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# THIRD ANNUAL SUMMER RESEARCH SYMPOSIUM TRINITY COLLEGE

## TABLE OF CONTENTS

<u>Poster #</u>	<u>Title</u>	<u>Page #</u>
<b><u>BIOLOGY</u></b>		
1.	<b>A MICROANATOMICAL STUDY OF THE EMBRYONIC DEVELOPMENT OF SNAKES</b> Kristie Anderson '10	8
2.	<b>THE ECOLOGICAL ROLE OF GLANDULAR HAIR SECRETIONS IN LARVAE AND PUPAE OF THE LADYBIRD BEETLE <i>DELPHASTUS CATALINAE</i></b> Laura E. Eckman, '09	8
3.	<b>PLACENTAL SPECIALIZATIONS IN THE VIVIPAROUS LIZARD <i>SCELOPORUS JARROVI</i></b> Greg Gavelis '08	9
4.	<b>ELECTROCOMMUNICATION SIGNALS ALONE INCREASE RADIAL GLIAL FIBER DENSITY IN THE BRAIN OF ADULT ELECTRIC FISH, <i>APTERONOTUS LEPTORHYNCHUS</i></b> Denisa Jashari '10, Elizabeth McCarthy '07	9
5.	<b>DEVELOPING A METHOD TO STUDY THE DIGESTION OF ALGAL CHLOROPLASTS IN TETRAHYMENA</b> Jo-Ann Jee '10	10
6.	<b>DETERMINING THE CHEMICAL COMPOSITION OF ANAL FLUID FROM NEWLY EMERGED CATERpillARS AND THE TAXONOMIC DISTRIBUTION OF THE DISPLAYED BEHAVIOR</b> Jacqueline Knapp '10, Patrick McCarthy '09, Catherine Rigoulot '08	11
7.	<b>ELIMINATION OF THE HYDROPHOBIC REGION IN THE SERRATE LIGAND AND ITS EFFECTS ON THE NOTCH SIGNALING PATHWAY</b> Jillian Langer '08	11
8.	<b>ENVIRONMENTAL EFFECTS ON VIRULENCE OF SINGLE OR COMBINED SPECIES OF ENTOMOPATHOGENIC FUNGI TO BLACKLEGGED TICKS</b> Justin R. Pool '08	12

<u>Poster #</u>	<u>Title</u>	<u>Page #</u>
9.	<b>ESTABLISHING A BASELINE OF THE MICROFLORA IN THE UPPER RESPIRATORY TRACT</b> Santiago Varela '09	13
10.	<b>SQUIRREL ABUNDANCE IN URBAN RED-TAILED HAWK TERRITORIES</b> Conner Wells '09	13
11.	<b>BIODIVERSITY IN THE ANGIOSPERM FLORA OF THE TRINITY COLLEGE FIELD STATION</b> Amanda White '08, Alexander Wing '08	14

## CHEMISTRY

12.	<b>CYCLIZATION OF A TETRAPEPTIDE WITH DIAMINOFERROCENE</b> Julianne Boccuzzi '08	14
13.	<b>ANALYSIS OF DNA THROUGH MATRIX ASSISTED LASER DEABSORPTION IONIZATION TIME-OF-FLIGHT MASS SPECTROMETRY</b> Caitlin Farrell '09	15
14.	<b>ACCELERATING EFFECTS OF N-METHYLFORMAMIDE WITH RESPECT TO AQUEOUS AND ORGANIC CONDITIONS IN INDIUM METAL PROMOTED COUPLING REACTIONS</b> Kwame Frimpong '08	15
15.	<b>FUNCTIONAL GROUP CONTROL THROUGH INDIUM PROMOTED COUPLING</b> Alden Gordon '10	16
16.	<b>SYNTHESIS AND CONFORMATIONAL ANALYSIS OF HELICAL METALLACYCLICPEPTIDES</b> Emmy Handy '08	16
17.	<b>THE SYNTHESIS OF ENEDIYNES TO TARGET CANCEROUS TUMORS BY INHIBITING DNA REPLICATION</b> Tania Joseph '08	17
18.	<b>IMAGING OF TYPE I TROPOCOLLAGEN USING THE TRANSMISSION ELECTRON MICROSCOPE (TEM)</b> Piper Klemm '09	17
19.	<b>ORGANIC SYNTHESIS THROUGH ANION CHEMISTRY</b> John Love '10	18

<b><u>Poster #</u></b>	<b><u>Title</u></b>	<b><u>Page #</u></b>
20.	<b>ANALYSIS OF MK-801 TOXICITY IN E13 CD-1 MICE BRAINS</b> Ariana Mullin '09, Brian Sinnott '08	18
21.	<b>SYNTHESIS OF A FLUORESCENT POLY PEPTIDE FOR USE AS A MARKER IN LIVER CELLS</b> Jonathan Nyce '09	19
22.	<b>THE SYNTHESIS OF 3-(2-BROMOALLYL)OCT-2-ENAL VIA INDIUM COUPLING REACTION AND COPE REARRANGEMENT</b> Laert Rusha '08	19
23.	<b>INDIUM COUPLING OF CYCLOHEXANECARBOXALDEHYDE AND 2,3-DIBROMOPROPENE IN AN N-METHYL FORMAMIDE SOLVENT</b> Merry Smith '09	20
24.	<b>TOWARDS THE FORMATION OF SMALL HOMO-CONJUGATED HYDROCARBON CAGES</b> Katharine Spencer '08	20
25.	<b>USE OF SOLVENT CONDITIONS TO CONTROL FUNCTIONAL GROUP FORMATION IN INDIUM PROMOTED COUPLING REACTIONS</b> Rebecca Sufilas '08, Timothy Scarella '08	21
26.	<b>DIRECT BROMINATION OF A NUCLEOTIDE</b> Ashley Swiggett '09	21
27.	<b>USING NUCLEAR MAGNETIC RESONANCE (NMR) TECHNIQUES TO DETERMINE THE RELATIVE SPATIAL ORIENTATION OF CAPSAICIN IN SOLVENTS OF VARYING POLARITY</b> Brice Vallieres '09	22

## **COMPUTER SCIENCE**

28.	<b>VARIABLE ANALYSIS OF RSA CRYPTOSYSTEM</b> Vinit Agrawal '10, Orko Momin '10	22
29.	<b>USING SUPPORT VECTOR MACHINES FOR MICROARRAY ANALYSIS</b> Saroj Aryal '09	23

**Poster #**      **Title**      **Page #**

## **ENGINEERING**

30.    **DELINEATION OF HEART MURMUR FEATURES THROUGH COMBINED WAVELET TRANSFORM AND AUTOREGRESSIVE MODELING**  
Nikolay Atanasov '08      23
31.    **DESIGN OF AN OPERATIONAL AMPLIFIER HAVING HIGH-PASS, LOW-PASS AND BANDPASS FILTERS**  
Mahmudul Chowdhury '08      24
32.    **CORRELATION DIMENSION OF THE HIPPOCAMPAL REM EEG DURING NORMAL DEVELOPMENT**  
Adam Grare '10, Ankit Saraf '10      24
33.    **ESTIMATION OF AUTOREGRESSIVE MODEL PARAMETERS THROUGH AN ORTHOGONAL TRANSFORM**  
Nabil Imam '08      25
34.    **DESIGN AND IMPLEMENT SOURCE CODING AND CHANNEL CODING ON A SINGLE-CHIP USING FIELD PROGRAMMABLE GATE ARRAY (FPGA)**  
Neil Robertson '08      25

## **ENVIRONMENTAL SCIENCE**

35.    **METALS AND ANIONS IN THE TROUT BROOK OF WEST HARTFORD, CT, SUMMER 2007**  
Elisabeth Cianciola '10, Susan Juggernaut '09, Nathan Sell '10      25
36.    **DETERMINING THE RELATIONSHIP BETWEEN EROSION RATE AND MAGNETIC ENHANCEMENT OF THE LOESSIC HILLS OF HITCHCOCK NATURE CENTER, IA**  
Chamae Munroe '10      26
37.    **MACROINVERTEBRATE POLLUTION SENSITIVITY SURVEY OF THE TROUT BROOK IN WEST HARTFORD, CT**  
Nathan Sell '10, Elisabeth Cianciola '10, Susan Juggernaut '09      27
38.    **ANALYSIS OF TIRE RUBBER LEACHATE WITH THE *SALMONELLA* MUTAGENESIS ASSAY (AMES TEST)**  
Sara Yoo '08      27

**Poster #**      **Title**      **Page #**

## **MATHEMATICS**

39.    **CHANNEL ASSIGNMENT AND GRAPH LABELLING**  
Nicholas Allen '09      28

## **NEUROSCIENCE**

40.    **LONG TERM POTENTIATION IN THE MULTISYNAPTIC PATHWAY  
EXTENDING FROM THE DENTATE GYRUS TO THE ENTORHINAL  
CORTEX**  
Nicole Albino '10      28
41.    **EFFECTS OF KETOGENIC DIET ON SYNAPTIC PLASTICITY IN FREELY  
BEHAVING RATS**  
Kaitlin Haines '09, Urey Chow '09, Katy Gaffney '09      29
42.    **CHARACTERIZATION OF THE ROLE OF CA3 MOSSY FIBERS IN  
INFORMATION PROCESSING IN HIPPOCAMPAL CIRCUITS**  
Connie Hernandez '10, Daisy Ramos '10      30
43.    **NEUROPHENOMENOLOGY OF TIME: FUNCTIONAL NEUROIMAGING IN  
THE PAST AND FUTURE TENSE AND AN FMRI BASIS FOR AN OBJECTIVE  
TIMESCAPE**  
Michael Pierce '10      30
44.    **THE EFFECT OF A LOW CARBOHYDRATE DIET ON ADENOSINE IN THE  
BRAIN**  
Laura Pomeroy '09, Caleb Wasser '08, Ritika Chandra '10      31

## **PSYCHOLOGY**

45.    **RETRIEVAL OF AUTOBIOGRAPHICAL MEMORIES**  
Stephanie Keith '08, Dzheni Dilcheva '08      32
46.    **EDUCATIONAL PRACTICES AND STUDENT LEARNING IN A LIBERAL  
ARTS COLLEGE: CODING QUALITATIVE INTERVIEWS FROM A PANEL  
STUDY**  
Eugene Pan '08      32
47.    **HAPTIC PERCEPTION VIA DYNAMIC TOUCH**  
Matthew Phinney '10      33

**Poster #**      **Title**      **Page #**

## **SCIENCE AND SOCIETY**

48.    **UNDERSTANDING SOCIAL CAPITAL AND STATUS IN RURAL ECUADOR**  
Cristina Wheeler Castillo '08      33

## **AV DAVIS FELLOWS**

49.    **REBIRTH: USING THE CULTURES OF THE AFRICAN DIASPORA TO REACH AND TEACH HARTFORD'S CREATIVE YOUTH**  
Haben Abraham '10      34
50.    **PUTTING DOWN ROOTS IN HARTFORD: AN INNOVATIVE LEADERSHIP PROGRAM PROJECT**  
Jasmin Agosto '10      34
51.    **FOOTBALL IS FREEDOM: A RENEGADE SOCCER PROJECT**  
Jason Azevedo '08, Alfonso Bui '08      35
52.    **MULTI-NATIONAL REFERENCES AND PERCEIVED ACADEMIC SUCCESS**  
Ashley Flemming '08      35
53.    **ANALYSIS OF THE GRASSROOTS IMMIGRANT RIGHTS MOVEMENT IN HARTFORD**  
Dulce Amor Imbo '09      36
54.    **HISTORIC PRESERVATION IN HARTFORD: IN PURSUIT OF AN APPLICATION**  
Isis Irizarry '10      36
55.    **SALVIA: A NEW EXTRACORPOREAL DRUG EXPERIENCE ON COLLEGE CAMPUSES**  
Meagan Miller '08      37
56.    **MUSLIM REFUGEE ADAPTATION IN HARTFORD: ANALYSIS OF CONTEMPORARY ISSUES**  
Alissa Phillips '08, Jessica Hart '08      37
57.    **'UNITED NATIONS': THIRD WORLD NATIONALISMS AND INTERNATIONALISM**  
Ashesh Prasann '08      38
58.    **ASSIMILATION OF SYMBOLISM: LANGUAGE ACROSS CULTURES**  
Roberta Rogers-Bednarek '09      39

<b><u>Poster #</u></b>	<b><u>Title</u></b>	<b><u>Page #</u></b>
59.	<b>HOUSE OF PEACE: INDIGENOUS TECHNOLOGY</b> L. Mixashawn Rozie '12	40
60.	<b>ECOLITERACY IN THE PARK RIVER WATERSHED</b> Jessica Scordamaglia '10	40

\*\*See also Nathan Sell in Environmental Science

## **MELLON FOUNDATION**

61.	<b>HUMAN TRAFFICKING IN THE PERU/CHILE REGION</b> Celia Rodriguez '08	41
62.	<b>FUNDS OF KNOWLEDGE OF LATINO FAMILIES IN HARTFORD</b> Cintli Sanchez '09, Christina Ramsay '09, Ashley Flemming '08	41
63.	<b>LEARNING ABOUT HUMAN RIGHTS-BASED APPROACHES TO HEALTH THROUGH ASTHMA EDUCATION</b> Cristina Wheeler Castillo '08	42
64.	<b>HIV/AIDS IN HONDURAS</b> Cristina Wheeler Castillo '08, Monika Zagaja '08, Armand DelRosario '07, Brian Lee '07, Todd Morrison '07	42



# **BIOLOGY**

1.

## **A MICROANATOMICAL STUDY OF THE EMBRYONIC DEVELOPMENT OF SNAKES**

Kristie Anderson '10

Faculty Sponsors: Daniel Blackburn, Ann Lehman

Vertebrate eggs contain structures external to the embryo, called extraembryonic membranes, which play essential roles in physiological exchange between the embryo and its external environment. The same extraembryonic membranes are responsible for sustaining the embryos in both viviparous (live-bearing) and oviparous (egg-laying) vertebrates. Light microscopy and scanning electron microscopy were used to investigate the structure and function of these membranes and their associated embryos in egg-laying corn snakes (*Pituophis guttatus*) and live-bearing brown snakes (*Storeria dekayi*). Embryos and extraembryonic membranes from eggs of the oviparous corn snake were harvested at different stages of development. Embryos were prepared for light microscopy by fixation in formalin, embedment in paraffin, microtome sectioning, and histological staining. The membranes were prepared for scanning electron microscopy through chemical fixation, dehydration, and the application of conductive coating. Scanning electron microscopy was used to study the surface of the membranes in detail, and allowed identification of specializations for physiological exchange. The chorioallantois appeared attenuated, creating a small diffusion distance for gas exchange, while the omphalopleure was composed of highly ridged cubodial cells, indicating the omphalallantois as a possible site of water and calcium uptake. In viviparous brown snakes, light microscopy revealed that these two extraembryonic membranes showed similar features, suggesting roles in maternal-fetal gas exchange and water transfer. Little is known about how the extraembryonic membranes of squamates (snakes and lizards), a major vertebrate group, serve to sustain an embryo throughout development. Thus, cellular features of the extraembryonic membranes of *Pituophis guttatus* and *Storeria dekayi* can provide insight and clarification into the function of squamate extraembryonic membranes, and ultimately, their evolution. Ongoing work on embryology of the reproductive system of corn snakes is beginning to reveal the pattern by male and female embryos diverge during mid- to late- development, and should clarify the process of sexual differentiation.

2.

## **THE ECOLOGICAL ROLE OF GLANDULAR HAIR SECRETIONS IN LARVAE AND PUPAE OF THE LADYBIRD BEETLE *DELPHASTUS CATALINAE***

Laura E. Eckman, '09

Faculty Sponsor: Scott Smedley

Glandular hairs, cuticular structures with droplets at the tip, are present in certain insects. One such insect is the ladybird beetle *Delphastus catalinae* (Order Coleoptera). The glandular hairs of this beetle are unique because they are found in both the larval and the pupal stages of the beetle, whereas previously studied beetle species possess secretory hairs only in the pupal stage. The ecological function of *D. catalinae* secretions has not been previously studied, although

secretions from glandular hairs of several other insects have been determined to serve a role in deterring predators. To determine the ecological role of the droplets, I have executed a series of bioassays with the predatory ant *Crematogaster lineolata*, in which the cleaning activity of the ants is monitored before and after coming into contact with three treatments of *D. catalinae*. Determination of the ecological role of *D. catalinae* secretions will further our understanding of predatory-prey relationships, insect evolution, and may give us information relevant to the continuation of the effective use of *Delphastus* as a biological control agent.

### 3.

#### **PLACENTAL SPECIALIZATIONS IN THE VIVIPAROUS LIZARD *SCELOPORUS JARROVI***

Greg Gavelis '08

Faculty Sponsors: Daniel Blackburn, Ann Lehman

Commonly known as the spiny lizard, *Sceloporus jarrovi* is derived from an ancestral group of egg-layers, but is itself viviparous and carries its embryos full term. Using light and transmission electron microscopy, we examined its placental membranes for modifications that allow for this live-bearing lifestyle. Our observations revealed a combination of specializations never before described among reptiles. Broadly defined, a placenta is any region of prolonged contact between fetal and maternal tissues. In *S. jarrovi*, loss of the vestigial egg shell membrane allows for intimate contact zones, the chorioallantoic and yolk sac placenta. At the chorioallantoic placenta, epithelium has been attenuated to leave a short diffusion distance between fetal and maternal blood vessels. Thus, the chorioallantoic placenta of *S. jarrovi* has been optimized for the provision of oxygen to sustain its embryos. In the yolk sac placenta, fetal epithelium forms unusual, elongated outgrowths, lined with absorptive epithelium, that extend into accumulations of eggshell and other material in the uterine lumen. The yolk sac placenta is avascular, and appears to be a site of secretion and absorption, and may have a nutritive function. Both placental types persists until the end of gestation. The occurrence of these placental specializations was unexpected, because, until now, *S. jarrovi* commonly was assumed to have a "simple" form of placentation.

### 4.

#### **ELECTROCOMMUNICATION SIGNALS ALONE INCREASE RADIAL GLIAL FIBER DENSITY IN THE BRAIN OF ADULT ELECTRIC FISH, *APTERONOTUS LEPTORHYNCHUS***

Denisa Jashari '10, Elizabeth McCarthy '07

Faculty Sponsor: Kent Dunlap

In electric fish, *Apteronotus leptorhynchus*, radial glia are important in guiding the migration of adult-born neurons and may play a role in behavioral plasticity. Long-term social interaction simultaneously potentiates the production of certain electrocommunication signals, and increases the formation of radial glial fibers and newborn cells in the brain region that controls these electrocommunication signals. Specifically, housing a fish with another fish for 1-7 d potentiates electrocommunication signals and increases vimentin immunoreactivity (VIR, a marker of radial

glia) in the periventricular zone (PVZ) adjacent to the prepacemaker nucleus (PPn, the nucleus that controls chirping).

We sought to determine what particular stimulus features of social interaction influence radial glial fiber formation. We housed fish in isolation, in pairs or in aquaria that received electric organ discharge (EOD) stimuli from another fish or sine wave stimuli from a function generator. One and 7 days of EOD stimuli increased VIR in the PVZ adjacent to the PPn, but had no effect on the cerebellum. These data show that EOD stimuli alone are sufficient for causing the socially induced changes in radial glial fiber density. Seven days of sine wave stimuli had no effect on VIR in the PVZ. This suggests that the EOD waveform or amplitude modulations are important in stimulating radial glial fiber formation.

## 5.

### **DEVELOPING A METHOD TO STUDY THE DIGESTION OF ALGAL CHLOROPLASTS IN TETRAHYMENA**

Jo-Ann Jee '10

Faculty Sponsor: Kathleen Archer

There's an interesting marine sea slug (*Elysia chlorotica*), which has a symbiotic relationship with certain species of algae on which they feed. The slug has the ability to retain chloroplasts from the algal cells without digesting them along with the rest of the algal components. The chloroplasts continue to live in the tissue of the slug and photosynthesize under sunlight. The slug thus has the ability to produce its own food source, the way plants do. The question addressed in this research is, how is the chloroplast retained and not digested? We explored the possibility that the algal chloroplasts are especially resistant to digestion. In our experiment, we used a protozoan, *Tetrahymena*, as a proxy for sea slugs as digestion in *Tetrahymena* is easily observed under the microscope. Also, we can then be assured that the chloroplasts truly resist digestion and do not survive because the slugs' digestive system is weak. In order to study the rate of digestion of chloroplast, we needed to know the ratio of chloroplasts to *Tetrahymena* cells at which the feeding rate is at its peak. We also tested the feeding rate in starved vs. fed *Tetrahymena* to see if it made a difference. Finally, we looked into methods of separating the uneaten chloroplasts from the *Tetrahymena* cells. The methods of separation tested were density centrifugation, dilution and sieving. Our results suggest that a suitable ratio of *Tetrahymena* to chloroplasts is 1:5, and that *Tetrahymena* fed for 24 hours had a higher feeding rate than starved *Tetrahymena* cells. None of the separation methods we tried successfully separated *Tetrahymena* cells from uneaten chloroplasts.

6.

**DETERMINING THE CHEMICAL COMPOSITION OF ANAL FLUID FROM NEWLY EMERGED CATERpillARS AND THE TAXONOMIC DISTRIBUTION OF THE DISPLAYED BEHAVIOR**

Jacqueline Knapp '10, Patrick McCarthy '09, Catherine Rigoulot '08

Faculty Sponsor: Scott Smedley

This study was undertaken to determine whether the anal fluid secreted by the Monarch butterfly (*Danaus plexippus*) contained cardenolides found in the host plant, (*Asclepias*) species of milkweed, posing the “U” maneuver observed as a defense mechanism against predators. During the maneuver, caterpillars will raise their heads and unite with the posterior of their bodies, forming a “U” shape. During this, anal fluid is released, which they then anoint on themselves. Samples of caterpillars were collected on the basis of controls and anointed samples as well as the collection of the fluid itself. Although both the Queen and Monarch butterfly perform the “U” maneuver, it has been observed that the Painted Lady butterfly (*Vanessa cardui*) does not perform this behavior. At present chemical results are pending on the Monarch project. In the future, more species of butterfly will be studied to see if they perform the “U” maneuver.

7.

**ELIMINATION OF THE HYDROPHOBIC REGION IN THE SERRATE LIGAND AND ITS EFFECTS ON THE NOTCH SIGNALING PATHWAY**

Jillian Langer '08

Faculty Sponsor: Robert Fleming

A highly conserved form of cell communication in animals is the Notch signaling pathway. As cell-to-cell communication at the time of differentiation is a crucial phase of development, the Notch pathway conveys a unidirectional message from one cell to another revealing its cell fate. This communication path consists of Notch receptors on all cells which respond to ligands present at the signaling junctions. Both Serrate and Delta are ligands responsible for transferring signals to neighboring cells; however, Serrate also strongly inhibits its own Notch receptors, unlike Delta's weak ability to do so. Serrate's strong cis-inhibition ceases the Notch reception abilities on the signaling cell so that its determined cell fate becomes permanent and unalterable. The Serrate ligand, comprised of a short intracellular piece and larger extracellular expanse of EGF-like repeats, contains a unique hydrophobic region. Located between the 5<sup>th</sup> and 6<sup>th</sup> EGF-like repeats, this hydrophobic region is present in Serrate and absent in the Delta ligand. A previous construct, developed by removing the hydrophobic region and those amino acids surrounding it on both sides, resulted in a loss of the strong cis-inhibition normally exhibited when Serrate acts on Notch in *Drosophila melanogaster*. Thus, it is predicted that with the elimination of only the extent of the hydrophobic region in Serrate, the typically observed cis-inhibition on Notch will be lost. The Serrate ligand is mutated by recombinant DNA techniques to remove only the hydrophobic region. Next, the new Serrate ligand with the deleted hydrophobic region is transferred into *Drosophila melanogaster* eggs and transgenic flies are grown up to view the effects of the mutated Serrate. Although the building of the construct is not quite complete, once the mutant Serrate is present in the *Drosophila*, it is expected that the strong inhibition of the Notch receptors will no longer be observed.

## 8.

### **ENVIRONMENTAL EFFECTS ON VIRULENCE OF SINGLE OR COMBINED SPECIES OF ENTOMOPATHOGENIC FUNGI TO BLACKLEGGED TICKS**

Justin R. Pool '08

Faculty Sponsors: Craig Schneider, Amy Tuininga, Rich Falco, Tom Daniels, Louis Calder  
Biological Field Station, Fordham University

The blacklegged tick, *Ixodes scapularis*, is the main vector for the transmission of *Borrelia burgdoferi*, the bacterium that causes Lyme disease. One way to control the risk of exposure to Lyme disease is to control the size and density of tick populations. An alternative to pesticides for tick control is entomopathogenic fungi, such as *Beauveria bassiana* and *Metarhizium anisopliae*, which are known to penetrate the tick cuticles. These fungi are most pathogenic at specific levels of temperature and relative humidity. To test the effects of environmental conditions on the virulence of these fungi, I exposed field-collected nymphal-stage blacklegged ticks to commercial fungal products in the first lab assay versus local isolates of the fungi in the second lab assay. Fungal treatments for both assays contained *B. bassiana*, *M. anisopliae*, a combination of the two, and there was a control with no fungus. Ticks were incubated at relative humidities of 75%, 85%, or 100% at room temperature over a two-week period. In the first assay, at 100% relative humidity, the commercial product containing *B. bassiana* was slightly more virulent to the blacklegged tick than the control, but the product containing *M. anisopliae* was not different from the control ( $F = 2.88$ ,  $p = 0.0495$ ). The only differences in virulence between any products and the controls in this assay were at 100 % relative humidity, not at lower levels of humidity. In contrast, the combined species fungal treatment in lab assay II, using local isolates, killed ticks significantly faster than the other treatments ( $F = 25.45$ ,  $p < 0.0001$ ) at all levels of relative humidity tested. In both lab assays, low humidity lead to faster tick death regardless of the presence of fungi. Relative humidity does play a role in the virulence of *B. bassiana* and *M. anisopliae* to the blacklegged nymphs. Results from the assay with local isolates from lab assay II also support that *M. anisopliae* is more virulent than *B. bassiana* at higher humidities, whereas the opposite is true for lower humidities. The field study showed that the number of live ticks remaining in the control and combination treated cages were significantly lower than the number of live ticks remaining in the cages treated with the commercial products containing *B. bassiana*, and *M. anisopliae* ( $F = 9.74$ ,  $p = 0.0164$ ). The reason that there was a difference between the commercial products and the local isolates in virulence could be due to the type of preparation of the commercial products. Commercial products of spores from combined species of fungi, but that are not emulsified in mineral oil might be the best type of biological control product for control of blacklegged ticks.

## **9.**

### **ESTABLISHING A BASELINE OF THE MICROFLORA IN THE UPPER RESPIRATORY TRACT**

Santiago Varela '09

Faculty Sponsor: Lisa-Anne Foster

The natural microflora in the human body play a vital role in immune health by aiding host defenses against foreign microbial invasions. The microflora have been identified in the gut and have shown to prevent pathogenic infections, which suggests that the endogenous microbes in the upper respiratory tract must share a similar role. In order to make a correlation between the health of the human host and the natural microflora in the upper respiratory tract, it is necessary to first create a baseline of the identities of the bacteria. In this experiment, cultures of bacteria containing amplified sRNA strands from bacterial suspensions were grown and re-isolated. The samples are to be analyzed in order to obtain the forthcoming results, which will help establish this baseline.

## **10.**

### **SQUIRREL ABUNDANCE IN URBAN RED-TAILED HAWK TERRITORIES**

Conner Wells '09

Faculty Sponsor: Joan Morrison

The red-tailed hawk (*Buteo jamaicensis*) is a common raptor in the northeastern United States, including in Hartford's urban environment. As a bird of prey, red-tailed hawks feed on rabbits, other small rodents, and birds. Field observations indicate that squirrels are a primary prey item for Hartford's red-tailed hawks. The working hypothesis was that hawks would be more likely to hunt urban green space due to the greater abundance of squirrels in these areas. In this study I examined the abundance of squirrels in four areas within Hartford where radio tagged hawks are known to be present. I determined squirrel abundance using line transect sampling. I counted squirrels along eight transects, each 100 m in length and 100 m wide, in four hawk territories. These transects covered a gradient between dense urban development and urban green space. I found a positive relationship between the amount of green space present per transect and the average number of squirrels. These preliminary results suggest that squirrels are more abundant in urban green space compared to highly developed urban areas. Future studies should include more sampling of transects, increased transect numbers per territory, and sampling of more known hawk territories. More importantly would be correlating hawk locations in urban green space in a similar manner.

## **11.**

### **BIODIVERSITY IN THE ANGIOSPERM FLORA OF THE TRINITY COLLEGE FIELD STATION**

Amanda White '08, Alexander Wing '08

Faculty Sponsor: Craig Schneider

This study was conducted to assess and record the current biodiversity in the Angiosperm (flowering plant) flora of the Trinity College Field Station in Ashford, Connecticut. Twice-weekly collecting trips were made to the field station where herbarium specimens were taken as vouchers, noting location, habitat and date of collection. Collected samples were dried using a standard botanical press and then identified with current literature sources. Thus far, eighty-five Angiosperm species have been identified. Trends were also noted in species abundance and distribution according to habitat. Utilization of this preserved herbarium and data set will aid future analysis of habitat changes, including global warming in the 21st century, as well as additions and disappearances in the flora and distribution of species.

## **CHEMISTRY**

## **12.**

### **CYCLIZATION OF A TETRAPEPTIDE WITH DIAMINOFERROCENE**

Julianne Boccuzzi '08

Faculty Sponsor: Timothy Curran

Previous research in our lab has shown that a tetrapeptide with lysines at the N and C-termini can be cyclized by reaction with 1,1'-ferrocenediacid chloride. The two lysine sidechains react with the diacid chloride to form the macrocycle. The cyclic structure is then forced to adapt a helical conformation. The goal of this research was to use the ferrocene derivative, 1,1'-diaminoferrocene, to cyclize the tetrapeptide, Glu-Val-Ala-Glu, by linking the glutamic acid sidechains to diaminoferrocene via amide bonds. This tetrapeptide was successfully synthesized via solution phase peptide synthesis, and the products of each reaction were analyzed via TLC, ES-MS, and <sup>1</sup>HNMR to confirm their purity and structure. The four-step synthesis of the 1,1'-diaminoferrocene from 1,1'-ferrocene dicarboxylic acid was successfully completed, but the cyclization of the tetrapeptide was unsuccessful.

### 13.

#### ANALYSIS OF DNA THROUGH MATRIX ASSISTED LASER DEABSORPTION IONIZATION TIME-OF-FLIGHT MASS SPECTROMETRY

Caitlin Farrell '09

Faculty Advisor: Richard Prigodich

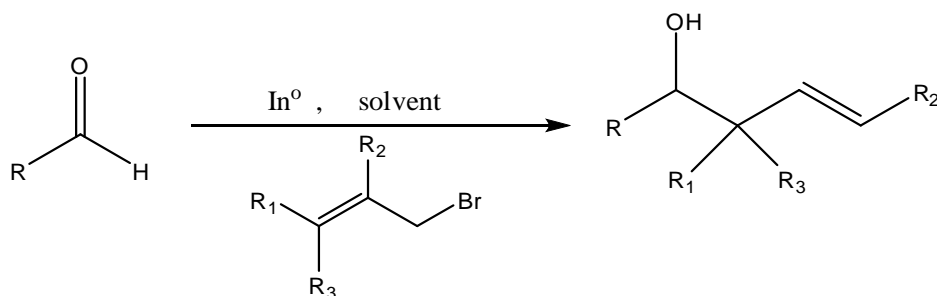
In an attempt to further develop methods to analyze DNA footprinting, various samples were examined through the use of MALDI TOF Mass Spectrometry. This type of mass spectrometry causes the sample mixed with a chemical matrix to become charged after being ablated from a metal target by a laser (MALDI – matrix assisted laser desorption ionization). This charged particle then travels down an evacuated flight tube, and the size of the molecule is measured by the time in which it takes the particle to travel the entire tube, hence time-of-flight (TOF). Initially a matrix consisting of 3,4 Diaminobenzophenone was placed on the plate, followed by the DNA sample. These were allowed to dry, and then loaded into the MALDI TOF Mass Spectrometer. These samples were run under both the positive and negative modes in order to best maximize signal. In addition, different sized DNA samples were.

### 14.

#### ACCELERATING EFFECTS OF N-METHYLFORMAMIDE WITH RESPECT TO AQUEOUS AND ORGANIC CONDITIONS IN INDIUM METAL PROMOTED COUPLING REACTIONS

Kwame Frimpong '08

Faculty Sponsor: Thomas Mitzel



Understanding the flow of electrons during synthetic reactions is important in chemistry to aid in constructing models that predict product formation. Two of the more interesting reactions studied in organic chemistry are nucleophilic additions and Cope Rearrangements. Indium metal has been shown to promote the formation of C–C bonds under aqueous conditions with good stereo- and regioselectivity. This presentation will aim to address the effect of solvent and variable reaction conditions on indium promoted reactions of allyl bromides to aldehyde functional groups.



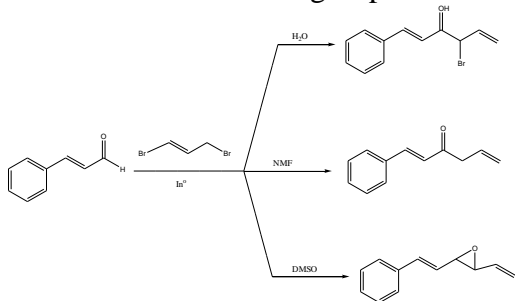
## 15.

### FUNCTIONAL GROUP CONTROL THROUGH INDIUM PROMOTED COUPLING

Alden Gordon '10

Faculty Sponsor: Thomas Mitzel

Varying functional groups of products usually requires a change in reactants and reaction solvents. This research has been aimed at controlling functional groups in the above reaction while maintaining reactants. The reaction run in NMF (*N*-methylformamide) has been the most elusive, and was the focus of the work. Cinnamaldehyde, 1,3 dibromopropene, and indium metal were mixed in NMF (*N*-methylformamide) and reacted for 24 hr. The product was then extracted with methylene chloride, separated in a column and analyzed with gas chromatography/mass spectrometry and nuclear magnetic resonance (NMR). Current research has yielded some successful reactions, with many failures due to impurities in original samples of cinnamaldehyde and indium powder. It has also recently been suggested that the quantity of indium original used in this above reaction was too great and the excess metal interfered with the completion of the reaction, explaining the consistent appearance of both brominated and unbrominated alcohol side product. Of the successful reactions often desired product was lost in separation. Future work will include repeating this reaction under recently modified conditions, to reduce side products and increase yield of ketone product. Success in these aspects of the research will present new means of functional group control that will be beneficial to other fields of research.



## 16.

### SYNTHESIS AND CONFORMATIONAL ANALYSIS OF HELICAL METALLACYCLIC PEPTIDES

Emmy Handy '08

Faculty Sponsor: Timothy Curran

A metal-ligand interaction can be used to tie together two ends of a peptide chain, yielding a metallacyclic peptide. In previous research, the tetrapeptide, Boc-Lys-Ala-Val-Lys-NHMe was cyclized with 1,1'-ferrocenedicarboxylic acid by the formation of amide bonds between the side-chain amines of the two lysines and the carboxylic acids of the ferrocene derivative. This yielded a metallacyclic peptide, which was found to be helical in structure, as shown by 1HNMR experiments. The goal of current research was to synthesize the tetrapeptide Boc-Lys-Met-Ile-Lys-NHMe and cyclize it similarly with the 1,1'-ferrocenedicarboxylic acid. The tetrapeptide was successfully synthesized via solution phase peptide synthesis and cyclized with the 1,1'-ferrocenedicarboxylic acid. 1- and 2-dimensional 1HNMR experiments of the product indicated that this cyclic peptide was also helical in structure.

**17.**

**THE SYNTHESIS OF ENEDIYNES TO TARGET CANCEROUS TUMORS BY INHIBITING DNA REPLICATION**

Tania Joseph '08

Faculty Sponsor: Thomas Mitzel

Recent work shows that natural products containing ene-diyne reactive centers inhibit replication of mutated DNA sites which may cause the formation of malignant tumors or cancer. Ene-diyne accomplish this by tying two strands of DNA together at a targeted location, therefore terminating replication. The major issue is that previous work on ene-diyne shows that they react with both mutated and healthy strands of DNA, making them too toxic to be used in humans. The key is to find reagents that will work with high yields in water or other solvents that are not harmful to the body (Mitzel 2007). Past studies have shown that coupling reactions between  $\alpha$ -chloropropargyl phenyl sulfide and aldehydes produces molecules with good stereoselectivity between syn and anti isomers, in addition to great regioselectivity (Mitzel 2002). The first step is to form the  $\alpha$ -chloropropargyl phenyl sulfide from phenyl propargyl sulfide. Attempts were made to couple the chloro-sulfide with propargyl aldehydes, in the presence of indium, to synthesize ene-diyne precursors. Subsequent research may potentially lead to breakthroughs in the chemical understanding of DNA.

**18.**

**IMAGING OF TYPE I TROPOCOLLAGEN USING THE TRANSMISSION ELECTRON MICROSCOPE (TEM)**

Piper Klemm '09

Faculty Sponsors: Richard Prigodich, Ann Lehman

Collagens are one of the most abundant proteins in the human body. Type I Collagen is a Fibrillar Collagen, which is an important component in many connective tissues in the human body including skin, bone, tendon and ligament. Type I Collagen binds to osteocalcin, a major component of bone tissue and bone formation. The osteocalcin binding site on the Collagen is unknown. To determine this activity, Type I Tropocollagen was imaged using the rotary shadowing technique of transmission electron microscopy. This preliminary study on imaging Type I Tropocollagen solitary molecules produced no definitive results.

## 19.

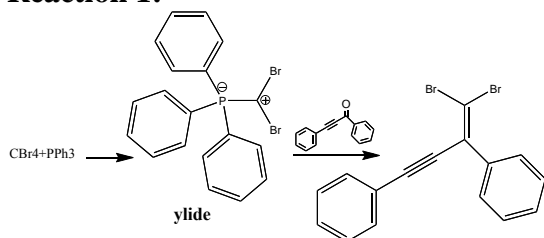
### ORGANIC SYNTHESIS THROUGH ANION CHEMISTRY

John Love '10

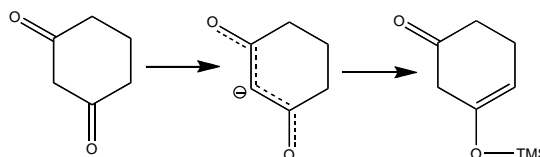
Faculty Sponsor: Thomas Mitzel

Much of organic synthesis depends on the ability to control reactive sites of molecules in order to achieve desired products. Two such synthesis reactions that were studied are shown below.

#### Reaction 1:



#### Reaction 2:



The first reaction shown is an intermediate step in a larger molecular synthesis of an asymmetrical diyne. Literature has shown the use of this ylide formation has worked on similar systems and would provide a high yield with no side products. The second reaction shown is the first step of a scheme to create a natural product found in lace bug nymphs. This poster will further explain the chemistry behind, and ramifications of, the two systems of study.

## 20.

### ANALYSIS OF MK-801 TOXICITY IN E13 CD-1 MICE BRAINS

Ariana Mullin '09, Brian Sinnott '08

Faculty Sponsor: Bill Church

Parkinson's syndromes results from the death of dopaminergic neurons following exposure to specific toxins, the best known being MPTP. MPTP is converted to  $\text{MPP}^+$ , which generates reactive oxygen species destroying cell membranes. Studies have indicated that MK-801 may have neuroprotective effects when administered prior to MPTP exposure. In order to explore this mechanism further, MK-801 must be determined not to be toxic itself. Ventral mesencephalic cells were cultured from E13 CD-1 mice, and plated at a density of 4.5 brains per plate. The cells were fed on DIV 4 and DIV 7 before being treated with either 10  $\mu\text{L}$  MK-801 or 10  $\mu\text{L}$  sterile, deionized, distilled  $\text{H}_2\text{O}$ . Cells were fixed using a paraformaldehyde solution 48 hours after treatment, and results were visualized using either a fluorescent or visual stain. Surviving cells were counted and it was determined that there was no statistical significance in cell death between the treatment groups. Further experiments will explore the neuroprotective effects of MK-801, as well as the roles of the various receptors involved in this mechanism. Also of interest will be the environmental toxin Rotenone, which is implicated in the development of Parkinson's syndromes, and the possible role that neuroprotective agents can play in preventative treatments.

21.

## SYNTHESIS OF A FLUORESCENT POLY PEPTIDE FOR USE AS A MARKER IN LIVER CELLS

Jonathan Nyce '09

Faculty Sponsor: Timothy Curran, George Barrows MD, St. Francis Hospital

Poly-l-lysine is used very commonly in medicine because it travels throughout the human body without breaking down and can easily couple to fluorescent molecules. The research done this past summer showed that cultured liver cells rejected both fluorescein and poly-l-lysine-FITC. The goal was to synthesize a molecule that the liver would accept while remaining coupled to a fluorescent marker. This poster will show the synthesis of Poly-UDC-Lysine-FITC.

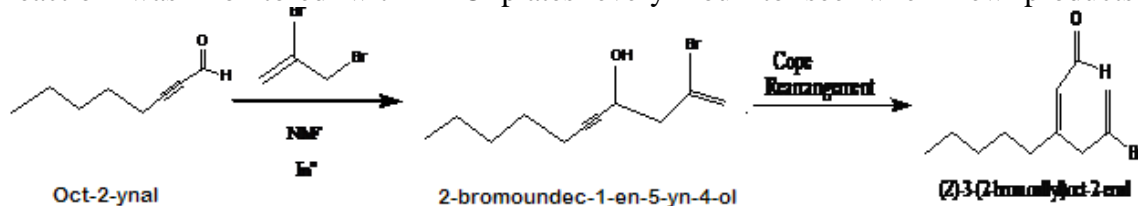
22.

## THE SYNTHESIS OF 3-(2-BROMOALLYL)OCT-2-ENAL VIA INDIUM COUPLING REACTION AND COPE REARRANGEMENT

Laert Rusha '08

Faculty Sponsor: Thomas Mitzel

The goal of this project was to synthesize organic compounds that would serve as templates for antitumor drugs. We set out to create 3-(2-bromoallyl)oct-2-enal. In a 25 mL round-bottom flask we mixed 1 mmol oct-2-ynal with 1.5 mmol 2,3-dibromopropene and 1.1 mmol of indium powder in NMF solvent (as seen in reaction scheme 1) and stirred vigorously with a stir bar. The reaction was monitored with TLC plates every hour to see when new products formed.



The alcohol product, 2-bromoundec-1-en-5-yn-4-ol, was formed with limited success. The reproducibility of the reaction was a problem. We were not able to consistently form the alcohol. The reaction parameters were tweaked and we found that NMF solvent works better than water, and that sonication at 50 degrees Celsius works better than room temperature. There was no sign of the cope rearranged product. In addition, a major side product consistently formed. We are still trying to isolate and identify this side product.

23.

**INDIUM COUPLING OF CYCLOHEXANECARBOXALDEHYDE AND 2,3-DIBROMOPROPENE IN AN *N*-METHYL FORMAMIDE SOLVENT**

Merry Smith '09

Faculty Sponsor: Thomas Mitzel

This research conducted investigated indium coupling reactions of allyl and aldehyde systems. The particular reaction studied dealt with reagents cyclohexanecarboxaldehyde and 2,3-dibromopropene reacted in the presence of indium metal in an *N*-methyl formamide solvent. A similar reaction studied, that of cyclohexanecarboxaldehyde and allyl bromide, also reacted in an NMF solvent with the presence of indium, yielded a coupled alcohol product. Based on these results, it was proposed that the reaction studied this summer of reagents cyclohexanecarboxaldehyde and 2,3-dibromopropene would yield a coupled product with an alcohol and bromine group. Instead, an as-yet unidentified product was consistently formed when the reaction solution was subjected to heating and sonication. Research is continuing into the isolation, purification, and characterization of the product formed.

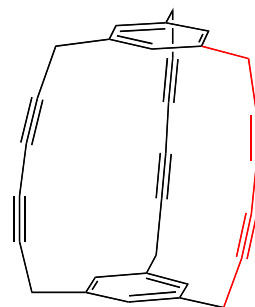
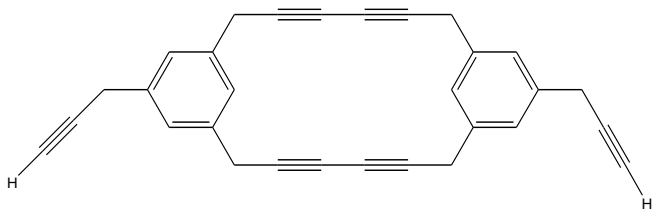
24.

**TOWARDS THE FORMATION OF SMALL HOMO-CONJUGATED HYDROCARBON CAGES**

Katharine Spencer '08

Faculty Sponsor: Thomas Mitzel

The delocalization of electrons across an sp<sup>3</sup> carbon is known as homo-conjugation and leads to increased stability of neutral systems. Molecules with 3-dimensional homo-conjugation, such as 3-D hydrocarbon cages are interesting synthetic targets as they could possibly increase stability of more complex systems. In addition, interaction of the pi-system with a guest molecule could give rise to interesting properties. Synthetic targets shown above were target molecules this summer. The larger cage can be formed using asymmetrical diynes as a synthetic precursor. Synthetic routes towards the smaller cage were also explored.



25.

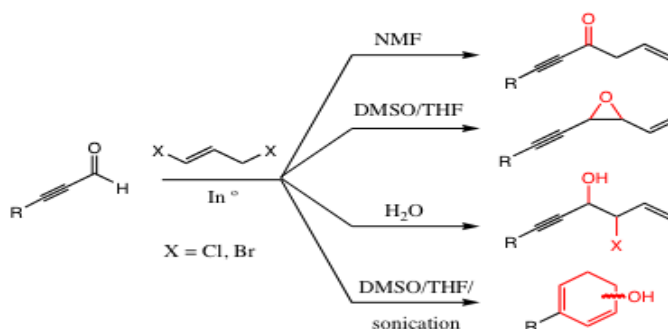
## USE OF SOLVENT CONDITIONS TO CONTROL FUNCTIONAL GROUP FORMATION IN INDIUM PROMOTED COUPLING REACTIONS

Rebecca Sufilas '08, Timothy Scarella '08

Faculty Sponsor: Thomas Mitzel

This poster will detail the use of 1,3-dihalopropenes as the nucleophilic species in indium metal promoted coupling reactions. We will show that, beginning with a single set of starting reagents, it is possible to form, in a controlled fashion, either an alcohol, ketone, epoxide, or bicyclic product simply by varying solvent and energy conditions within the reaction mixture.

Scheme 1: Functional Group Formation Control Through Solvent Effects



26.

## DIRECT BROMINATION OF A NUCLEOTIDE

Ashley Swiggett '09

Faculty Sponsor: Richard Prigodich

The goal of this project is to synthesize a nucleotide phosphonoamidite. This will allow synthesis of oligonucleotides with a 3'-methylene group between a ribose ring and phosphorus atom of a phosphonate linker. The purpose is to use the unique NMR chemical shift of the phosphonate phosphorus atom (compared to phosphate phosphorus) and the proton-phosphorus coupling constant to monitor metal ion binding to oligonucleotides. The first step was to protect the 5'-hydroxyl group of thymidine with tert-butyl-diphenylsilylchloride (TBDPSCl). This first intermediate was then reacted with pyridine and thionyl bromide to cause a Sn2 reaction at the primary alcohol at the 3'-site. This reaction was tried at various low temperatures to create the proper environment for this reaction to occur without the bromine reacting twice. It appears the reaction rate is very fast and very low temperatures must be used to control the reaction. After this bromination is successfully carried out with high yields a Grignard reaction will be the next step in creating the phosphonamidite nucleoside.

27.

**USING NUCLEAR MAGNETIC RESONANCE (NMR) TECHNIQUES TO DETERMINE THE RELATIVE SPATIAL ORIENTATION OF CAPSAICIN IN SOLVENTS OF VARYING POLARITY**

Brice Vallieres '09

Faculty Sponsor: Richard Prigodich

The purpose of this research project was to determine the inter-proton distances of capsaicin in solvents of varying polarity. The extent of the folding was mainly mapped using intensities found in one dimensional nOe's (nuclear Overhauser effect) and 1D rOe's (rotational frame nOe's). A standard proton NMR, and 2 dimensional experiments, such as a COSY, a NOESY and a ROESY were obtained. In addition to deuterated chloroform, deuterated benzene and deuterated methanol were also tested. In order to determine the extent of folding, more testing needs to be completed. Further investigation of this molecule will likely lead to results that will show the extent of the folding in environments of different polarity (i.e. aqueous solution versus membrane bound versus protein receptor environments).

## COMPUTER SCIENCE

28.

**VARIABLE ANALYSIS OF RSA CRYPTOSYSTEM**

Vinit Agrawal '10, Orko Momin '10

Faculty Sponsors: Takunari Miyazaki, Ralph Morelli

The RSA (Rivest-Shamir-Adelman) protocol is one of the strongest public-key cryptosystems and plays an integral part in internet security. In RSA, a message  $m$  is encrypted by computing  $m' = m^e \text{ mod } pq$ , where  $p, q$  are large secret primes, and  $m'$  is decrypted by computing  $m = m'^d \text{ mod } pq$ . Here  $e$  is arbitrarily chosen while  $d$  is determined by  $e$ . It has been conjectured that, if  $d < n^{0.5}$ , the system becomes vulnerable to attacks. In this study the relationship between the size of  $d$  and the system's strength was analyzed experimentally. Duplicate Java and Mathematica routines were developed and used to determine experimentally, for large sets of  $p$  and  $q$ , what percentage of  $d$  (and hence  $e$ ) would result in vulnerable keys. For random  $p$  and  $q$  ranging in bit lengths from 8 to 32, the number of values of  $d$  less than  $n^{0.5}$  was calculated. Results for both sets of routines produced identical results and showed that percentage of invalid  $d$  decreased significantly with increasing bit length. These experimental results suggest that the vulnerabilities of RSA become almost insignificant for very large prime numbers.

**29.**

### **USING SUPPORT VECTOR MACHINES FOR MICROARRAY ANALYSIS**

Saroj Aryal '09

Faculty Sponsor: Ralph Morelli

A microarray is a small silicon chip that is covered with thousands of nucleotides of known sequence. They are used in a number of biological domains to study gene expression patterns at the genomic level. One of the ways of studying these microarray data is by using Support Vector Machine software. A Support Vector Machine (SVM) is a computational tool that performs classification of input data (usually in the form of vectors) by constructing a multi-dimensional plane that separates the data into two or more classes based on the training data.

Several open-source SVMs were studied in regards to their advantages and disadvantages. Extensive tests were done on libSVM using publicly available datasets. By varying the kernel functions used and the cross-validation and scaling techniques, we were able to observe different levels of training accuracy and classification accuracy. Using libSVM, we conducted three binary classification experiments. The first used a publicly available dataset of types of splice-junction: exon/intron(EI) and intron/exon(IE) junctions. This experiment showed that 90.4368% of the testing examples were classified accurately. The second experiment was distinguishing winning and losing baseball teams based on publicly available baseball statistics. In this experiment, the SVM model proved to be a significantly better predictor of winning team than a random model. The last experiment was to classify the two types of leukemia: acute lymphoblastic leukemia (ALL) and acute myleoid leukemia (AML), based on publicly available microarray. The results in this case matched the classification results achieved in previously published analyses of these data sets.

## **ENGINEERING**

**30.**

### **DELINEATION OF HEART MURMUR FEATURES THROUGH COMBINED WAVELET TRANSFORM AND AUTOREGRESSIVE MODELING**

Nikolay Atanasov '08

Faculty Sponsor: Taikang Ning

The focus of this paper is on systolic heart murmurs of clinical significance. It presents a new approach to delineate cardiac auscultation measurements with quantitative features such as timing, intensity, duration, pitch, and shape of heart murmurs through an effective combination of joint time-frequency wavelet analysis (WT) and autoregressive (AR) modeling. These quantitative descriptors are generated in a systematic fashion and are immune to the personal bias and are useful for clinical diagnosis to detect and assess the severity of possible cardiovascular abnormalities. Without loss of generality, this paper exemplifies the effectiveness of the suggested new approach herein through simulations with several systolic heart murmurs of clinical significance, e.g., atrial septal defect (ASD), ventricular septal defect (VSD), Still's murmur, and mitral valve prolapse (MVP), to name a few. For each examined heart murmur, quantitative parameters were extracted, which correspond to correct clinical decisions.



### **31.**

#### **DESIGN OF AN OPERATIONAL AMPLIFIER HAVING HIGH-PASS, LOW-PASS AND BANDPASS FILTERS**

Mahmudul Chowdhury '08

Faculty Sponsor: Taikang Ning

The purpose of the research was to design a high gain operational amplifier which has high-pass, low-pass and bandpass filters. An operational amplifier is a high-gain electronic voltage amplifier with differential inputs and, usually, a single output. The operational amplifier used for the design was an instrumentation amplifier. Instrumentation amplifier is a differential amplifier that has very low DC offset, low drift, low noise, very high open-loop gain, very high common-mode rejection ratio, and very high input impedances. A combination of resistors and capacitors were used to make high-pass, low-pass and bandpass filters. A high-pass filter rejects any frequency below a certain threshold frequency. A low-pass filter rejects any frequency above a certain threshold frequency and the bandpass filter only passes frequencies within a certain range. For each filter, the 3dB frequency was first determined. The cutoff frequency or 3dB frequency of an electronic circuit is either the lowest or the highest frequency for which the output of the circuit deviates less than 3 dB from the assigned value. The circuit designed was first simulated using B2 Spice simulation. Instrumentation amplifiers are sold as IC chips or integrated circuit chips. The part number for the chip used in the design was INA111AP-ND. The output of the chip was tested using an oscilloscope. A gain of about 1000 was achieved using a suitable resistance value. The value of the resistor can be changed to increase or decrease the gain. Factors like shielding and grounding were also taken into consideration.

### **32.**

#### **CORRELATION DIMENSION OF THE HIPPOCAMPAL REM EEG DURING NORMAL DEVELOPMENT**

Adam Grare '10, Ankit Saraf '10

Faculty Sponsor: Taikang Ning

In chaos theory, the correlation dimension (also known as fractal dimension) measures the complexity of a set of points in space. The correlation dimension is estimated by the slope of the correlation integral. In this study, we proposed a modified Grassberger-Procaccia algorithm that uses a normalized Euclidean distance to compute the correlation integral. The algorithm was implemented using both FORTRAN and MATLAB programming languages and utilized to compute the correlation dimensions of REM sleep EEGs collected from the hippocampal subfields of CA1 and the dentate gyrus, the two primary sites related to memory and learning abilities. We used the correlation dimension as an index to examine developmental changes for rats at 15 and 90 days of age.

**33.**

**ESTIMATION OF AUTOREGRESSIVE MODEL PARAMETERS THROUGH AN ORTHOGONAL TRANSFORM**

Nabil Imam '08

Faculty Sponsor: Taikang Ning

A new autoregressive modeling algorithm based on orthogonal transform is developed and implemented to examine any time series of interest. The estimated AR model coefficients are least-squared error optimal and efficiently computed through vector computations. Using Gram-Schmidt orthogonal transformation, the new AR modeling algorithm progressively extracts linear relationship from data samples to determine the optimal forward and backward linear prediction. The performance of the new method was examined and justified through extensive simulations. It is capable of generating accurate AR model coefficients and high resolution power spectra with insignificant bias. Our algorithm can find many applications in biomedical data analysis, such as ECG, EMG and EEG.

**34.**

**DESIGN AND IMPLEMENT SOURCE CODING AND CHANNEL CODING ON A SINGLE-CHIP USING FIELD PROGRAMMABLE GATE ARRAY (FPGA)**

Neil Robertson '08

Faculty Sponsor: Taikang Ning

In modern communication systems, coding plays a crucial role in digital communication and dictates the overall performance. The goal of this project was develop a Field Programmable Gate Array (FPGA) based system that could utilize custom coding techniques for digital communication. The FPGA system allows rapid prototyping due to its flexible architecture and also provides very high processing speed because of its hardware base. A core system that essentially performs all the tasks of a microcontroller (CPU, I/O, memory, communication, etc.) was successfully implemented on an FPGA system. A prototype channel coding technique was successfully implemented in hardware using Simulink and Altera conversion tools. The FPGA system was able to encode, decode and successfully detect and correct errors in a set of data to meet the requirement of real-time performance.

## **ENVIRONMENTAL SCIENCE**

**35.**

**METALS AND ANIONS IN THE TROUT BROOK OF WEST HARTFORD, CT, SUMMER 2007**

Elisabeth Cianciola '10, Susan Juggernaut '09, Nathan Sell '10

Faculty Sponsor: Jonathan Gourley

The purpose of this study was to examine heavy metal and anion concentrations in the Trout Brook from Beachland Park to the Park River. Historically, outflows from nearby metal finishing facilities, autobody shops, the West Hartford dump and sanitary sewer overflows (SSO's) have

dumped into the Trout Brook. Even if organisms lower in the food chain, such as macroinvertebrates, can tolerate excessive levels of metals in aquatic ecosystems, they can bioaccumulate in organisms higher in the food chain, especially fish, to lethal concentrations. In order to determine the concentrations of metals and anions in the sediment and water of the Trout Brook, sediment and water samples were collected from various locations and analyzed using inductively coupled plasma atomic emission spectrometry (ICP-AES) and ion chromatography (IC), respectively. Sediment samples were sieved at the 230 grain size so that only the smallest particles, those which would be available to aquatic life, would be digested. Likewise, weak acid digestion (Hornberger, 1999) was used to prepare the sediment samples for ICP, because this technique analyzes only the metals on the surface of sediment particles, which would be those that aquatic organisms come in contact with.

In comparison with Environmental Protection Agency (EPA) and Connecticut Department of Environmental Protection (DEP) water quality standards, the metals in sediment samples do not reach harmful levels, although they do exhibit a trend of increased concentrations downstream, after the Trout Brook passes through industrial property. Water samples, however, appear to exceed DEP chronic effect levels for aquatic organisms for lead, copper, cadmium, zinc, nickel, and arsenic in the majority of samples. Chloride, nitrate, and sulfate levels, however, do not appear to exhibit distinct trends in the Trout Brook. Further repetitions and testing at different times of the year and in the Park and Connecticut Rivers would solidify these results.

### **36.**

#### **DETERMINING THE RELATIONSHIP BETWEEN EROSION RATE AND MAGNETIC ENHANCEMENT OF THE LOESSIC HILLS OF HITCHCOCK NATURE CENTER, IA**

Chamae Munroe '10

Faculty Sponsor: Christoph Geiss

We measured erosion rates and sampled several soil profiles on steep hill slopes at Badger Ridge in the Hitchcock Natural Area, Iowa, just north of Omaha, Nebraska. Erosion rates were measured the last four years at 12 sites of varying vegetation and slope angles by measuring the length of a stake above ground at each site. Soil cores were taken at four sites, all which were located in prairie vegetation. Site B had a slope angle of 25 degrees, site D was at the top of the hill, site E had a slope angle of 27 degrees, and site G had a slope angle of 10 degrees. All soil profiles were taken with a manual push probe and sub-sampled into intervals of five centimeters. The soil profile at site B was taken down to 55 cm and one additional measurement at 75 cm. The soil profile at site D was taken down to 70 cm and at site E, the profile was taken down to 80 cm. At site G, the soil profile was taken down to 60 cm. Once back to Connecticut, various magnetic parameters were measured including magnetic susceptibility, anhysteretic remnant magnetization (ARM), isothermal remnant magnetization (IRM) and the ARM/IRM ratio since these are the more sensitive parameters. Although sites B and E had the about the same slope angle, site B had an erosion rate of 0.9 cm/yr while site E had an erosion rate of 0.09 cm/year. While it was hypothesized that as erosion rates increased, the magnetic signal would decrease, only site B had a higher erosion rate but lower magnetic signal than D. All of the other samples acted contrary to what was expected. Next year multiple measurements will be taken at each site

to ensure that the magnetic signal is consistent in a localized proxy and a more detailed analysis of the vegetation will be taken to see if there is any variation within the prairie that may affect the magnetic enhancement of the soil.

**37.**

**MACROINVERTEBRATE POLLUTION SENSITIVITY SURVEY OF THE TROUT BROOK IN WEST HARTFORD, CT**

Nathan Sell '10, Elisabeth Cianciola '10, Susan Juggernaut '09

Faculty Sponsor: Jonathan Gourley

The Trout Brook, a tributary of the Park River flows into the Connecticut River and ultimately the Long Island Sound. The Trout Brook runs through West Hartford where water from a sanitary sewer overflow (SSO), the West Hartford landfill, metal finishing companies, and stormwater runoff are discharged. In this study, macroinvertebrates from the Trout Brook were collected and identified. The orders of insects that are most sensitive to river pollution are ephemeroptera, plecoptera, and trichoptera (EPT) (Clements, 1994). To determine what substrate was preferred by macroinvertebrates, grain size analyses were conducted in the areas that macroinvertebrates were collected. The results indicated that macroinvertebrates prefer rocky sediments over sandy substrates. By examining the percent EPT orders we were able to see that three areas stand out as having very low percent EPT and thus are likely in poor health: 1) at an outflow in the Beachland Park stretch, 2) the SSO, and 3) at the outflow from the West Hartford Landfill. These areas were shown to have a rocky substrate where larger populations of macroinvertebrates should be found. However, lower than expected populations were observed in these rocky areas. In addition, there are also a higher percentage of blood worms (order Diptera), which are known to inhabit polluted areas (McCafferty, 1998). High levels of heavy metals in the river may be a factor affecting the macroinvertebrates, and it has been shown that there is an accumulation of heavy metals in the sediments of the downstream portion of the Trout Brook. Future research will examine the accumulation of heavy metals within macroinvertebrate tissues.

**38.**

**ANALYSIS OF TIRE RUBBER LEACHATE WITH THE SALMONELLA MUTAGENESIS ASSAY (AMES TEST)**

Sara Yoo '08

Faculty Sponsor: Alison Draper

Rubber particles from automobile tires wear off with use and contribute to water pollution, leaching harmful chemicals into the environment. It has long been suspected that polycyclic aromatic hydrocarbons (PAHs) leached from tire rubber are responsible for a mutagenic and carcinogenic effect on living organisms. PAHs are metabolism-dependent mutagens, and previous research using the Ames *Salmonella* mutagenesis assays suggests that tire rubber leachate is only mutagenic when activated by a metabolic agent such as liver homogenate S-9. In an effort to further analyze the correlation between concentration and mutagenicity, an Ames bacterial assay using strains TA1535 and TA1538 of *Salmonella typhimurium* was performed

according to Standard Methods to determine a dose-response relationship. In a preliminary experiment, a dose-response relationship was observed for TA1538 when exposed to varying concentrations of known mutagens 2-aminoflourene and NPD, indicating that a dose-response curve is attainable. In a further attempt to identify as the physical-chemical characteristics of the mutagenic agents in tire rubber, sunlight and enzyme induction were used. It is known that sunlight breaks down PAHs. The mutagenicity of a sample of tire leachate exposed to sunlight were compared to that of leachate stored in the dark; TA1535 showed less mutagenicity with exposure to sunlight-exposed leachate. In addition, S-9 obtained from naïve rats was compared with that from rats induced with  $\beta$ -naphthofalvone and phenobarbital, which induce CYP1A and CYP2B, respectively, the former responsible for PAH metabolism. There was only half as much mutagenicity in TA 1535 when exposed to non-induced S-9. These findings are further evidence that PAHs may be the dominant mutagens in tire rubber. Further work is necessary to establish a definite correlation between concentration and mutagenicity and isolate the harmful chemical(s) in tire rubber so that these compounds can be eliminated in future tire production.

## **MATHEMATICS**

**39.**

### **CHANNEL ASSIGNMENT AND GRAPH LABELLING**

Nicholas Allen '09

Faculty Sponsor: David Mauro

The assignment of the electromagnetic wave frequencies and amplitudes to television and radio stations depends on such factors and the strength of the stations signal and the height of its antennas. The distance between stations also plays a major role in the channel assignment. Mathematicians have been using graph theory to study these situations since the 1970's. Broadcasting stations are graphically represented as vertices and these vertices are adjacent when their respective stations are significantly close to one another. A function was developed called Ld(2,1)-labeling that transforms vertices into numbers that correspond to the frequencies they can be assigned. It followed that a number a similarities could be found among these graphs that lead to a number of theorems and rules that applied not just to these specific graphs, but to graphs that have been labeled with more generalized (i,j)-labeling functions.

## **NEUROSCIENCE**

**40.**

### **LONG TERM POTENTIATION IN THE MULTISYNAPTIC PATHWAY EXTENDING FROM THE DENTATE GYRUS TO THE ENTORHINAL CORTEX**

Nicole Albino '10

Faculty Sponsor: Harry Blaise

The hippocampus is a small area of the limbic system in the brain that plays a significant role in learning and memory and is believed to be the first stop for processing of sensory information

before it is relayed to the neocortex for storage. Previous research has shown that sensory information destined for hippocampal processing enters through the entorhinal cortex, takes a closed circuitous path through the hippocampus in what is known as the trisynaptic circuit and leaves through the entorhinal cortex. But it is not yet fully understood how this information once processed is extracted out of hippocampal areas and projected back to the neocortex. In order to understand more of this phenomenon, we assessed whether long-term potentiation (LTP), a form of enhanced synaptic plasticity induced by frequent activation of a synaptic pathway, can be reliably induced in the multisynaptic pathway extending from the hippocampal dentate gyrus to the entorhinal cortex. If indeed, information processed by the hippocampus is projected back out to the neocortex through the entorhinal cortex, then this multisynaptic pathway should be able to reliably support induction of long term plasticity. To this end, surgery was performed on adult male and female Sprague-Dawley rats to chronically insert a recording electrode in the entorhinal cortex and a stimulating electrode in the hippocampal dentate gyrus. After a 3-5 day recovery period, both baseline single-pulse and paired-pulse evoked potentials were recorded in the entorhinal cortex in response to dentate gyrus stimulation. LTP was then induced using a 0.1 Hz burst stimulation protocol. Preliminary results indicate that LTP is reliably induced and maintained in some but not all of the animals under study. Furthermore, there were no gender-related differences between either group. Because the enhancement of LTP indicates more efficient transmission of information through synapses, in this case more efficient processing and consolidation of information, our results tend to support the idea that information is cycled through the hippocampus and then transferred back to the neocortex through the entorhinal cortex. We are conducting more studies to shed light on why LTP was induced only in some animals and not in others.

#### **41.**

#### **EFFECTS OF KETOGENIC DIET ON SYNAPTIC PLASTICITY IN FREELY BEHAVING RATS**

Kaitlin Haines '09, Urey Chow '09, Katy Gaffney '09

Faculty Sponsor: Harry Blaise

The ketogenic diet is known to have anticonvulsant effects on children who experience epileptic seizures; however, the underlying mechanism for this medicinal efficacy is unknown. The objective of this study was to determine the effects of the ketogenic diet on hippocampal synaptic plasticity in freely moving adolescent rats in order to understand how the ketogenic diet alters neuronal communication. Synaptic plasticity, which is measured by the changes in neuronal activity, is defined as bidirectional, incurring long term potentiation (LTP) in the positive direction and long term depression (LTD) in the negative direction. LTP can be defined as an increase in neuronal activity and synaptic efficacy, whereas LTD can be referred to as a decrease in synaptic strength. Only LTP was measured in this study. In order to assess the effects of the ketogenic diet, weaned rats (age 21 days) were placed on a strict diet of ketogenic food (80% fat, 8% protein, minimal carbohydrates) for 3 weeks while a control group was fed a normal rodent diet. Weighing of both the control and ketogenic animals occurred every other day to assess body growth. Between 42-58 days of age, animals underwent surgery to insert stimulating, recording and ground electrodes in the perforant path, dentate gyrus, and contralateral parietal cortex, respectively. After a 7 day recovery period, the animals were

stimulated with a 100 pulse, 5 Hz theta burst stimulation to induce LTP. Preliminary results indicate a lower expression of LTP among animals fed the ketogenic diet when compared to control animals. This suggests that an inhibitory process at the synaptic level may prove to be the underlying mechanism by which the ketogenic diet exerts its influence.

#### **42.**

### **CHARACTERIZATION OF THE ROLE OF CA3 MOSSY FIBERS IN INFORMATION PROCESSING IN HIPPOCAMPAL CIRCUITS**

Connie Hernandez '10, Daisy Ramos '10

Faculty Sponsor: Harry Blaise

In the brain, the hippocampal formation is known to be involved in learning and memory function. It consists of the trisynaptic pathway extending from the entorhinal cortex to the dentate gyrus (DG) via the perforant pathway nerve fibers, then from the DG to area CA3 via the mossy fibers, and from CA3 to area CA1 via the Schaffer collaterals. Learning and memory occur when communicating neurons increase the strength of their synaptic connections. Memories may also be erased by decreasing the strength of synaptic connections between neurons. The ability of synapses to be strengthened or weakened is referred to as synaptic plasticity. Long-term potentiation (LTP) and long-term depression (LTD) are two examples of synaptic plasticity mechanisms which can strengthen or weaken synaptic connections in the hippocampus, respectively. The present study investigated LTP and LTD of the synaptic connection linking the DG and CA3 regions (mossy fibers). Electrodes were implanted in the DG and CA3 of adult male rats. Three to five days after surgery, either LTP or LTD was induced using standard stimulation protocols. Paired pulse index (PPI) data, which are indicative of short-term neural plasticity, were also recorded from each subject and correlated to LTP/LTD data. Preliminary results show that both LTP and LTD of the DG-CA3 synapse occurred in some animals. However, there were a greater number of animals which exhibited neither LTP nor LTD. These findings are interesting in view of other investigators reporting that the mossy fibers which link the DG and CA3 regions are both excitatory and inhibitory, which may help to explain why some animals showed synaptic enhancement while others did not. We are presently collecting more data to determine what factors are responsible for the mossy fibers having either an excitatory or inhibitory influence on the DG-CA3 synapse.

#### **43.**

### **NEUROPHENOMENOLOGY OF TIME: FUNCTIONAL NEUROIMAGING IN THE PAST AND FUTURE TENSE AND AN FMRI BASIS FOR AN OBJECTIVE TIMESCAPE**

Michael Pierce '10

Faculty Sponsor: Dan Lloyd

Current functional neuroimaging research remains almost entirely focused on the present tense. That is, today's research paradigms examine the metabolic state of the brain as a function of current task and stimulus conditions. These studies, therefore, are methodologically blind to the temporal inflections that constitute any state of awareness. In this poster, we report on research techniques in functional MRI that lift the curtain on the past and future. Combining the

statistical technique of independent component analysis with the pattern detection capabilities of artificial neural networks allows us to probe the temporal information in fMRI images, and measure the extent to which each image inscribes its own history and anticipated future. During the course of our investigation we discovered that any given brain image produces major peaks in information density around changes in experimental condition. These peaks assert the ability of a single fMRI image to hold information regarding both past and future states. Armed with this knowledge, we trained artificial neural networks to identify the current experimental conditions, and project both past and future conditions based on single images. The networks' ability to do so accurately reinforces the conclusion that single brain volumes hold significant information beyond that which pertains to current conditions, and provides evidence for an objective temporal landscape within the brain. These findings have broad implications in terms of uncovering the mind's mechanisms for handling temporal processes.

#### **44.**

##### **THE EFFECT OF A LOW CARBOHYDRATE DIET ON ADENOSINE IN THE BRAIN**

Laura Pomeroy '09, Caleb Wasser '08, Ritika Chandra '10

Faculty Sponsor: Susan Masino

The ketogenic diet, which is a high fat, low carbohydrate regimen, has been used as an alternative therapy for epileptic seizures since the 1920s. While the diet is known to be effective in children who do not respond well to anticonvulsant medications and to have fewer side effects than other treatments, it is difficult to maintain and not very palatable. Additionally, the mechanism behind the diet's anticonvulsant effects remains unknown. Previous studies and preliminary results reveal that adenosine, due to its role as an inhibitory neuromodulator and endogenous anticonvulsant, may play a key role in the diet's effectiveness. In order to test this hypothesis, weaned male Sprague-Dawley rats were fed either the ketogenic diet or a basal control diet for three to four weeks. Open field and y-maze behavior tests were conducted. Electrophysiology was then performed to test the endogenous influence of adenosine in the hippocampi of both groups. Preliminary behavioral experiments showed an increase in locomotor activity. Preliminary recordings show a reduced response to extracellular adenosine in ketogenic hippocampal slices. These results, as well as parallel previous studies, show that the ketogenic diet alters behavior and supports our hypothesis that the diet increases the influence of adenosine on brain excitability. Our findings may help develop a new assortment of novel treatments for individuals suffering from epilepsy and other neurological disorders.



# PSYCHOLOGY

45.

## **RETRIEVAL OF AUTOBIOGRAPHICAL MEMORIES**

Stephanie Keith '08, Dzheni Dilcheva '08

Faculty Sponsor: Karl Haberlandt

We conducted an exploratory study of the mechanisms that affect the retrieval of autobiographical memories. It is well known that visual experience plays an important role in the retrieval of memories. For this reason, researchers often manipulate stimulus imagery to study its effect on memory. In our study, we used cue words varying in degree of imagery to learn more about the effect of imagery on autobiographical memory retrieval. Autobiographical memories are complex in that they include different memory types (e.g. semantic, episodic, and sensory memories). Williams and colleagues (1999) claim that recall of specific events from autobiographical memory is facilitated by cue words that are high in imagery.

We designed an experiment to replicate and expand on the study by Williams and colleagues. Participants were shown a cue word (e.g. *baby*, *effort*, *bouquet*) and asked to respond with a personal, specific memory. Cue words were balanced with regard to imagery (high vs. low) and frequency (high vs. low). After completing the cued recall task, participants assigned dates and rated the pleasantness of their recalled events.

Based on data from 29 participants, preliminary results support Williams' finding that cue words high in imagery elicit faster recall of personal memories. A large data set was collected in the summer 2007. We are interested in examining several dependent variables from this data set in the future, including but not limited to, specificity and pleasantness of the recalled event, the date of the event in the person's lifetime, the characteristics of speech responses (e.g. speech duration and fluency), and the retrieval process (direct or generative).

46.

## **EDUCATIONAL PRACTICES AND STUDENT LEARNING IN A LIBERAL ARTS COLLEGE: CODING QUALITATIVE INTERVIEWS FROM A PANEL STUDY**

Eugene Pan '08

Faculty Sponsor: David Reuman

Working with a small group of selective liberal arts colleges in New England, Trinity is conducting a multi-year study in which students are followed as they make the transition from high school to college and progress through their undergraduate careers. The goal of this study is to increase our understanding of how students make decisions about their academic programs (e.g., choice of courses, choice of major), how they adjust to living at a residential college, and what contributes to (or detracts from) a successful college experience. 36 students from the Class of 2010 were recruited using a stratified random sampling technique designed to maximize the diversity of background and experience of students included in the study. Participants were interviewed three times during the 2006-2007 academic year. The interviews followed structured sets of questions, with interviewers probing for specific, relevant detail as needed.

This report focuses on the first round of interviews, conducted in October and November of 2006. The interviews were transcribed, coded, and linked to other demographic and survey data. The interview sample did not differ from the full population of first-year students with respect to survey data on their college goals and anticipated academic, social, and personal difficulties. The qualitative interviews showed that positive descriptions of professors focused on their devotion to teaching and their accessibility; negative descriptions of professors derived from methods and personalities of professors; problems with time management, adjustment to Trinity's location in Hartford, and peers' academic apathy were mentioned repeatedly. The results of this project will be used by staff, faculty, and students at Trinity to improve and develop programs to support students, both academically and socially.

**47.**

### **HAPTIC PERCEPTION VIA DYNAMIC TOUCH**

Matthew Phinney '10

Faculty Sponsor: William Mace

Dynamic touch is used in everyday life to allow individuals to perceive objects without the use of sight. Perception via dynamic allows people to gain impressions about the length, weight, shape, and orientation of an object. While much literature exists regarding dynamic touch, there is very little research being conducted as to the ways in which it is used in everyday life. Ping-pong players, for example, watch the ball during a game and use dynamic touch to perceive their racket. In this experiment subjects were asked to hit a ping-pong ball with four paddles of different weight distributions; a screen occluded the paddle in the participant's hand. Subjects were then asked to determine the point of contact of the ball and paddle using dynamic touch. Video footage was analyzed to determine the actual point of contact, and any discrepancies were evaluated.

## **SCIENCE AND SOCIETY**

**48.**

### **UNDERSTANDING SOCIAL CAPITAL AND STATUS IN RURAL ECUADOR**

Cristina Wheeler Castillo '08

Faculty Sponsor: James Trostle

Recent studies show that cognitive and structural social capital are important determinants of health. While the majority of studies focus on objective measures of social capital, very few studies have explored subjective social capital, which relies on cognitive validation techniques. Even fewer of these studies focus on developing nations. As part of a larger epidemiological study (EcoDeSS), data for this research project was collected from one of 21 study villages in rural Ecuador for one month and included 25 formal interviews. These interviews, together with notes from other EcoDeSS anthropologists, help the EcoDeSS project coalesce sociodemographic and disease data. The majority of respondents from the village were found to understand the social capital survey questions, as the researchers had intended; therefore, the survey questions are considered a useful measure of cognitive and structural social capital.

## **AV DAVIS FELLOWS**

**49.**

### **REBIRTH: USING THE CULTURES OF THE AFRICAN DIASPORA TO REACH AND TEACH HARTFORD'S CREATIVE YOUTH**

Haben Abraham '10

Faculty Sponsor: Susan Pennybacker

I became an intern on the Artists Collective Staff for Summer 2007. I conducted interviews with faculty and students, as well as contributed an art piece in the Collective's summer final production of "Olivia and the Children of Hope". A mural that I and Balam Soto's mural class designed was to display the 'hardships and chance for hope in poor neighborhoods' and the piece was featured as the backdrop in the play finale. Placing myself within the classrooms allowed me to both work and build relationships with students and begin my search to understand the arts impact on their lives. I was introduced to things I had not strongly considered before I began working at the Collective, for instance, the work and preparation needed to serve children under DCF or foster care policies, or the attention necessary for children that are either hearing impaired or have behavioral issues. My focus was also finding traces of the teaching cultures of the African Diaspora, (i.e.) the idea of parent-child relationships, disciplinary methods and order were all prevalent within the Collective's classrooms. I also questioned because times have changed- in what ways has the community or the students changed as well? Over time changing, do these teaching methods have any positive effect on the students? What has changed about Hartford and its youth to make instructors or the students themselves feel as though the teaching methods of the African Diaspora no longer work? Through the use of some video, photo, written works and interviews I plan to display what I have learned and what I have contributed. As a final project I will design an "African Oral History Book" through the written works and interviews that I have gathered. With the use of experiential learning, my observations and participation in classrooms I was able to understand the arts impact on the youth. Self esteem, confidence, collective work and support were all factors. I witnessed behavioral changes first hand in at- risk and/or shy youth at the Collective this summer.

**50.**

### **UTTING DOWN ROOTS IN HARTFORD: AN INNOVATIVE LEADERSHIP PROGRAM PROJECT**

Jasmin Agosto '10

Faculty Sponsors: Jack Dougherty, Donna Berman, Director of Charter Oak Cultural Center

A project for facilitating the growth of Hartford high school students is precisely the work I put in for the summer. A leadership program called "Putting Down Roots in Hartford" was to be developed and implemented during the summer of 2007 at Charter Oak Cultural Center in the Charter Oak/Sheldon neighborhood near downtown. It entailed creating a schedule, recruiting students, communicating with community organizers, investigating local history, putting together an organic garden project, and creating a socially conscious mural.

All in all, my project was altered greatly by the kinds of difficulties that go into putting together any sort of project of such greatness. After visiting parents and prospective kids in their own homes, making endless signs and passing out information about the project for garden donations, making phone calls and emails, and writing up draft schedules, I was not able to fully carry out the program. I had started the recruiting of students too late; many of them had plans for other programs or jobs they were supposed to do. We were not able to get all the materials we needed for the garden project. On top of it all, I was trying to take it all on myself.

However, I was greatly appreciative of the supportive adults such as Donna Berman, the director of COCC and Chris Phillips, a coworker and specialist in urban gardening. I learned about time management, how to approach high school students, and especially how to begin to put together a truly innovative curriculum, which the draft is my final project of the summer. Interestingly enough, I met a partner who would like to add a hip hop element to the program. Although facing obstacles, the project will continue into the spring and summer in which I will be able to manifest the program.

## **51.**

### **FOOTBALL IS FREEDOM: A RENEGADE SOCCER PROJECT**

Jason Azevedo '08, Alfonso Bui '08

Faculty Sponsors: Drew Hyland, Luis Figueroa, Tauheedah Muhammad, Trinity College Boys & Girls Club

Following Nelson Mandela's words, "Soccer is one of the most unifying activities amongst us," the Football is Freedom project works to integrate the Hartford community with the Trinity College campus while leveraging soccer's popular appeal, the enjoyment it fosters, and the physical benefits it offers to all. From July 5th to August 10th, 2007, 60 kids from Hartford's Trinity College & Southwest Unit Boys & Girls Clubs ages 6-13 participated in a free summer soccer clinic Wednesdays and Thursday at Trinity's Jesse/Miller Field. All program participants were given a free soccer ball and camp T shirt. Camp activities focused on fun, fitness, and basic skill development. Youth players were able to develop a love of soccer and to enjoy themselves, all the while bridging gaps that have existed between Trinity and the Hartford community. In addition to the soccer camp, research has been conducted to investigate the possibility of constructing an urban 6v6 soccer court within the Frog Hollow neighborhood. This field would be free and open to members of the public.

## **52.**

### **MULTI-NATIONAL REFERENCES AND PERCEIVED ACADEMIC SUCCESS**

Ashley Flemming '08

Faculty Sponsors: Andrea Dyrness, Janet Chang

This study analyzes the impact of a transnational identity on the academic perceptions of migrant Hartford students. The present study evaluates middle and high school children (N= 19) of immigrants who return to their place of origin during their academic career (k-12). Likert scale surveys were designed to analyze students' feelings about themselves in the school environment.

Interviews were conducted with 3 parents of participants to identify any cultural impacts on student perceptions. The surveys reflect Portes's findings, (1999) that children lacking success in American schools tend to come from "involuntarily immigrant" (Ogbu, 1991) Families. The present study finds that younger students (age 11-14) who continually revisit native lands that maintain voluntary and supportive relations with the United States have more positive perceptions of their academic engagements than other groups.

### **53.**

#### **ANALYSIS OF THE GRASSROOTS IMMIGRANT RIGHTS MOVEMENT IN HARTFORD**

Dulce Amor Imbo '09

Faculty Sponsor: Sonia Cardenas

The immigrant rights movement in Hartford is one of countless grassroots campaigns across the United States that are trying to shape public forum about immigration not only at the local level but at the national level as well. To examine and learn about the movement, hour long in-depth interviews were conducted with various peoples from different perspectives of the movement. Several activists, an immigration lawyer about the ICE raids and the legal and political rights of undocumented or "illegal" immigrants, a nonimmigrant member of the Hartford community, and a member of a Connecticut anti-immigrant group were interviewed. Two undocumented or "illegal" immigrants living in Hartford also participated. A total of nine interviews were conducted. Events regarding immigrant rights such as immigrant rights rallies, an immigration hearing for the New Haven detainees, a press conference and meetings with a local immigrant rights group were attended and observed. The immigrant rights movement in Hartford is found to ebb and flow. Over the course of the research, it has risen in action and on the verge of becoming something bigger. In general it is more reactive than proactive with a small core group of activists mainly consisting of college students. The activists are aware of such fact and are trying to become more proactive by forcing the city government to publicly discuss the issues, expanding their network of organizations, and planning events to garner more support from the immigrant community. Further research is recommended to observe and analyze the next stages of the immigrant rights movement in Hartford.

### **54.**

#### **HISTORIC PRESERVATION IN HARTFORD: IN PURSUIT OF AN APPLICATION**

Isis Irizarry '10

Faculty Sponsors: Andrew Walsh, Rebecca Parkin, Senior Planner, City of Hartford Dept. of Develop. Services, Planning Division

Of the many characteristics crucial to a city's survival, the most interesting to me is its infrastructure: the roads, buildings and institutions that converge within a city. Hartford's infrastructure, for various reasons, met a period of decline, which was slow and steady at times, and rapid and seemingly unstoppable at others. It would be unfair to make reference to this disintegration without stating the City of Hartford's interest in stopping and reversing this aspect of this city's past. One of the ways in which city officials approach their desire to improve

infrastructure can be seen in Historic Properties. These are buildings and sites that have been deemed historically valuable, for reasons ranging from someone important having lived within them—as in the Harriet Beecher Stowe house—or because the structure is one of the oldest of its kind—like the Old State House. Members of Hartford’s Department of Developmental Services, along with the Hartford Preservation Alliance, recognized the importance and value of these structures and sites. These two groups created a process by which the deterioration and inaccurate repair of these structures and sites would be halted and, in many cases, reversed. Hartford’s Historic Preservation Commission and Historic Properties Commission perform Historic Review of Building Permit Applications. In doing so, they ensure that intentions to perform visible construction, repairs, and renovations conform to pre-established guidelines. By way of these applications, we see certain roadblocks in the process of review and appreciate the outcomes of the assessment process. This view into the application process also gives urbanites a clearer view into the importance and beauty of Historic Preservation.

**55.**

**SALVIA: A NEW EXTRACORPOREAL DRUG EXPERIENCE ON COLLEGE CAMPUSES**

Meagan Miller ‘08

Faculty Sponsor: James Trostle

Salvia is a plant in the mint family historically used to treat everyday ailments and to help in shamanic healing rituals by those indigenous to Oaxaca, Mexico. Because it is easily and legally purchasable from various internet sites, its recreational use extends worldwide. It is classified as a hallucinogen, but the difference between it and other hallucinogens is that the user has a marked out-of-body experience. While much has been written about its active ingredient Salvinorin A, information on salvia’s modern use and effects is lacking. Preliminary research done this summer has shown that while there are some recurrent physical and mental effects, there is quite a range of “visuals” and “hallucinations” that varies with the individual. Salvia’s high has been described as even more intense than that of heroine or methamphetamine. A question that presented itself was: Why are people continuing to use a drug that has such strong and frightening effects? Salvia has become increasingly controlled in the United States and is illegal in many countries already. This is because of its recent increase in popularity in the media. My research is aimed to assess salvia’s modern use and effects through qualitative interviewing, primary literature searches, and internet monitoring.

**56.**

**MUSLIM REFUGEE ADAPTATION IN HARTFORD: ANALYSIS OF CONTEMPORARY ISSUES**

Alissa Phillips ‘08, Jessica Hart ‘08

Faculty Sponsor: Janet Bauer

The U.S. Government, along with many other countries, funds asylum of millions of refugees around the globe. In fact, the United States admits tens of thousands of refugees annually for permanent resettlement. While this humanitarian effort to provide refuge for victims of conflict

is well-intentioned, the suffering of refugees certainly does not stop as they cross national borders into North American territory. The research conducted this summer sought to understand the process of refugee resettlement in Hartford, Connecticut, for Muslim refugees and the problems that these persons encounter in securing a prosperous livelihood in this country.

In order to understand the experience of Muslim refugees, interviews were conducted with a random sampling of Somali Bantu Refugees, as well as with refugees of Turkish and/or Russian decent. Upon hearing the experiences of these Muslim refugees, it became apparent that the general consensus in these communities is that they face two problems as communities upon entering Hartford: firstly, in the area of adult education or English language skills, and secondly, in the housing offered to refugees.

In addition to discovering the difficulties these communities face, it was also imperative to discern the role religion played in the resettlement process. We sought to understand how Islam in particular influenced the daily lives of these refugees; in other words, whether or not it was significant in terms of preserving identity, community ties, and general contentment with life in the United States. Ultimately our research concluded that religion plays an enormously important role in preserving these refugees' sense of self in a foreign place like the United States. It helps them overcome the challenges they face and helps preserve their sense of community.

57.

#### **'UNITED NATIONS': THIRD WORLD NATIONALISMS AND INTERNATIONALISM**

Ashesh Prasann '08

Faculty Sponsor: Susan Pennybacker

Patriotism is when love of your own people comes first; nationalism, when hate for people other than your own comes first.

- Charles de Gaulle

After World War I and II, Eurocentric definitions of Nationalism tend to emphasize its affinity to violence and hatred; Albert Einstein went as far as to term it an “infantile disease ...the measles of mankind”. Yet, there was a period in the middle of the 20<sup>th</sup> century, when Nationalism as a sentiment and movement became the irresistible force which uprooted colonialism and created nation states where there was only Empire.

Where the competing nationalisms of Europe had caused WWI, Afro-Asian anti-colonial nationalism was seeped in the concept of multiplicity – of religion, culture and race, thus giving birth to the concept of multinational states. The shared history of colonialism united not just communities within nations but the community of future nations as well. Ironically, the metropolises of empire, London, Paris and Brussels, became the birthplaces for Afro-Asian solidarity in the interwar period as students and intellectuals conferred and collaborated. While the realization that **they weren't alone** came about at these meetings, it was at Bandung (1955), when the idea that **they needed each other** to thwart neocolonialism gained currency. Sukarno put the importance of Bandung in perspective, “We no longer need to go to other continents to conference”.

Bandung had laid the foundation of Non-Aligned Movement, a forum which focused the nationalisms of nascent states into an internationalism which opposed colonialism, foreign domination and interstate conflict. Tireless promotion of disarmament produced the institutional offspring of International Atomic Energy Commission (IAEA). OPEC was a product of the idea that developing countries should form cartels to ensure a decent price for their commodities. The UN Conference on Trade and Development (UNCTAD) was set up in 1964 in response to developing countries' dissatisfaction with the Bretton Woods system. In fact, the relative success of UN system itself is attributable to the activism of Afro-Asian nations, in stark contrast to the League of Nations, which was a tool to preserve colonialism. If European ethno-nationalisms nearly destroyed the world, Asian and African nationalisms have attempted to heal it and create a just and equitable planet. And that should be the legacy of anti-colonial nationalism.

**58.**

### **ASSIMILATION OF SYMBOLISM: LANGUAGE ACROSS CULTURES**

Roberta Rogers-Bednarek '09

Faculty Sponsor: Martha Risser

Urban centres have historically undergone significant cultural change as a result of population migrations. For thousands of years, architectural structures—of both pagan and sacred origin—have been assumed by migrating or newly-established religious organizations. Symbols associated with the original occupants or purpose of the structure frequently adorn its exterior and/or interior. Whether or not adaptive re-use is a lost art or has followed with the migration of European peoples to North America, and specifically, Hartford, CT is the focus of this research. In an effort to compare the maintenance of symbolism in European urban centres to Hartford's, 15 re-used structures in four Italian city centres were visited, photographed and analyzed. Following extensive research and consultation with the Hartford Preservation Alliance, 12 structures in Hartford were identified and studied similarly. Of particular interest was evidence of symbolism associated with previous occupants and/or visual representation of the facilities' former function. Geometric and figural symbols, known to have cross-cultural meanings, as well as those associated with specific sacred rights were highlighted. Visual confirmation of preservation and restoration efforts was also noted. Evidence suggests that in both European city centres and Hartford, adaptive re-use existed. While not able to view and document interiors of all structures, numerous examples of assimilated symbols are present on facades and in exterior designs. With the development of scientific methods of architectural conservation and preservation, evidence exists of these efforts both locally and abroad. Further study would be devoted to investigating the purposeful maintenance or destruction of existing religious and cultural symbols associated with these structures to assess the ways in which the symbols are received and perceived by those re-using the buildings.



**59.**

**HOUSE OF PEACE: INDIGENOUS TECHNOLOGY**

L. Mixashawn Rozie '12

Faculty Sponsor: Eric Galm, Steve Haynes, Executive Director, Center for Community

Technology can be used as a lens to highlight cultural elements over time. My project utilizes the construction of an Indigenous wigwam as a practical tool in a contemporary urban setting, and then that space becomes a learning environment where students can learn about Indigenous music and culture. This process opens a window into deeply entrenched colonial values and perceptions that are present in today's society in the United States. Building wigwams from local materials is an educational tool that can promote an understanding of the circle as the ultimate equation of peace, creativity and well being. In order to gain a comprehensive understanding of this dynamic, I approach this project from both technological and sociological perspectives.

The ancient human traditions of constructing shelter from common materials is reflected in the wigwam, wikiup, wetu, and a multitude of names used throughout the original world to describe this structure. It is an efficient and cost effective means of shelter, constructed from hard wood saplings, and arranged in a circular pattern, evoking a hemispheric atmosphere. The use of this "Hemispheric Principle" is both practical and spiritual, as spirituality functions as a guide to living within Indigenous belief systems. Contemporary non-Indigenous cultures often misidentify wigwams as teepees, tents, or impractical childish toys. My project strives to observe and decode these reactions through a process where students collectively create their own space for learning Indigenous musical and cultural concepts and how they relate to their own personal experiences.

**60.**

**ECOLITERACY IN THE PARK RIVER WATERSHED**

Jessica Scordamaglia '10

Faculty Sponsor: Jonathan Gourley, Mary Rickel Pelletier, Project Director for the Park River Watershed Revitalization Initiative (in collaboration with the Farmington River Watershed Association)

Ecoliteracy is an emerging form of environmental education that involves hands-on, place-based, systemic, and fun learning. In an effort to learn more about ecoliteracy, as well as to create environmental awareness within Hartford, I have conducted research to evaluate the current condition of environmental education for youth in the Park River Watershed (especially Hartford) by looking at the collections of the libraries, observing various environmental activities and events, and learning about what the public schools and parks have to offer. It was found that there were not many resources of information on the local environment available, even though there were a number of environmental activities for youth. Overall, there is environmental education available, although it is episodic and little of it can be considered ecoliteracy. From my observations I have made some recommendations about how to begin to make Hartford a more ecoliterate city in the future.

# **MELLON FOUNDATION**

**61.**

## **HUMAN TRAFFICKING IN THE PERU/CHILE REGION**

Celia Rodriguez '08

Faculty Sponsor: Alison J. Draper

Human trafficking is a crime that diminishes the fundamental rights of human beings in which over 200 million innocent women and children fall victim every year. It is considered a contemporary type of slavery and an extreme form of violence against women and children that strip them of their fundamental rights. In the Chile/Peru border area, I encountered two countries with almost opposite economic, social and political stabilities with an enormous potential for human trafficking. This inequity causes an uneven flow of Peruvians entering Santiago, which is by far the largest and most metropolitan city in Chile. The scarcity of jobs and educational opportunities in Peru make Chile golden opportunity for many Peruvian citizens, but this also makes them an easy target for prostitution or labor trafficking. Santiago's population of six million people includes many victims who have been trafficked internally or from Argentina, Peru and Bolivia for sexual exploitation and/or labor abuse. The government of Chile is known for not fully complying with the minimum standards for the elimination of trafficking, and through the International Organization for Migration (IOM), it is conducting research, information campaigns, and training. Although no legislation exists in Chile against the trafficking of people, Peru established the Law Against the Trafficking of People and Illicit Trafficking of Migrants (Law N°28950) January of this year. The clandestine character, its link to organized crime, and the vague knowledge surrounding human trafficking make it difficult to calculate an exact number of victims. The IOM in Lima, Peru, CSECA (Prevention of Commercial Sexual Exploitation of Children and Adolescents and the Assistance for the Victims in Chile) in Santiago, and the International Police in both countries are vital to the continued fighting of this problem.

**62.**

## **FUNDS OF KNOWLEDGE OF LATINO FAMILIES IN HARTFORD**

Cintli Sanchez '09, Christina Ramsay '09, Ashley Flemming '08

Faculty Sponsor: Andrea Dyrness

Latinos in Hartford come from a diverse range of backgrounds, and bring a wide range of skills, experiences, and expectations to the Hartford educational system. Students in Ed 307, Latinos in Education, Spring 2007, interviewed members of Hartford's Latino communities about their experiences with the educational system in Hartford and in their home countries. This poster presentation provides a snapshot of our research findings and a glimpse into Hartford's diverse Latino communities.

**63.**

**LEARNING ABOUT HUMAN RIGHTS-BASED APPROACHES TO HEALTH THROUGH ASTHMA EDUCATION**

Cristina Wheeler Castillo '08

Faculty Sponsor: Alison J. Draper

In a first-year program for students interested in studying science, we offered a year-long course on asthma and its global implications. In the first semester, students carried out a community service project in collaboration with the American Lung Association (ALA) and the Hartford Department of Public Health. Asthma has reached nearly epidemic proportions in Hartford, particularly among Latino and African American children, and students took the ALA Open Airways program into elementary schools to help children learn how to manage their asthma. In the second semester, we explored the implications of asthma around the world, particularly in Hartford's Peruvian population and in Peru. Students carried out independent community service projects, including a documentary and design of an asthma education website. Additionally, students explored health care and asthma policy in Peru, and at the end of the semester, traveled there to learn about it first-hand. Examination of health care inequities both locally and globally expanded students' understanding of a human rights-based approach to public health.

**64.**

**HIV/AIDS IN HONDURAS**

Cristina Wheeler Castillo '08, Monika Zagaja '08, Armand DelRosario '07, Brian Lee '07, Todd Morrison '07

Faculty Sponsors: Sarah Raskin, Laurel Baldwin-Ragaven

This past March, the Trinity Health Fellows Program traveled to Honduras to gain a better understanding of how HIV/AIDS has crippled this developing nation. Thanks to a generous grant from the Mellon Foundation, students saw, firsthand, the challenges faced by healthcare providers.

These experiences helped them link urban issues here in Hartford to global issues throughout the Americas. It truly augmented the themes of the Health Fellows Seminar.