphnia. After some time we began to shift our topic towards biochemistry and how the different compositions in green tea affect living organisms, such as daphnia. Our research is still in progress of improving our data and to go more in depth in our research.

BIO-11 Does Monk Parakeet Occupy the Niche of Extinct Carolina Parakeets?

Kate Taponarova* and Irina Pyatigorskaya*

Advisor: Mr. Steven Kaye

When the Europeans first came to North America there were millions of green parakeets filling the skies. These beautiful birds, known as Carolina Parakeets, had yellow heads and orange faces. John James Audubon and many other early naturalists and artists painted pictures of them. But now they are gone. The only parrot native to what is now the United States has been extinct since the beginning of the twentieth century. Numbers of these birds were beginning to decline as early as the 1880s, and the last known Carolina parakeet died in the Cincinnati Zoo in 1918. However over the past 30 years, by accident, and sometimes by design, groups of other parrots known as Monk (or Quaker) parakeets have been released to the wild and in several areas of the country. Now you can see nests of Quakers all over the US, they are aseptically common in New York, Chicago and Florida.

The Monk Parakeet is very similar in size and color to the extinct Carolina Parakeet. The Monk parakeet has white forehead, chin, and breast, blue flight feathers and an entirely green tail. Like the monk parakeet, the Carolina parakeet was a colorful, small parrot that lived on an elected diet of seeds, buds, and fruits and was kept as a caged bird. Both birds were always found in flocks, they have tolerated extreme weather conditions thanks to their unusual nesting, and both have been hunted by farmers who thought their crops were threatened and because of their beautiful feathers that were used to decorate headgear. Even their calls, when compared, were found to be almost identical. For example, a famous ornithologist John James Audubon, in his works about Carolina parakeet, wrote that when an individual bird was shot it would produce a certain call that made the others in that flock go to their wounded comrade. The same thing was observed with Monk parakeets, they too seem to have a special call that indicates danger and brings the whole flock together.

The biggest behavioral difference between the two species is that the Carolina parakeet was a tree-cavity dweller. The clearing of forests and the introduction of European honeybees, which competed with the birds for hollow trees and reduced the numbers of Carolina parakeets. But the incredible similarity, not only in looks but also in feeding and nesting behavior of those two species, helped us to come up with the theory that Monk parakeet could occupy the niche vacated by the extinct Carolina parakeet.

BIO-12 What are the Pathways in Apoptosis

Ernest Karabas*

Research Advisor: Steven Kaye

James Madison High School

Control of the activation of apoptosis is important both in development and in protection against cancer. In the classic genetic model *Caenorhabditis elegans*, the pro-apoptotic protein CED-4 activates the CED-3 caspase and is inhibited by the Bcl-2-like protein CED-9. CED-4 can interact with CED-3 and its mammalian counterpart interleukin-1beta-converting enzyme (ICE), Thus CED-4 plays a central role in the cell death pathway, biochemically linking CED-9 to CED-3 and the ICE family of pro-apoptotic cysteine proteases.

HNS-1. THE EFFECTS OF TCDD AND DIETARY FACTORS ON THE EXPRESSION OF CYP1A2.

Jumoke Daramola* and Jean Grassman. Department of Health and Nutrition Sciences, Brooklyn College-CUNY, Brooklyn, NY 11210.

Dioxins are highly toxic, widely dispersed environmental contaminants. They are by products of industrial processes such as incineration, and combustion. The most potent dioxin, 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD) is considered to be a human carcinogen. Everyone is exposed to dioxins through their diet, primarily through the consumption of animal fat from fish, meat and dairy products. Because dioxins are fat-soluble, they tend to accumulate in body fat. In addition, humans metabolize dioxins slowly and as a result, dioxins continue to accumulate in the body over a period of time. Rodent studies identified CYP1A2 as the binding protein leading to dioxin accumulation in the liver. A recent study provides evidence that CYP1A2 also sequester dioxins in humans. Other studies have show TCDD and other dioxins to be inducers of CYP1A2. However, the effects of TCDD and dietary factors on CYP1A2 expression have not been measured. This study will examine components of diet that affect the body's ability to store dioxins in the liver. The study will use a simple in vitro system of immortalized liver cells (HepG2 cells) to determine factors that affect the expression of CYP1A2. The cells will be cultured to allow for a variety of treatment levels. Initially, the HepG2 cells will be pre-treated with different concentrations of caffeine to determine caffeine concentrations that will induce CYP1A2 expression. This will serve as a model for the treatment of the HepG2 cells with TCDD. Similarly, the cells will be treated with TCDD. The measurement of CYP1A2 expression will be observed through quantitative RT-PCR. Comparisons in the levels of CYP1A2 expression will be used to determine whether there is inhibitory or synergistic effect on the induction of CYP1A2 by TCDD.

HNS-2. Investigation into the Diffusion of Cigarette Content

Jamar Rambally*, Kareem Wegman*, Gregory Geffrard*

Middle College High School At Medgar Evers College

The goal of this study is to simulate the diffusion of smoke through body tissues and highlight the dangers of smoking. The experiment showed how the content of cigarette diffuses through the lungs and possibly the placenta. The experiment was carried out by emerging a dialysis sac with distilled water into mixture of smoke filled distilled water. Different dialysis sacs were also placed into an extract of cigarette smoke. Litmus paper and universal indicator were used to test pH changes which indicated if diffusion occurred. Other changes in the dialysis tubing were also recorded and relevant inferences were concluded.

PEES-1. AN ANIMAL MODEL OF DELAYED PUBERTY

Sandra Shaw*[^], Amit Khaneja#, Angela Corcoran*, Vanessa Yingling*

*Physical Education & Exercise Science, #Health and Nutrition Sciences, Brooklyn College

Low bone mass has emerged as a crucial factor that may contribute to the development of osteoporosis. In women 50% of bone mass development occurs during puberty (Rakover, 2001). Drinkwater et al (1984) suggests that the average bone mineral density of amenorrheic athletes (low estrogen levels) was equivalent to that of women 51.2 years of age, therefore delayed menarche may decrease bone mass accrual and thus contribute to the development of osteoporosis. The aim of this study was to develop an animal model of delayed puberty and to determine the effects of delayed puberty on bone strength.

This study examined 11 female rats (29 days age), 6 experimental and 5 controls. The experimental rats were injected with a GnRH antagonist for 18 days. Vaginal swabs were taken on the day of vaginal opening in all rats. Sacrifice occurred during the estrus phase for both control and experimental animals. The uterus, ovary, femur and tibia of all rats were harvested and weighed. The structural strength of the tibiae and femora were tested using three-point bending at a load rate of 1mm/second. There was a delay in the time of vaginal opening in the experimental rats. Furthermore, the uterine and ovary weights were significantly lower in the experimental rats compared to the control rats ($p < 0.05$) suggesting that the onset of puberty was delayed. The bone strength (maximal force at failure) in the delayed puberty group was significantly lower ($p < 0.05$). This model of delayed puberty will provide a foundation for future investigations regarding the optimization of peak bone mass obtained during adolescence.

This work was supported (in part) by grants from the National Institutes of Health (R15 AG19654-01A1) and The City University of New York PSC-CUNY Research Award Program (64293-00 33).

ENG-1. Can microcontrollers be used to automate a green house?

Victor Atlasman*, Steven Tsardounis*, Andrew Eichel*

Research Advisor: Mr. Steven Kaye

James Madison High School

Plants have specific requirements for survival. These include light, humidity, and Temperature. Agricultural greenhouses are used to provide the optimal conditions for plant growth. The maintenance of a greenhouse requires frequent monitoring of data and frequent adjustments to sustain the internal conditions.

If greenhouse type environments were to be established in space and provide long-term space missions with food and oxygen recycling, automated control would be necessary. Several years ago an artificial environment called The Biosphere attempted to use this strategy but failed.

Our research is investigating whether simple microcontroller circuits could be used for data acquisitions and control to regulate conditions in a greenhouse. The research is ongoing.

ENG-2 Can Riblets Improve Rocket Performance?

Denis Oreshkin*, Denis Bulet*

Advisor: Mr. Steven Kaye

Riblets, One of a series of microscopic grooves, each a few thousandths of an inch wide, inscribed on the surface of an adhesive-backed tape Surfaces with riblets create less drag and friction. Riblets are generally used for rockets, missiles, ships, planes, and submarines.

If riblets were introduced to commercial airlines, the outcome of their use would be quite beneficial. The riblets would either provide less fuel consumption or increase the flight distances of airliners. Boeing is currently producing an airliner making use of the riblets, developments of this airliner have not been released to the public.

ENG-3. Flow Visualization Modeling Of Flexible Membrane Interaction With Viscous Simulated Biofluid

Yuki Song* Research Advisor: Dr. Wong/Mr. Steven Kaye

James Madison High School

In this paper, Bio-fluid-membrane interaction is investigated through flow visualization method, pressure, and flow-rate measurement. The flexible membrane interacting with viscous biofluid is proven to be an important factor in the formation of stenosis in the human vessels. The interaction was simulated by flow through a flexible tube. The two-dimensional image of fluid velocity profile within the flexible membrane was captured by particle image velocimetry (PIV) system, where vortex shedding and flow separation occurred. The recorded results can provide an insight on the mechanism of stenosis formation.

ENG-4 THERMAL ELECTRIC COOLING OF A CPU CHIP.

Vadim J. Bychok*, Abdullah Javed, Lous Li.

James Madison High School
Research Advisor: Mr. Steven Kaye

In the computer field customers constantly demand machines that are smaller and faster than the previous generations. Increased Processing leads to increased heat production. If the chips overheat, the computer crashes, and information gets lost.

Traditional cooling methods include Aluminum heatsinks that radiate the heat into the surrounding air, and fans. With the most powerful CPU's (Central Processing Unit) these methods could not keep up with the heat production. Experiments have been performed using peltier junctions (Thermal Electric cooling) to study active heat removal from the CPU chip. The experiments yielded promising results.

ENG-5 Thermally Induced Deformation as the Triggering Event in the Failure of the Twin Towers

Yevgeniy Slutskiy*

High School: James Madison High School
Research Adviser: Steven Kaye

Many questions about the events of September 11th terrorist attack on the World Trade Center have been left unanswered. One of the biggest issues from the engineers' perspective is why the steel in the World Trade Center failed. A lot of contradictory material about the fireproofing and performance of the buildings was released up to this date.

The study which follows examines the structure of the weight bearing floor trusses under conditions of thermal expansion and deformation due to heat and unexpected loads. It suggests possible reasons for the failure of the WTC Towers.

**ENV-1 THE ENVIRONMENTAL IMPACT OF SEPTEMBER 11, 2001,
AND THE PUBLIC PERCEPTION OF THE IMPACT.**

COREY BRASWELL#, ANNEMARIE TURZILLI#, MELISSA TORRES#,
CATHERINE MARQUEZ#, MILAGROS GARCIA #, AND MARIA LIATSIS#

Brooklyn College

The objective of our project is to investigate the environmental impact of the 9/11 catastrophe and the public's reaction to it. The air quality was greatly contaminated, and many people faced serious health risks. Marine life in nearby bodies of water was greatly affected.

Among the immediate exposure concerns are agents such as asbestos from concrete, polychlorinated biphenyls (PCBs) from electrical wiring, dioxins from jet fuel combustion, particulate matter from pulverized concrete and other building materials, and lead and other metals from computers and monitors. By some accounts, Marine creatures in this area sustained a double whammy from the events of 9/11: the fallout of thousands of tons of airborne debris, and subsequent digging up by dredging that deepened channels to allow barges in to carry out the rubble.

It was reported that dust and debris on 9/11/01 affected thousands of people with the "World Trade Center cough" that diminished lung capacity. There have also been many cases of laryngitis, sinusitis, and asthma in addition to the WTC cough. Dr. Steven Levin of Mount Sinai School of Medicine (who treated many people at Ground Zero) stated, "I have very few patients who in fact have returned to pre-9/11 levels of lung function." The EPA immediately began monitoring the air around the site for some pollutants, but the long-term effects of the potential exposures is yet to be known.

ENV-2 TO RECYCLE OR NOT TO RECYCLE, THAT IS THE QUESTION.

TASHA LONG#, NATASHA NURSE#, MAGDALENA GARCIA#,
SABRINA WINSTON#, DAWN JACKSON#

Brooklyn College

A comparative study was conducted by five college students to determine if recycling is really necessary in helping to reduce solid waste, energy and pollution or is recycling America's most wasteful activity in terms of cost? Our group compared statistics and data of New York City with other cities in the United States. Among one of the cities chosen was San Francisco, it was compared with New York City because its population density and diversity came closest to New York's. Our study shows the differences between each city in terms of how they recycle and what is recycled as well as the cost per ton (of the solid wastes.)

It is evident after a careful analysis and research of this data that the question should really be; Is New York City putting forth the honest effort in making recycling work or is cost a cover up in order to save the city a few extra dollars? Our group has carefully analyzed the data, now it is up to you, the observer-voter, to make the decision of whether recycling is beneficial for New York City or is it indeed one of America's most wasteful activities? You decide!

ENV-3 DREDGING OF THE GOWANUS CANAL?

EVAN STRASSER#, JEANMARIE SAPIENZA#, MARIA KAPNISAKIS#, JESSICA MANTIN#, IVETTE ORIOL#, STEFANIE HARARI#

The Gowanus Canal, located in Brooklyn New York, which was constructed in the 1860's, has very little tidal exchange with open water. Since the 1900's the water quality has been rapidly deteriorating. The Canal has been a source of public complaints because of odor as well as the health hazards it presents in the form of Cholera, Hepatitis and much more. To reverse the environmental degradation, the Gowanus Flushing Tunnel which had been out of operation for nearly twenty years, was recently repaired. The environmental health appears to be quickly restored but the sediment at the bottom "remembers" the history. A contentious possible solution is dredging the canal. In fact, a waterway very similar to the Gowanus Canal, located in San Antonio Texas, has been rehabilitated and turned from an eyesore full of health hazards, into a viable working tourist attraction which has greatly improved the community surrounding it. Our project investigates the dredging issue attempting to answer issues such as: Is it safe, how much will it cost, and exactly what the dredging consists of. After analyzing all of this information presented, it will then be up to you, fellow Brooklynites, to do what sees fit. Can there be a Venice in Brooklyn? The ball is in you're court!!!!

ENV-4 Controlled Crystallization of Struvite using Stearic Acid and Polymer Membranes.

Menachem Tabanpour*

NASA SHARP PLUS

Mentor: Phillip Barak PhD Advisor: Mr. Steven Kaye
Department of Soil Science UW-Madison

Phosphates released into the environment are a leading cause of eutrophication of water bodies because phosphate fertilizes aquatic plants, which leads to environmental, economical and human health problems. To mitigate this problem, regulations require that phosphates in municipal waste water be kept at a level of 1 ppm (mg/L) or below.

Struvite precipitation that occurs during the waste water treatment process, generally in places of high kinetic energy, obstructs water flow. Struvite (magnesium ammonium phosphate hexahydrate) is a naturally-occurring crystalline mineral that is used as a slow-release fertilizer. The high cost of struvite removal suggests that a method of controlled crystallization and struvite recovery would be beneficial.

The hypothesis under investigation is whether the methodology for the controlled crystallization of CaCO_3 could be adapted for the recovery of struvite. Initial experiments were performed using supersaturated solutions (x_1 , x_2 , x_4 , x_8 , x_{16} , x_{32} times struvite solubility) of Mg, NH_4 , and PO_4 to establish control levels. Then experiments were performed, first, using compressed, negatively-charged monomolecular layer of stearate floated over metastable solutions containing Mg, NH_4 , and PO_4 and, second, negatively-charged cation exchange membranes (e.g., commercially-available, sulfonate-based polymer membrane) conditioned with a phosphate-free solution and then immersed into metastable solutions containing dissolved magnesium, ammonium, and phosphate.

Environmental Studies

Solutions of x1, x2, and x4 supersaturation were chosen because they would be a good indication of reduced nucleation time since initial experiments showed them to crystallize in >48 hours. The experiments were performed several times and the results were compared.

Results showed that crystallization of struvite using both stearic acid and polymer membranes reduced the nucleation time for struvite crystallization from Mg, NH₄, and PO₄ solutions and enhanced the size and orientation of the crystals. The experiments using supersaturated solutions without the membranes to induce crystallization resulted in the x1 crystallizing in six days, x2 in four days, x4 in two days while the other solutions crystallized in <48 hours. The results confirmed that crystallization using the membranes reduced nucleation time by half; the x4 in <24 hours, x2 in <48 hours, and the x1 in less than <72 hours.

Controlled crystallization of struvite can potentially lower the cost of water and manure treatment by removing phosphate and the struvite byproduct can be sold. The low solubility of struvite ensures that the fertilizer phosphates from struvite will not end up in runoff. Using struvite to remove phosphate is much more efficient than systems used today and it has a potential impact on water quality around the globe.

CHEM-1 Synthesis of Enantiomeric Pure Phosphoroselenoate DNA for Structure Determination by X-ray Crystallography

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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 some studies on the novel synthesis of nucleoside triphosphates harboring the selenium functionality at the α -phosphate (NTP α Se) and their enzymatic incorporation into DNA or RNA using primer extension or in vitro transcription, respectively. To accomplish the synthesis of the NTP α Se, we exploited a nucleoside phosphite intermediate that was oxidized with selenium. Complete characterization of the analogs was carried out by ¹H-NMR, ³¹P-NMR, mass spectroscopy, and HPLC. To investigate the suitability of NTP α Se for the enzymatic synthesis of DNA and RNA, we studied the efficiency of incorporation of the HPLC-isolated diastereomers of uridine and thymidine α -selenotriphosphates at various Mg²⁺, EDTA, and NTP α Se/NTP concentrations. The level of incorporation was analyzed by comparative gel electrophoresis using radioactive ³²P-adenosine triphosphate. The results demonstrated that UTP α Se was an inhibitor of RNA polymerization, while TTP α Se promoted the polymerization of DNA efficiently.

* This work was supported by the graduate LS-AMP Fellowship and the Gates Millennium Scholarship.

Chem-2 Computer Analysis of Anomalous Microcrystalline Features Associated with Archaeological Sites

Andre R. Grange[#] and Mark N. Kobrak, Department of Chemistry, Brooklyn College and the Graduate Center of the City University of New York, Brooklyn, NY 11210

Recent studies of Scandinavian archaeological sites have provided useful information on the rise of commercial fishing around the 12th century AD. Analysis of bone fragments recovered from soil at settlement locations has been a useful tool in this regard. Microscopic analysis of soil samples has revealed the presence of microcrystalline features, and analysis of these features by proton induced X-ray emission spectrometry (PIXE) indicates that they are composed of varying ratios of calcium, iron and phosphate ions. Previous studies of similar features have suggested they are a product of the degradation of bone matter, but this has been the subject of some debate. Resolution of this issue could be useful in interpreting archaeological data. In this work, we perform computer analysis of PIXE data to compare the composition of different crystalline samples. We show that these compounds are similar to compounds that have been synthesized previously.

Supported by NIH- MARC Grant GM08078.

CHEM-3 UNDERSTANDING POLARITY IN ROOM-TEMPERATURE IONIC LIQUIDS

Vasily S. Znamenskiy and Mark N. Kobrak, Department of Chemistry, Brooklyn College and the Graduate Center of the City University of New York, Brooklyn, NY 11210

Room-Temperature Ionic Liquids (RTILs) have been the subject of extensive experimental interest for the past decade. These materials are salts that are molten at room-temperature and stable under ambient conditions, making them a novel class of solvents. Experiments have already shown these systems may serve as media for an enormous range of synthetic, separatory and electrochemical processes. In spite of these successes, little is known about the details of the chemical environment of RTILs. They appear to possess solvation properties comparable to moderately polar molecular organic solvents, but no theoretical description exists to describe the interaction between a molecular solute and a fused salt. In this work, we simulate the solvatochromism and solvation dynamics of a chromophore in an ionic liquids, and show that the chief contribution to the polarity of the solvent arises from the first solvation shell. Interactions with more distant ions, while individually strong, are cancelled by collective effects. We also observe a wide separation of timescales for solvation dynamics, and discuss possible interpretation of the motions on each timescale.

This work is supported in part by a grant of the Professional Staff Congress of the City University of New York.

CHEM-4 SURFACTANT MOLECULAR INTERACTIONS IN MIXED MONOLAYERS AND THEIR RELATIONSHIP TO ENHANCED SPREADING ON SOLID SUBSTRATE

Qiong Zhou and Milton J. Rosen, Surfactant Research Institute, Department of Chemistry, Brooklyn College of CUNY, Brooklyn, NY 11210

Spreading of mixed aqueous hydrocarbon-chain surfactant solutions on the solid polyethylene surface has been studied. Synergistic effect on the spreading of the mixed surfactant solution on the polyethylene film has been observed, and the obtained spreading is comparable to superspreading normally obtainable from trisiloxane-based surfactants. Some other interfacial phenomena related to surfactant spreading, such as surfactant-surfactant molecular interactions in the mixtures adsorbed at various interfaces, dynamic contact angle change of the mixed surfactant solutions during the process of spreading on hydrophobic polyethylene substrate and surfactant adsorption at the solid / liquid and air / liquid interfaces have been investigated. It is suggested that stronger surfactant-surfactant attractive interactions and greater adsorption at the polyethylene powder / aqueous solution interface than at the air/aqueous solution interface account for the observed spreading enhancement in the mixed hydrocarbon-chain surfactant systems, which is also accompanied by lower dynamic contact angles, implying greater dynamic spreading coefficients.

CHEM-5 PURIFICATION OF GOLD COLLOIDAL NANOPARTICLES USING TEMPERATURE RESPONSIVE POLYMERIC HYDORGELS

Weimin Zhang[^] and Malgorzata Ciszowska, Department of Chemistry, Brooklyn College and the Graduate Center of the City University of New York, Brooklyn, NY 11210

Gold colloidal nanoparticles were synthesized using controlled chemical reduction method in aqueous solution. These gold colloids, with diameters in the range of 5 nm to 60 nm, were characterized using UV/vis spectroscopy and transmission electron microscopy. Temperature responsive poly(N-isopropylacrylamide) (NIPA) hydrogels modified with colloidal gold nanoparticles was prepared and characterized. It was found that these nano size gold particles cannot diffuse freely in the hydrogel, even through the pore size of the hydrogel is much larger (100 – 200 nm) than that of gold nanoparticles. Based on this discovery, a new approach to a separation of organic and inorganic small molecules from gold colloid solution was developed. It was proofed to be a high efficiency method, especially for organic molecules. The polymeric gels used to purify the colloid solution can be recovered by slight heated in oven based on its temperature responsive properties.

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CHEM-6 SPECTROPHOTOMETRIC CHARACTERIZATION OF THERMORESPONSIVE GEL MODIFIED WITH GOLD NANOPARTICLES

Tzvetomira (Mira) Atanassova^{*}, Ewa A. Kazimierska and Malgorzata Ciszowska; Midwood High School, 2839 Bedford Ave. Brooklyn, NY 11210

The object of this study is preparation and characterization of thermoresponsive polymeric gel, N-isopropylacrylamide (NIPA), modified with gold colloids. UV-vis spectroscopy was employed to determine the wavelength of maximum absorbance of the gold nanoparticles in neat colloid and in modified gels. Particles of several different sizes were examined. It was found that wavelength of maximum absorbance increases when particle size increases. The study of particle size over time was also carried out. If not exposed to light, the colloidal particles do not agglomerate as time elapses. The new gel-colloid systems reversibly swell and shrink in response to a change in temperature. Temperature of such phase transition was determined however no difference comparing with unmodified polymer was recorded. Once these new materials are characterized potential applications for electrochemical uses, renewable biosensors and lithium batteries can be explored.

CHEM-7 ELECTROCHEMICAL STUDIES OF THERMORESPONSIVE POLYMERIC GELS MODIFIED WITH GOLD COLLOIDAL PARTICLES

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Preparation and characterization of thermoresponsive polymeric gels, N-isopropylacrylamide (NIPA) and its co-polymer with acrylic acid (NIPA-AA) modified with colloidal gold particles is reported. Very efficient methodology for the introduction of gold particles into gels to obtain three-dimensional polymeric networks with uniform distribution of gold nanoparticles was developed. Chemical and electrochemical properties of those new systems, such as potential window, transport properties and half wave potentials of electroactive probes were determined. The experimental approaches are electroanalytical techniques (voltammetry, chronoamperometry with regular size and microelectrodes) supported by spectroscopic techniques (UV-vis, SPR, SERS) and TEM. Optical analysis allows determination of size and size distribution of incorporated golden nanoparticles. Modified gels possess specific properties resulting from the properties of thermoresponsive hydrogels and gold nanoparticles. They undergo volume phase transition; they reversibly swell or shrink in volume as a response to changes in temperature and show surface plasmon resonance

CHEM-8 ASSESSING THE FEASIBILITY FOR THE DELIVERY OF OXYGEN ATOMS VIA OPTICAL FIBERS

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An exciting recent observation was that a fused aromatic sulfoxide in the presence of low energy light can undergo photodeoxygenation to generate a highly reactive oxidant. In the presence of light of only 76 kcal in energy, 1,2-benzodiphenylene sulfoxide can react with alkanes to afford alcohols. We consider atomic oxygen [O(3P)] as the most likely candidate for the intermediate based on mechanistic studies with substrate acceptors to the oxidation. In an effort to devise methods to accomplish similar transformations we are developing a research topic (with H. Gafney, Queens College) aimed at a heterogeneous source of reactive oxygen species. We describe our recent progress on the sulfoxide photodeoxygenation reaction in solution and in porous glasses. Experiments are carried out with samples of porous glasses derived from the base catalyzed polymerization of tetramethoxysilane, ethanol, and water. The chemistry of atomic oxygen in solution is largely unknown which is an interesting commentary on the state of this subject since its gas phase chemistry has been examined so extensively. Experiments thus far show that gas-phase triplet oxygen atoms have the same characteristic as the intermediate in the condensed-phase sulfoxide photochemistry. The discussion will, among other steps, present our effort to examine the number of photogenerated oxygen atoms that diffuse from the porous glass into the surrounding medium. Measurements of the photoproducts in fluid solution and the porous glass can indicate the fraction of oxygen atoms that are synthetically useful to gauge the feasibility for the delivery of oxygen atoms via an optical fiber.

CHEM-9 PENTATHIEPIN DNA-CLEAVING AGENTS. IS SULFUR SHEDDING TO INVOLVE O-BENZYNE A POSSIBILITY IN ANALOGY TO CALICHEAMICIN, WHICH IS KNOWN TO PRODUCE A PHENYL DIRADICAL?

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This study represents an effort to explore the mechanism of sulfur bond-making and bond-breaking of varacin and other pentathiepin natural products. The naturally-occurring polysulfanes varacin and calicheamicin exhibit antitumor antibiotic activity and give rise to DNA cleavage. An interesting aspect is that both natural product polysulfanes possess an amine functionality that provides an enhancement of the bioactivity. Without these amine attachments the biological activities are decreased. Evidence suggests that breakdown of pentathiepin is of importance in S-S cleavage and the generation of an activated sulfuration fragment, S₃, which may control the toxic effects of the natural product varacin. Potential parallels were considered between the polysulfanes varacin and calicheamicin and much is known about 1,4-didehydroarene (p-benzyne) biochemistry in the enediyne class of antitumor agents. The biochemical reactivity of p-benzyne is established; however, the production of o-benzyne in vivo remains unknown. A benzyne-pentathiepin reaction immediately came to mind and we present work in this area. Based on information from mechanistic studies we suggest an inability for pentathiepin to decompose to yield 1,2-didehydroarene (o-benzyne) and believe it can be ruled out. The intermediacy of o-benzyne was studied with the idea that some marine organisms developed chemical pathways to use elemental sulfur in small molecule biosynthesis. Pentathiepins are proposed to be developed by some organisms from dopamine precursors. A new concept is presented here that connects aspects of o-benzyne chemistry to factors related to the biogenesis of pentathiepin natural substances. Since biochemical studies have established the existence of p-benzyne, we thought that a physical-organic study could add confidence to the suggestion that dopamine may lose hydrogen to yield 1,2-didehydroarene, which serves as an acceptor of sulfur to generate varacin.

CHEM-10 Separation Properties of Temperature-Responsive Smart Polymeric Gels.

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Gels are three-dimensional polymeric networks swollen by a solvent. Many of them exhibit dramatic changes in their structure and consequently their volume by responding to environmental stimuli like pH, light or temperature. Temperature-responsive gels exhibit discontinuous volume phase transitions by rapidly changing their volume at a certain temperature, with volume changes as large as 90%. "Smart gels" of our interest consist of N-isopropylacrylamide (NIPA) crosslinked with N, N - methylenebisacrylamide. These gels can be used for power sources, as sensors and in drug delivery systems. To investigate the use of NIPA temperature-responsive gels as

drug delivery systems, we sought to determine the concentration of dissolved species in swollen gels, collapsed gels and expelled liquids using UV/vis spectroscopy. The NIPA gels are swollen with aqueous solutions of organic or inorganic compounds such as ascorbic acid or nickel chloride (NiCl_2). Two different samples containing 2% NIPA and 4% NIPA are swollen with 50 mM NiCl_2 solution. The absorbance of dissolved species in the swollen gel is compared to that of the expelled liquid from the collapsed gel. The results show that the concentration of NiCl_2 in the expelled liquid is different from that in the swollen gel.

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CHEM-11 SYNTHESIS OF THYMIDINE-THYMIDINE (6-4) PHOTOLESION AND ITS INCORPORATION INTO OLIGONUCLEOTIDES FOR DNA REPAIR MECHANISM STUDIES.

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Ultraviolet (UV) light is known to induce mutations in base moieties of genes. We have strategically planned routes to synthesize a DNA containing the T(6-4)T photolesion. Two methods have been reported for the preparation of photolesions at adjacent pyrimidine sites. The first method is the direct UV irradiation of DNAs. This method generated substantial amount of impurities which rendered the purification process difficult. The other method is the direct solid-phase oligonucleotide synthesis using a phosphoramidite building block of the photolesion. In this method, the photolesion formed was destroyed in the ammonia deprotection step during the phosphoramidite synthesis and resulting in low yield (16%).

In our approach, we first synthesized a thymidine-thymidine dinucleotide (dimer) with a protecting group at the 3' end from phosphoramidite. This dimer was purified on TLC and reverse-phase HPLC, and characterized using ^1H -NMR, UV/Vis and mass spectroscopy. The yield obtained was 70%. Irradiation strategies on different functionalities of the dimer were employed. The optimum irradiation time occurred after 1h to produce the desired unprotected T(6-4)T photolesion. The lesion obtained was purified and characterized similarly to the non-photocrossed linked dimer. The yield of the photolesion was 80%. This purified lesion was ligated into chemically synthesized oligonucleotide via enzymatic procedures. Ultimately, the DNA lesion will be crystallized with DNA repair enzymes in an effort to further understand the DNA repair mechanism. Results of chemical synthesis and enzymatic preparation will be presented.

CHEM –12 INTERACTIONS OF A GLOBULAR PROTEIN WITH BILAYER MEMBRANES AND SURFACTANTS USING FLUORESCENCE SPECTROSCOPIC METHODS.

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Studies of conformational changes of globular proteins that occur during interaction with surfactants and lipid bilayers have great biotechnological implications and are important for the pharmaceutical, food, cosmetic, and detergency industries. Our studies have focused on the interactions of the homodimeric globular protein Bovine Plasma Amine Oxidase (BPAO) with phospholipids. This copper containing metalloenzyme (192kDa) plays a fundamental role in the regulation of biogenic amines by deamination to the corresponding aldehydes. Plasma amine oxidases represent a class of dimeric proteins that are implicated in many important cellular processes including: tissue differentiation; cellular proliferation; growth of tumors; wound healing; and programmed cell death. As such, the possible interaction of BPAO with cell membranes could have important biological consequences. From previous fluorescence studies of intrinsic tryptophan fluorescence of BPAO, our laboratory has determined that BPAO can undergo reversible unfolding through a molten globule intermediate. This hydrophobic intermediate can potentially bind with cell membranes. Using benzylamine as the substrate for BPAO, we have first investigated the effects of varying amounts of dimyristoylphosphatidylcholine, (DMPC) a model saturated phosphoglyceride component of cell membranes, on enzyme activity. By monitoring the appearance of benzaldehyde spectrophotometrically at 250nm we observed no inhibitory effect of DMPC on the specific activity of BPAO in its native conformation. Use of DMPC allows modulation of cell membrane fluidity and composition. Future fluorescence studies are now focused on investigating the binding properties of DMPC single bilayer membranes vesicles (SUVs) with BPAO in the native and molten globule states.

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CHEM-13 ELECTROANALYTICAL STUDIES IN POLYELECTROLYTE SOLUTIONS AND GELS. EFFECT OF GEL FORMATION ON TRANSPORT OF SMALL, NEUTRAL MOLECULES

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Physical properties of polyelectrolyte solutions are critically influenced by conformation of polymeric chains, which in turn, is imposed by intra- and intermolecular interactions. Poly(acrylic acid) is an example of a weak polyacid that upon titration with a strong base gradually increases ionization degree. This enhances interactions between carboxylic groups attached to the backbone, which results in the increase of the macromolecule size. During such a titration viscosity of the solution initially increases rapidly, reaching

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plateau at higher neutralization degrees. According to the Stokes-Einstein equation, one would expect that diffusion coefficient of neutral molecules present in such media would decrease with the increase of viscosity. Our studies show however, opposite effect. During initial stages of gel formation (i.e. when the viscosity increases), diffusion coefficient of 1,1'-ferrocene-dimethanol also increases. This is reversed after the gel is formed and the viscosity reaches plateau. Such transport behavior of the probe can supply information on the structure of the medium, and it can reflect changes during sol-gel transition.

CHEM-14 Spectrophotometric Determination of Lead Using Solvent Extraction

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Middle College High School At Medgar Evers College

This project investigated the possibility of high concentration of lead in the school drinking water. Lead is extracted as the dithizone complex into methylene chloride at pH above 9. The intensity of the color of the complex is measured spectrophotometrically and compared to a calibration curve prepared similarly from lead standards to calculate the amount of lead. Sulfate was added as masking agents to eliminate most interference from other metals. The relevant data were collected and conclusions were made based on the results of the experiment.

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Legend:

Anth-Anthropology
Bio-Biology
Chem-Chemistry
Eng-Engineering
Env-Environmental Studies
HNS-Health & Nutrition Science
PEES-Physical Education & Exercise
Sciences
Psy-Psychology
Speech-Speech Communication Arts &
Sciences