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# TWENTY-FIRST ANNUAL SYMPOSIUM OF TRINITY COLLEGE UNDERGRADUATE RESEARCH

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# **BIOLOGY**

1.

## **PLACENTAL MORPHOLOGY OF THE VIVIPAROUS SNAKES *STORERIA DEKAYI* & *NERODIA SIPEDON***

Kristie Anderson '08

Faculty Sponsors: Daniel Blackburn, Ann Lehman

In live-bearing lizards and snakes, pregnant females provide oxygen, water and nutrients to their embryos by means of placentas. Techniques of light microscopy and scanning electron microscopy were used to investigate the structure and function of the placentas of embryos of the viviparous brown snake, *Storeria dekayi*, and viviparous water snake, *Nerodia sipedon*. In the brown snake, the allantoplacenta appears to be specialized for interhemal exchange. The chorionic and uterine epithelium are attenuated, and the uterine tissue and allantois are highly vascularized. Only fragments of the vestigial shell membrane remain. The omphalallantoic placenta appears to be specialized for maternal-fetal exchange. The omphalopleure contains two distinct populations of cells which appear to have an absorptive function, and are the possible site of water and calcium uptake. Early results suggest that *N. sipedon* exhibits similar features, including a highly a vascularized allantois and uterine epithelium, and a vestigial shell membrane. The placental membranes showed similar morphological features to those of other thamnophiine snakes, as well the more distantly related oviparous snake, *Pituophis guttata*, suggesting a common ancestral origin. Thus, cellular features of the placentas of *S. dekayi*, and *N. sipedon* can provide insight into the function of squamate placental membranes and ultimately, their evolution.

2.

## **INTERSPECIFIC ELECTROCOMMUNICATION OF *APTERONOTUS LEPTORHYNCHUS* TO THE PULSE-FORM ELECTRIC DISCHARGE OF *BRACHYHYPOPOMUS PINNICAUDATUS***

Seth Banever '17

Faulty Sponsor: Kent Dunlap

The weakly electric gymnotiform fish, *Apteronotus leptorhynchus* exhibit interspecific electrocommunication behavior toward the pulse-form electric discharge of the closely related weakly electric fish, *Brachyhypopomus pinnicaudatus*. *A. leptorhynchus* have two distinct electroreceptor organs, tuberous and ampullary receptors. Tuberous receptors sense high frequency electric signals such as the electric organ discharge (EOD) of other electric fish and function in electrocommunication. Ampullary receptors detect low frequency signals, such as muscle movement of nearby fish, and function in prey location. Recent evidence suggests that there may be an integration of the ampullary and tuberous receptor systems in *Apteronotus*. The waveform of *B. pinnicaudatus* contains a low frequency component that may be detected by the ampullary electroreceptors of *A. leptorhynchus*.

Electrocommunication behavior of *A. leptorhynchus*, measured as chirp rate, was higher when exposed to *B. pinnicaudatus* than when isolated or exposed to non-electric goldfish. *A.*

*leptorhynchus* produced an average of 34 chirps/5 min. when exposed to *B. pinnicaudatus*, compared to 3 chirps/5 min. when isolated and 1 chirp/5 min. when exposed to goldfish.

Further examination into electrocommunication behavior of *A. leptorhynchus* to filtered frequency recordings of the electric discharge of *B. pinnicaudatus* may provide evidence of the integration of tuberous and ampullary electroreceptors in the pacemaker nucleus of *A. leptorhynchus*.

### 3.

#### **ROLE OF NORMAL FLORA IN PATHOGENIC INFECTION OF UPPER RESPIRATORY TRACT**

Nicole Benjamin '08, Michael Chung '11

Faculty Sponsor: Lisa-Anne Foster

Studies have shown that the normal flora play a key role in preventing pathogenic infection of the upper respiratory tract. The normal flora, displaying interfering capabilities, prevent the colonization of incoming pathogens thereby proposing an alternative to antibiotics. The normal flora between individuals of varying health status, such as smoking and non-smoking, will be compared to determine if a relationship exists between one's health status and their microbial community. The bacterial species of the oropharyngeal region were first identified via DNA sequencing and genetic databases. Due to the timely and costly manner associated with DNA sequencing, the direction of the project was steered toward identifying specific pathogens and normal flora through the use of specific polymerase chain reaction (PCR) primers. Optimal concentrations of the specific primers, optimal annealing temperature and optimal quantity of PCR reagent  $MgCl_2$  were determined through trial and error by keeping two variables constant while varying the third. To date, the primers detecting *S. aureus* and *S. pneumoniae* have been successfully identified, as well as their specificity and sensitivity. The collection of throat swabs from a pool of volunteers and the identification of more potential pathogens and/or interfering normal flora will be the focus in the future.

### 4.

#### **PLACENTAL SPECIALIZATIONS IN THE SPINY 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 its 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

avasascular, appears to be a site of secretion and absorption, and may have a nutritive function. Both placental types persist 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.

## 5.

### **THE BAMBOO WORM INVASION OF SAMISH BAY: ECOLOGY AND CONTROL OF *CLYMENELLA TORQUATA* IN A NORTHEASTERN PACIFIC ESTUARY**

Lillian Hancock '08, P. Sean McDonald, Freya Goetz '08, Paul Dinnel

Faculty Sponsors: Craig Schneider, Sean McDonald PhD, Advisor at Western Washington University

The bamboo worm, *Clymenella torquata*, is a tube-building polychaete native to the northwestern Atlantic. While not generally known for strong interactions, invasive *C. torquata* in the northeastern Pacific have impacted oyster culture operations. In Samish Bay, Washington, bioturbating worms destabilize sediments, thereby indirectly increasing mortality of oysters that subside into unconsolidated mud. The present study investigated the ecology of invasive *C. torquata* along beaches adjacent to an infested shellfish farm to determine factors affecting worm distribution. At each survey station physical and biological data were collected and compared to worm biomass and tube mass. Survey results corroborate previous observations that a significant negative relationship exists between *C. torquata* and sediment compaction/firmness; worms also alter grain composition of the substrata. Biomass of *C. torquata* increases seaward perpendicular to shore, with highest worm activity at about +30 cm MLLW. In laboratory experiments, temperature affected burial speed and tube construction rate, and worms produced highest-quality tubes in sediment ranging between 250-500  $\mu\text{m}$ . Our work suggests that the distribution of *C. torquata* may be limited and physical control measures might mitigate impacts on aquaculture.

## 6.

### **EXPRESSION AND PURIFICATION OF HUMAN CYP4X1**

Stacy Hathcox '09

Faculty Sponsor: Hebe Guardiola-Diaz

The CYP4X1 enzyme is a membrane-associated protein belonging to the larger cytochrome P450 protein family. Cytochrome P450 enzymes can be found throughout human tissues, with very few expressed in the brain. Interestingly, CYP4X1 enzymes are expressed primarily in the brain, which suggests that these enzymes are highly important in the nervous system. The function and regulation of CYP4X1 is unknown, but sequence similarity with other CYP4 subfamily enzymes suggests that CYP4X1 may be involved in fatty acid metabolism. The long-term goal of this research is to determine the function of CYP4X1. Toward that aim, the specific objective of this project is to optimize expression of CYP4X1 in a bacterial cell system. The human CYP4X1 coding DNA sequence was inserted into the expression plasmid pTrc99A and transfected into Rosetta cells to circumvent prokaryotic codon bias. A 4xhistidine tag was added to the C-terminus on both forms to facilitate purification via nickel affinity chromatography. Expression of the gene was induced with IPTG, and the enzyme was purified. Results show a partial purification of human CYP4X1.



7.

**ELECTROCOMMUNICATION SIGNALS ALONE ARE SUFFICIENT TO INCREASE BRAIN CELL ADDITION IN WEAKLY ELECTRIC FISH, *APTERONOTUS LEPTORHYNCHUS***

Denisa Jashari '10

Faculty Sponsor: Kent Dunlap

Long term social interaction induces brain plasticity in weakly electric fish, *Apteronotus leptorhynchus*. We established that the electric signal of another fish, through a single modality is sufficient to increase brain cell addition. Fish that received an electrocommunication signal of another fish alone for 7d had higher levels of Brdu immunoreactivity (marker of new cells) in the ventricular zone than fish housed in pairs and significantly higher levels than fish housed in isolation. Moreover, 30-60% of newborn cells differentiate into neurons.

Artificial sine wave stimuli that mimicked electrocommunication signals fail to increase cell addition above that of isolated fish. Exposure to sine wave stimuli for 7d did not increase Brdu immunoreactivity above fish housed in isolation. Thus, some feature of the natural communication signal (e.g., amplitude variation) is crucial for promoting adult neurogenesis.

8.

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

Jillian Langer '08

Faculty Sponsor: Robert Fleming

Cell-to-cell communication is a crucial aspect of cellular differentiation during animal development. The highly conserved Notch signaling pathway, consisting of a receptor (called Notch), responds to ligands present at the signaling junctions between adjacent cells. Both Serrate and Delta are the ligands in our research organism, *Drosophila melanogaster*. The ligands have two distinct properties: the first is their ability to activate Notch receptors on adjacent cells and the second is their ability to inhibit Notch receptors on their own cell surface. This second property, known as cis-inhibition, ensures that signals remain unidirectional between interacting cells during the cellular differentiation process.

A previous mutant construct, developed by removing a unique hydrophobic region and some surrounding epidermal growth factor-like (EGF-like) sequences from the extracellular region of Serrate, resulted in the loss of the strong cis-inhibition effect of Serrate without affecting its ability to stimulate Notch on adjacent cells. To pinpoint the precise region responsible for the loss of the cis-inhibition, a new construct was built using recombinant DNA techniques to remove only the hydrophobic region of Serrate. Here we report on the effects of this new construct when expressed in transgenic lines of *Drosophila* and project future studies for the determination of this important property of Notch ligands.

9.

**AN EXAMINATION OF THE FUNCTION AND SOURCE OF COMPOUNDS WITHIN THE DEFENSIVE SECRETIONS OF THE LADYBIRD BEETLE *DELPHASTUS CATALINAE***

Patrick McCarthy '09, Rick MacLeod '11

Faculty Sponsor: Scott Smedley

This study investigated compounds found in the defensive secretions of the various life stages of the ladybird beetle *Delphastus catalinae* (Coleoptera: Coccinellidae). While many ladybird beetles possess defensive alkaloids, *D. catalinae* is unique in producing quinonoids, with novel structures, and germacrene sesquiterpenes. To further characterize these novel quinonoids, adult beetles were sampled so that the compounds can be isolated and tested for biological activity in future studies. *D. catalinae* larvae were also used to ascertain whether the germacrene sesquiterpenes found in the pupal defensive secretion are sequestered from the diet or synthesized *de novo* by the beetles themselves. Preliminary evidence suggests the latter route. To establish this more conclusively, larvae, which prey upon eggs and juveniles of the whitefly *Bemisia tabaci*, were fed eggs coated with a labeled form of sodium acetate, a potential precursor of the sesquiterpenes, and raised to the pupal stage. The pupal secretion will be analyzed to determine whether these sesquiterpenes show incorporation of the label.

10.

**ENVIRONMENTAL EFFECTS ON VIRULENCE OF SINGLE OR COMBINED SPECIES OF ENTOMOPATHOGENIC FUNGI TO BLACK-LEGGED TICKS**

Justin Pool '08, Amy Tuininga, Tom Daniels, Rich Falco, Cassie Fairchild

Faculty Sponsors: Craig Schneider, Amy Tuininga PhD, Fordham University

The black-legged tick, *Ixodes scapularis*, transmits the Lyme disease-causing bacterium, *Borrelia burgdorferi*. Entomopathogenic fungi are known to control tick populations, and are most pathogenic at specific temperature and relative humidity (RH) levels. To test environmental effects on the virulence of these fungi either alone or in combination, field-collected nymphal black-legged ticks were exposed to commercial products in one lab assay versus local isolates of the fungi in another lab assay, and death rates of ticks were compared to a control with no fungus. Ticks were incubated at relative humidities of 75%, 85%, or 100% at room temperature for 2 weeks. At 100% RH, a commercial product containing *Beauveria bassiana* was slightly more virulent to the black-legged tick than a product containing *Metarhizium anisopliae*. In contrast, the local isolate of *M. anisopliae* was more virulent than *B. bassiana* at higher humidities, while *B. bassiana* was more virulent at lower humidities. The combined local isolates killed more ticks than other treatments at all levels of RH tested. It is likely that RH affects the virulence of native *B. bassiana* and *M. anisopliae* to the black-legged nymphs in situ and there may be different effects when fungal species are applied alone versus in combination. We tested this and fewer ticks were recovered from cages treated with both commercial products than in cages treated with either product alone. Products containing local isolates of several species of fungi applied at moderate to high humidity levels could be an effective biological control strategy for black-legged ticks.

## 11.

### **MUTAGENESIS OF SERRATE LIGAND AND ITS EFFECT ON *CIS*-INHIBITION IN *DROSOPHILA MELANOGASTER***

Kaiwan Raza '11

Faculty Sponsor: Robert Fleming

Notch signaling is a highly conserved form of cell-to-cell communication present within all metazoans that is used for assigning cell fates and for lateral inhibition. The structures involved in this communication pathway include ligands (either Serrate or Delta in *Drosophila melanogaster*) that are located on the signaling cell and a receptor (called Notch). On adjacent cells, the ligand-receptor binding initiates Notch signaling, which alters gene expression in the receiving cell and changes its fate.

A less well known but very important role of the ligands is their ability to shut off the Notch receptor when it is located on the same cell surface as the ligand which causes the phenomenon known as *cis*-inhibition. This property ensures that signaling cells express a different set of genes than do receiving cells. A mutant form of the Serrate ligand, which had a segment of its extracellular domain, including part of epidermal growth factor-like (EGF-like) repeats 5 and 6 as well as a unique hydrophobic region removed, lost its ability to perform *cis*-inhibition. In order to locate the exact region of Serrate that causes *cis*-inhibition, a mutant form of the ligand missing the fifth EGF-like repeats is being constructed in the laboratory using PCR methods and recombinant DNA techniques. When completed, transgenic lines capable of expressing this mutant form will be generated and tested. Finding the specific location that causes *cis*-inhibition will have important implications in this signaling pathway because its properties are highly conserved in higher vertebrates including humans.

## 12.

### **MICROSCOPY OF THE PLACENTAL TISSUES OF THE WATER SNAKE, *NERODIA SIPEDON***

Andy Weisenfeld '11

Faculty Sponsors: Daniel Blackburn, Ann Lehman

Light microscopy (LM) and scanning electron microscopy (SEM) have been powerful tools for understanding the form and function of placentas in animals that give birth to their young. My goals this semester were to learn the basic techniques of microscopy, and to begin applying them to studies of the viviparous (live-bearing) water snake *Nerodia sipedon*. For LM, paraffin-embedded tissues were sectioned, dehydrated with gradations of ethanol, stained with eosin and hematoxylin, and viewed with a compound microscope. For SEM, tissues were preserved using mixed aldehydes, fixed with OsO<sub>4</sub>, dried at the critical point, sputter coated with gold/palladium, and viewed with a JEOL JSM-IC848A scanning electron microscope. Photomicrographs revealed details of the placental tissues that reflect their roles in sustaining the developing embryos during pregnancy. One notable observation is the presence of elaborate capillary networks that may function in maternal-fetal gas exchange.

13.

### **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 nine areas within Hartford where radio tagged hawks are known to be present. I determined squirrel abundance using line transect sampling, where I counted squirrels along transects (up to fourteen), each 100 m in length and 100 m wide, in nine 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 will examine hawk locations in relation to squirrel abundance, where we would predict the presence of hawks in areas of higher squirrel density.

## **CHEMISTRY**

14.

### **SYNTHESIS AND ANALYSIS OF NEW BIDENTATE ORGANOPHOSPHORUS MOLYBDENUM COMPOUNDS**

Stephen Bloom '09

Faculty Sponsor: Maria Parr

Several new molybdenum compounds with the formula  $[\text{Mo}(\text{CO})_4\text{L}_2]$  were synthesized using bidentate organophosphorus ligands [ $\text{L}_2 = \text{xantphos}$ ,  $\text{DPEphos}$  and  $\text{dppe-F20}$ ] with  $[\text{Mo}(\text{CO})_4(\text{pip})_2]^-$  as the precursor. The structural elucidation of the products was determined through infrared spectroscopy, multinuclear NMR spectroscopy, elemental analysis and x-ray diffraction.

15.

### **CHARACTERIZATION AND DISCRIMINATION OF INKS BY FOURIER TRANSFORM INFRARED SPECTROSCOPY (FTIR), RAMAN SPECTROSCOPY, SURFACE ENHANCED RESONANCE RAMAN SPECTROSCOPY (SERRS), AND THIN LAYER CHROMATOGRAPHY (TLC)**

William Burns '09, Jonathan Nyce '09

Faculty Sponsor: Janet Morrison

The ability to identify and differentiate between different inks is extremely important in the case of document forgeries. Previous work has demonstrated that Fourier transform infrared spectroscopy, Raman spectroscopy, surface enhanced resonance Raman spectroscopy, and thin layer chromatography have been successfully and cooperatively used to characterize numerous

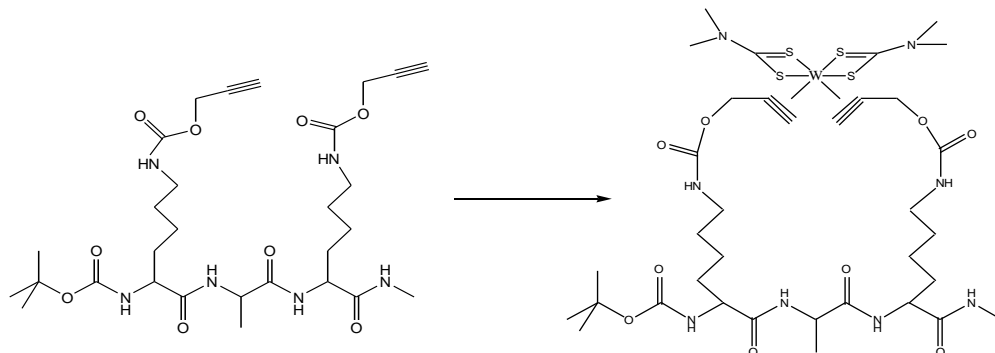
ink types and colors. Current research in our laboratory is focused on the development and application of each of the above-mentioned methods for the analysis of six blue ink samples in order to provide “signatures” of each ink, allowing for the successful analysis of forged documents. Results of initial studies aimed at identifying spectral and chromatographic ink “fingerprints” will be presented.

## 16. SYNTHESIS OF A METALLACYCLIC TRIPEPTIDE

Neena Chakrabarti '09

Faculty Sponsor: Timothy Curran

Peptide side-chains can be bound using various metal complexes and once these side chains are linked, the peptide conforms to a different secondary structure. The ability to predict the formation of these secondary structures and define the shapes of the peptides may aid in the creation of proteins which can bind to DNA and fight terminal illnesses, such as cancer. The goal of this research focuses on the linkage of the lysine side-chains using a tungsten metal complex. The first step toward this final product is the synthesis of the tripeptide Boc-Lys(Poc)-Ala-Lys(Poc)-NHCH<sub>3</sub>. The alkyne groups on the lysine side chain will then be linked by a tungsten complex as shown in the reaction below.



It is predicted that the coupled peptide will form a  $\beta$ -turn. The secondary structural conformation of the final coupled tripeptide will be analyzed through instrumental techniques such as electro-spray mass spectrometry (ESI-MS), and COSY, NOESY, <sup>1</sup>H and <sup>13</sup>C experiments using nuclear magnetic resonance (NMR).

## 17. FORENSIC CHARACTERIZATION OF ARSON ACCELERANTS USING HEADSPACE VAPOR CONCENTRATION AND GAS CHROMATOGRAPHY-MASS SPECTROMETRY (GC-MS)

Neena Chakrabarti '09, Samantha Levy '09, Merry Smith '09

Faculty Sponsor: Janet Morrison

One of the primary goals of the forensic chemist investigating a potential arson is the detection and characterization of accelerants in the debris collected from the fire scene. The most commonly used method for trapping and analyzing accelerant residues is headspace analysis by gas chromatography-mass spectrometry (GC-MS)

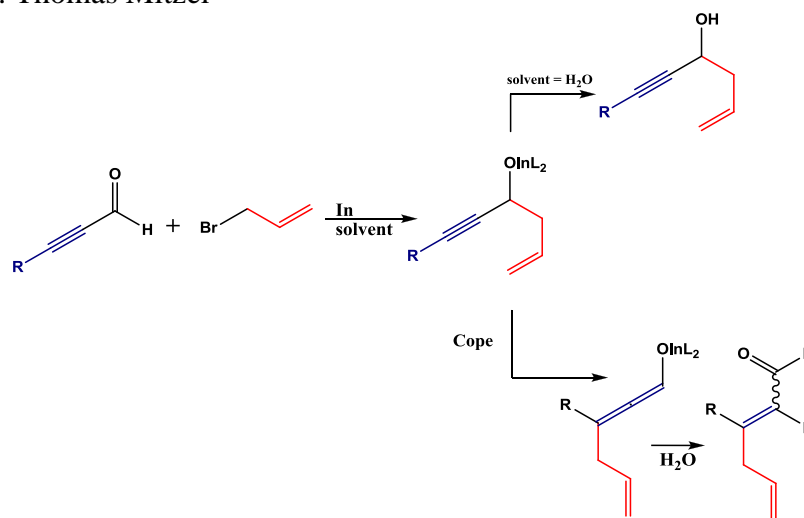
In the current study, a method based on trapping and concentrating the headspace accelerant vapors on a solid adsorbent was evaluated. Wood chips and carpet samples were burned in the presence of various accelerants under controlled conditions, and the charred arson debris was collected and sealed in paint cans for subsequent analysis. The accelerants of interest in this study included charcoal lighter fluid, nail polish remover, and mineral spirits. Charcoal strips were suspended in the paint cans containing the charred debris in order to trap the accelerant vapors driven off from the debris as the cans were heated. The charcoal strips were subsequently removed and eluted with an organic solvent. The solvent extract was then analyzed by GC-MS to characterize the headspace of each charred sample and detect and identify the specific accelerant that was used.

## 18.

### MECHANISM AND KINETICS OF INDIUM-PROMOTED COUPLINGS EN ROUTE TO COPE REARRANGEMENT: OBSERVANCE OF HIGH REGIOSELECTIVITY

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.

This presentation will also introduce efforts in utilizing Au catalysts in indium-promoted couplings en route to Cope rearrangement.

## 19.

### SYNTHESIS AND CHARACTERIZATION OF TRANSITION METAL POLYHYDRIDE COMPLEXES

Jennifer Gifford '09

Faculty Sponsor: Maria Parr

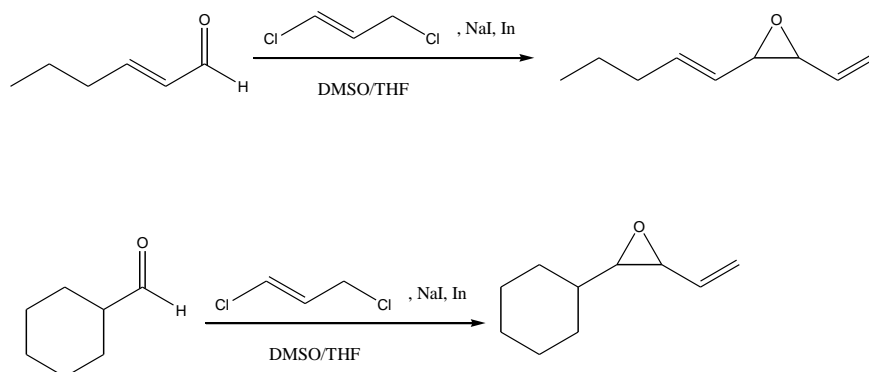
Transition metal polyhydride complexes have been shown to possess catalytic properties in hydrocarbon reactions and are possible precursors for chemical vapor deposition of pure metals. This project's goal is to synthesize rhenium polyhydride complexes of the type  $[\text{ReH}_7(\text{L}_2)]$ , where  $\text{L} = \text{DPEphos}$ ,  $\text{biphep}$  and  $\text{xantphos}$ . Thus far, the necessary precursors –  $[\text{ReOCl}_3(\text{DPEphos})]$ ,  $[\text{ReOCl}_3(\text{biphep})]$  and  $[\text{ReOCl}_3(\text{xantphos})]$  – have been synthesized in relatively high yields and characterized using infrared spectroscopy, as well as  $^{31}\text{P}$  and proton NMR spectroscopy. Further research will focus on the synthesis of the rhenium polyhydride complexes from the three precursors and characterization of the polyhydride structures using variable-temperature  $^1\text{H}$  NMR spectroscopy.

## 20.

### INDIUM PROMOTED COUPLING IN EPOXIDE SYNTHESIS

Alden Gordon '10

Faculty Sponsor: Thomas Mitzel



Varying functional groups of products usually requires a change in reactants and reaction solvents. The two reactions above, the focus of this research, have been studied in an attempt at controlling functional groups of a product while maintaining reactants through solvent variation. Both reactions have been studied this semester, with a recent emphasis on the upper most reaction. Attempts at optimizing conditions and characterizing products and side products of these reactions have been made, and significant progress has been made on the trans-2-hexenal reaction.

## **21.**

### **SYNTHESIS AND CONFORMATIONAL ANALYSIS OF HELICAL METALLACYCLIC PEPTIDES**

Emmy Handy '08

Faculty Sponsor: Timothy Curran

The helix is an important and commonly occurring secondary structural element in proteins. Because nucleation of a helix in short peptides is entropically unfavorable, it is difficult to study such structures. One method for overcoming this problem is to form a cyclic peptide via a link between side chains of two residues, which induces hydrogen bonding and stabilizes helix formation. In this thesis work, stabilization of a peptide helix was achieved using an organometallic compound as the link between side chains. Linear tetrapeptides, Boc-Lys(Cbz)-Ala-Val-Lys(Cbz)-NHMe and Boc-Lys(Cbz)-Met-Ile-Lys(Cbz)-NHMe, were successfully synthesized via solution phase peptide synthesis, and were cyclized with the organometallic compound, 1,1'-ferrocenediacid chloride. The cyclizing link was achieved by forming amide bonds between the amines on the lysine side chains and the carbonyls of the ferrocene derivative. Analysis of the resulting metallacyclic peptides by <sup>1</sup>H NMR, COSY, TOCSY, and ROESY experiments indicated that they had adopted the conformation of a 3-10 helix.

## **22.**

### **DETERMINATION OF ARSENIC IN CHICKEN BY INDUCTIVELY-COUPLED PLASMA ATOMIC EMISSION SPECTROSCOPY (ICP-AES)**

Emmy Handy '08, Julianne Boccuzzi '08

Faculty Sponsor: Janet Morrison

Recently there has been heightened concern about inorganic arsenic present in consumer chicken meat. The food additive roxarsone (4-hydroxy-3-nitrobenzene-arsonic acid) is fed to roughly 70% of the broiler chickens raised for human consumption in the United States, and is responsible for the inorganic arsenic detected in chicken meat. In this experiment the concentration of arsenic present in store bought chicken marketed as "organic" and not marketed as so was determined via inductively-coupled plasma atomic emission spectroscopy (ICP-AES). In order to extract the arsenic from the chicken tissue two different literature procedures were investigated and compared.

## **23.**

### **DEVELOPMENT OF LC/MS AND FLUORESCENCE METHODS FOR TRACE-LEVEL DETECTION OF OPTICAL BRIGHTENERS IN WELL WATER**

Adam Hill '08

Faculty Sponsor: David Henderson

Contamination of rural wells by human waste is of significant concern to environmental scientists. It has been suggested that the optical brighteners commonly found in laundry detergent can be used to selectively detect domestic waste. A method is being developed to find ultratrace levels of the brighteners DSBP and DAS1 via solid phase extraction and LC/MS. After considering a variety of compounds, dinonylnaphthalene sulfonic acid was selected as an internal standard due to its positive chromatographic properties and slow breakdown. Standards solutions of the three compounds were used to produce a calibration curve for quantification of



brightener concentrations. Also in development is a parallel detection method using fluorescence spectrophotometry of the brightener compounds to corroborate the concentrations determined via the LC/MS method.

## 24.

### **THE SYNTHESIS OF ENEDIYNES TO INHIBIT DNA REPLICATION AT CANCEROUS SITES**

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  $\omega$ -chloropropargyl phenyl sulfide and aldehydes produces molecules with good stereoselectivity between syn and anti isomers, in addition to great regioselectivity (Mitzel 2002). After forming the  $\omega$ -chloropropargyl phenyl sulfide from phenyl propargyl sulfide, the chloro-sulfide is to be coupled with a propargyl aldehyde, in the presence of indium. The aldehydes worked with thus far are oct-2-ynal and phenyl propargyl aldehyde. The coupling of the propargyl aldehyde with the chlorosulfide is the first step to synthesize the ene-diyne, which may potentially lead to breakthroughs in the chemical understanding of DNA.

## 25.

### **USING THE TRANSMISSION ELECTRON MICROSCOPE (TEM) TO IMAGE THE OSTEOCALCIN BINDING SITE ON TYPE I TROPOCOLLAGEN**

Piper Klemm '09

Faculty Sponsors: Richard Prigodich, Ann Lehman

Type I collagen is a fibrillar collagen that is an important component of skin, bone, tendon and ligament. Osteocalcin is a major component of bone tissue and has a role in bone formation and remodeling. Osteocalcin binds hydroxyapatite and collagen. The osteocalcin binding site on collagen is unknown. To identify this site, type I tropocollagen was imaged using rotary shadowing and transmission electron microscopy. Tropocollagen at a concentration of 3  $\mu\text{g/mL}$  was sprayed onto freshly cleaved mica. The mica was vacuum evaporated, and at a rotary angle of six degrees, was coated with carbon and platinum. Decorin, which binds 25 nm from the tropocollagen carboxy-terminus, was used as a marker on the tropocollagen molecules to determine directionality on the tropocollagen molecule.

26.

**QUANTITATIVE ANALYSIS OF TRACE LEVELS OF COCAINE ON U.S. BANKNOTES**

Piper Klemm '09, Jennifer Gifford '09  
Faculty Sponsor: Janet Morrison

Banknotes in the United States have been shown to contain trace levels of cocaine, regardless of the geographical origin of the bills. In the initial phase of this study, various extraction methods were applied to single dollar bills to isolate cocaine from the surface, including vortexing, ultrasonication, and supercritical fluid extraction (SFE). The extracts obtained by vortexing and ultrasonication were subsequently subjected to solid-phase extraction for further clean-up prior to quantitative analysis by gas chromatography-mass spectrometry (GC-MS). SFE extracts were analyzed directly by GC-MS with no further clean-up. Each of the extraction methods was non-destructive, and the bills could be used post analysis. The quantitative results obtained for each of the extraction methods were compared, and the most efficient method was applied for the quantitative determination of trace cocaine on bills of various denominations from various locations in the United States.

27.

**METHOD DEVELOPMENT FOR THE ANALYSIS OF THE HALLUCINOGENIC DRUG DIMETHYLTRYPTAMINE IN BOTANICAL FORMULATIONS**

Michael Lee '10, Jonathan Ashby '10  
Faculty Sponsor: Janet Morrison

'Ayahuasca' is a hallucinogenic "brew" commonly used in traditional practices of various South American indigenous cultures. This brew is typically concocted with the leaves of the plant 'Psychotria viridis', which contains the naturally-occurring psychoactive compound N,N-dimethyltryptamine (DMT). The illicit use of such hallucinogenic concoctions has spread to Europe and North America in recent years, and DMT has now been classified as a Schedule I controlled substance by the U.S. Drug Enforcement Administration (DEA).

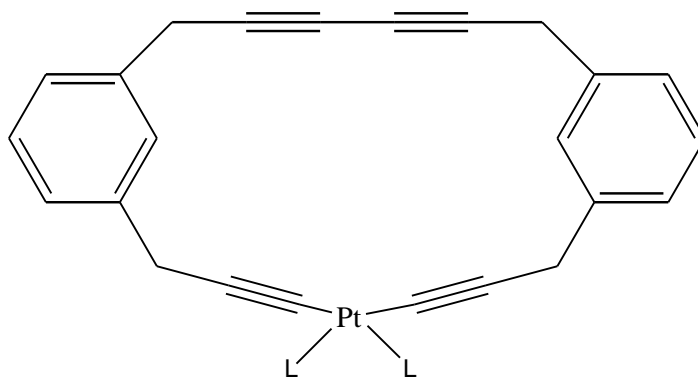
The goal of the present study is to develop an analytical method based on supercritical fluid extraction (SFE) and gas chromatography-mass spectrometry (GC-MS) for the detection, identification, and quantification of DMT and other naturally-occurring psychoactive components in plant materials. Initial SFE spike-recovery experiments were conducted on assorted matrices in order to determine solubility and optimize extraction conditions for the most efficient recovery of DMT. The resulting extracts were analyzed using GC-MS to determine the presence and quantity of DMT extracted. In order to eliminate chromatographic tailing of DMT, a derivatizing agent (BFSTA) was incorporated into the analytical method. As a result, the amount of DMT extracted can be better quantified.

**28.**  
**SYNTHESIS OF PLATINUM-COUPLED, HOMOCONJUGATED, 2-DIMENSIONAL, HYDROCARBON CAGES**

John Love '10

Faculty Sponsor: Thomas Mitzel

Conjugated hydrocarbon cages have been studied extensively because of their unique electronic properties. Introduction of an  $sp^3$  hybridized carbon creates a system that retains some of the electronic properties as a fully conjugated system, while increasing stability and flexibility of the system. Platinum metal, which has been shown to bind to alkynes, could help close these rings while maintaining the delocalization of electrons. The synthesis of the small 2-dimensional cage shown below was investigated.



**29.**  
**CHARACTERIZATION OF ARCHAEOLOGICAL ARTIFACTS BY INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROSCOPY(ICP-AES)**

Kathryn McColl '08, William Burns '09

Faculty Sponsors: Janet Morrison, Maria Parr, Nicholas Bellantoni PhD, State Archaeologist

In 1997 a team of archaeologists led by Dr. Nicholas Bellantoni (Chief Archaeologist, Connecticut Archaeology Center) excavating a site in Pachaug State Forest in Voluntown recovered what was believed to be an ancient Indian encampment containing a variety of highly unusual Native American artifacts determined to be at least 1000 years old. Subsequent analysis of the artifacts and examination of the soil and tree roots in the area of the site, however, suggested that the unearthed artifacts were deliberately placed in five discrete locations at the site as part of an elaborate archaeological hoax or an attempt to influence local Indian history. Previous work done in the laboratory of Dr. Maria Parr has employed scanning electron microscopy with energy dispersive x-ray analysis (SEM-EDX) to characterize the elemental content of copper beads recovered from the suspicious site and compare it with that of copper beads from an authentic Native American burial site. In collaboration with Dr. Parr and Dr. Bellantoni, current research in our laboratory is focused on the development and application of inductively coupled plasma-atomic emission spectroscopy (ICP-AES) methods for the analysis of recovered artifacts in order to provide more complete elemental “signatures” of these artifacts and thereby contribute to a greater understanding of their authenticity. Results of initial studies aimed at the evaluation and optimization of sample dissolution and solid sampling methods will be presented.

30.

### EFFECTS OF LEWIS ACIDS ON INDIUM-PROMOTED BARBIER-TYPE REACTIONS: ENROUTE TO COPE REARRANGEMENT

Jonathan Nyce '09

Faculty Sponsor: Thomas Mitzel

Indium metal is becoming very popular for use as a catalyst in Barbier Reactions because of its utility in stereo- and regio-selectivity under mild conditions. Past research using n-methylformamide has shown that polar solvents tend to yield in high stereoselectivity in product formation. This presentation will describe the use of Lewis Acid catalysts in an attempt to control either a 1,2 or 1,4 addition and their effect on product formation in n-methylformamide. The use of pi-philic lewis acids in attempt to control possible cope rearrangements in the indium-coupled products will also be shown.

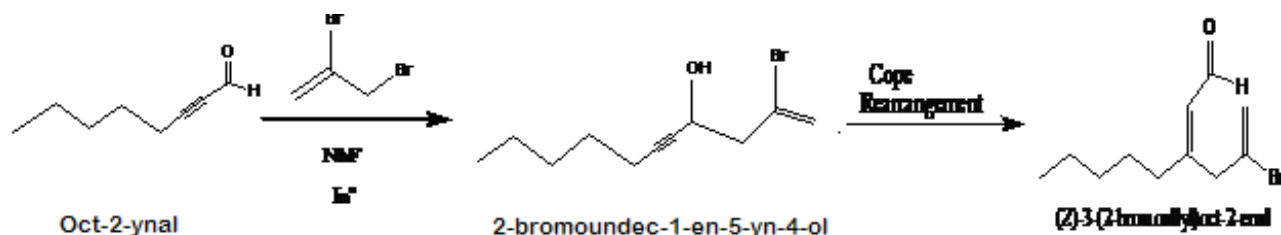
31.

### THE SYNTHESIS OF A MULTIFUNCTIONAL ALCOHOL 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 identify this side product.

**32.**

**ULTRATRACE ANALYSIS OF TRICLOSAN**

Erica Smith '08

Faculty Sponsor: David Henderson

Triclosan (5-chloro-2-(2,4-dichlorophenoxy)phenol) is used as a common biocide in commercial products. Water contamination by sewage effluent could be determined by analysis of triclosan levels. Analysis methods for detecting triclosan using SPE, GC-MS and the principles of ELISA have been developed and optimized. Using the internal standard, triclosan-d3, accurate calibrations have been obtained and a limit of detection for the GC-MS method has been determined. Water samples from the Honey Pot Brook have been analyzed using both the developed GC-MS method and ELISA, indicating possible sewage contamination. The final method will ultimately be applied to the study of water contamination in Connecticut.

**33.**

**INDIUM-PROMOTED COUPLING INVOLVING ALLYL AND ALDEHYDE SYSTEMS**

Merry Smith '09

Faculty Sponsor: Thomas Mitzel

Research is moving forward investigating indium coupling reactions of allyl and aldehyde systems. The reaction studied at the start of the term dealt with reagents cyclohexanecarboxaldehyde and 2,3-dibromopropene reacted in the presence of indium metal in an n-methyl formamide solvent. Based on the results of previous research, it was proposed that the reaction studied would yield a coupled alcohol product. Polymerizing 2,3-dibromopropene led to a new synthesis of 2,3-dibromopropene from 1,2,3-tribromopropane and sodium hydroxide. With the fresh reagent, it appeared that no reaction took place, though research is continuing into longer reaction times. The second project started this term investigated indium promoted coupling of alkyne aldehydes and chloroalkene systems. So far, the reagent oct-2-ynal has been successfully synthesized to begin the next stage of research.

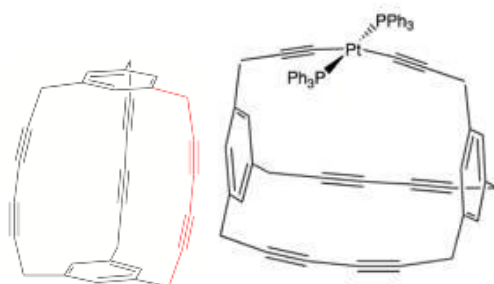
34.

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

Katharine Spencer '08

Faculty Sponsor: Thomas Mitzel

In recent years, the electronic properties of fully conjugated systems have been investigated as a possible energy storage system. The continuous pi-system allows for the introduction of an electron to the system, indicating potential storage capacity. The delocalization of electrons across an  $sp^3$  carbon is known as homo-conjugation and leads to increased stability of neutral systems and the presence of the  $sp^3$  carbon increases flexibility of the molecule. The use of platinum also allows for the increased flexibility of the molecule while still allowing full electron delocalization. The synthesis of two small homo-conjugated hydrocarbon cages has been investigated.



35.

### CASCADE REACTIONS USING BARBIER COUPLING CONDITIONS

Becca Suflas '08

Faculty Sponsor: Thomas Mitzel

The stereoselectivity of indium promoted coupling reactions involving 1,3-dichloropropene was studied. The reaction was carried out using several different R-groups and solvents which were run under different conditions to determine how these changes would affect the product of the reaction. Each of the conditions yielded slightly different products and concentration of those products. Solvents used in this reaction were DMSO, NMF, THF, H<sub>2</sub>O, and a 1:1 solution of DMSO/THF. The reactions utilized Barbier conditions under sonication.

36.

### DIRECT BROMINATION OF A NUCLEOTIDE

Ashley Swiggett '09

Faculty Sponsor: Richard Prigodich

A modified nucleotide is brominated as an intermediate toward creating a double-stranded oligonucleotides with single 3'-phosphonate linkages at varying points in the sequence. This oligonucleotide will be used to study the nature of the interactions of metal ions with the ribose-phosphate DNA backbone. Phosphorus 31 NMR will be used to measure the chemical shift and coupling constant of a single phosphonate in the oligonucleotide. Changes in these NMR parameters will reflect the strength of binding and whether metal ions are coordinating in an inner- or outer-sphere fashion. The first step in synthetic route is to protect the 5'-position of

thymidine. The 5'-protected nucleoside is reacted with thionyl bromide and pyridine in methylene chloride at -75C and allowed to warm up to room temperature. This produces a 3'-bromine thymidine. The next step is to react the brominated thymidine with a vinyl Grignard reagent.

**37.**

**DETECTION OF RIBOFLAVIN AND COCAINE IN URINE USING FLUORESCENCE AND ULTRAVIOLET-VISIBLE SPECTROPHOTOMETRY**

Ashley Swiggett '09, Stephen Bloom '09

Faculty Sponsor: Janet Morrison

Ultraviolet-visible and fluorescence spectrophotometric methods were used to quantify the concentrations of riboflavin and cocaine in urine. External standard calibration curves were created for both riboflavin and cocaine on each instrument. Mock urine samples containing the target analytes were subjected to solid phase extraction to isolate the cocaine and riboflavin prior to spectrophotometric analysis. Authentic urine samples obtained both pre- and post-administration of riboflavin were also analyzed. The analytical figures of merit for the riboflavin and cocaine analyses by each spectrophotometric method were calculated and compared to determine the most sensitive and reliable method for analysis.

**38.**

**INDIUM PROMOTED COUPLING OF A PHENYL PROPARGYL ALDEHYDE TO ALLYL BROMIDE USING AU(III)**

Brian Sinnott '08

Faculty Sponsor: Thomas Mitzel

Using 1-Ethynylbenzene and reacting it with t-BuLi, DMF, and KH<sub>2</sub>PO<sub>4</sub>, as formalized by Kwame Frimprong, a phenyl propargyl aldehyde can be formed. After creation of the propargyl aldehyde, the final product was obtained using Au(III) and In<sup>0</sup> catalysts with allyl bromide. The research covers Cope Rearrangements and formation of C-C bonds by In<sup>0</sup> and the accelerating effects of Au in different solvents.

## COMPUTER SCIENCE

**39.**

**TESTCHEM: AN ON-LINE CHEMISTRY EDUCATION RESOURCE**

Brian Sinnott '08

Faculty Sponsor: Peter Yoon

TestChem was created to make a more tangible link between a professor's students and their chemistry work. TestChem allows professors to give students quizzes, tests, home works, and practice problems for them to study. The intent of the program is to allow the professor to keep a repository of questions that can be accessed by students as further study materials. To further compliment the site, a simple on-line chemistry modeling program will be available for students to submit molecules in a hand drawn fashion. The addition of file uploads for programs such as ChemDraw® and other files allows for a functional interface for chemistry students and instructors.

**40.**

### **TRINITY COLLEGE ONLINE HOUSING SYSTEM**

Mark Canning '08

Faculty Sponsor: Madalene Spezialetti

The Trinity College Online Housing is a program meant to solve the confusion of the housing lottery at Trinity College. Normally, students are given lottery numbers. With these numbers, students find other students to room with and then show up in person to the lottery early in the morning. In the current system, the school does not provide a system for students to organize rooms before they are officially selected, in addition to devoting an entire week to choosing housing options.

The Online Housing System will alleviate this problem by giving students their lottery number, but then allowing them to set up their planned rooms on the site before the actual lottery takes place. The Online TCHS functions similarly to Facebook or other web 2.0 applications in that it is mostly user driven. Any news regarding housing at Trinity will be placed on the main splash page of the site when students log in. Once students log into the system with their provided trinity username and password, they are able to invite other students to their proposed rooms, accept invites into other rooms, and receive email and text message notification from the site.

Once the actual lottery begins and an administrator decides that students can begin selecting rooms, the site automatically organizes the students by lottery number and begins giving them the option to choose their room online and in real time. Students are notified when their turn to choose arrives, either by email, text message or both. Thus, with the new Online Trinity College Housing System, a student can select his housing options painlessly, without even having to leave his room.

**41.**

### **THE AUTOMATIC TOUCHSCREEN PROJECT**

Giovanni Capalbo '08

Faculty Sponsor: Ralph Morelli

In order for a computer system to be used with a touchscreen, the system's user interface, or how the user interacts with the system, must be transformed in such a way that allows for one's finger to do the clicking. Buttons and related interface elements, such as scroll bars and links, must be enlarged. Also, a virtual keyboard must be present on the screen in order to allow for typing. These considerations, and others, make it clear that a complete redesign of the user interface is necessary in order to have a system be used with a touchscreen. The primary goal of the Automatic Touchscreen Project is to have one package of software that will automatically transform any web-based system's user interface in such a way that allows it to be used with a touchscreen, so that redesign of the user interface is not necessary. Unlike similar toolkits, this toolkit aims to not obscure the original look and feel of the system it is used in as well as maintain a clearly defined method of extensibility.



**42.**

**POSIT: PORTABLE OPEN SEARCH AND IDENTIFICATION TOOL**

Prasanna Gautam '11

Faculty Sponsor: Ralph Morelli

POSIT (Portable Open Search and Identification Tool) is an open source application designed to collect data for searching for and identifying victims of natural or man made disasters. It uses the Software development Kit provided by Google for their Linux and Java based Android phone. It is an effort to provide an open source framework to facilitate search operations or for scientific research. We used Android's technologies like XML, its internal SQLite database, Global Positioning System, Camera and touch screen to provide an easy and intuitive interface to collect data. The data could be in any form including pictures, text descriptions or voice which could then be retrieved on another cell phone or on a computer using internet. This will be a great plus to search teams and field scientists who often need to carry many devices to get a similar level of functionality. Currently the POSIT prototype has been developed to facilitate Emergency Medical Technicians (EMTs) manage accident scenes, for field researchers to collect, track, document and communicate their findings and for rescue workers to collect valuable data for post-disaster rescue operations. However, since POSIT is an open source tool, it can have a wide variety of applications in the field of geology, botany, environmental science, and other areas where a hand-held device would be beneficial in collecting data and communicating effectively with the teams in field.

## **ENGINEERING**

**43.**

**QUANTIFYING IMPEDANCE DEFINED FLOW**

Phil Almquist '08, Haley Lepo '08

Faculty Sponsor: Joseph Palladino

Impedance defined flow (IDF) is a fluid-mechanical phenomenon characterized by net, unidirectional, valveless flow. Differences in upstream and downstream flow impedance produce a net flow when pressure is applied to the system in a specific way. Our project was designed to determine which modes of pressure application produce net flow. In addition, we hoped to quantify the correlation between the system impedance and the observed flow.

The experimental tubing system consists of two tubes, one rigid and one elastic, connected together to form a circle. Pressure is applied to the system by a linear solenoid. Experimental data is collected with a linear variable displacement transducer (measuring actuator displacement) and a pressure transducer (measuring fluid pressure at a given point).

The system is controlled using a LabVIEW computer program. The program user inputs waveform specifications on the PC running the LabVIEW program. This information is then sent to a variable power supply, driving the actuator. The program collects the actuator displacement and pressure data. Post-processing is performed by a separate program, converting the pressure data to provide a system flow rate.

Experimental data has shown that a square wave provides the high-frequency pressure changes that are necessary to produce IDF. Testing concerning the effect of varying system impedance is ongoing. Another important result of our project is the system setup itself. The physical components are precise and consistent, allowing for easily repeatable tests. The program features real-time calibration of data and a modular design, meaning that any future modifications will be straightforward. Due to these features, our system setup will allow for accurate testing of IDF for years to come.

#### **44.**

### **STEREO VISION SYSTEM FOR 3D SURFACE RECONSTRUCTION**

Nikolay Atanasov '08, Nabil Imam '08

Faculty Sponsor: David Ahlgren

A stereo vision algorithm was implemented in a Valde Systems VS1501 stereo vision processor. The algorithm, developed by C. L. Zitnick and T. Kanade, was based on two assumptions: uniqueness (the disparity map has a unique value per pixel) and continuity (the disparity map is continuous everywhere). The assumptions were used to create updating match values that would diffuse support among neighboring pixels and inhibit the ones that lie in similar lines of sight. The disparity maps produced were accurate and smooth. The algorithm was implemented on the VS1501 for real time processing. The VS1501 is designed around a C64x series Digital Signal Processor from Texas Instruments, 64M bytes of high speed SDRAM memory, and two IEEE-1394 firewire ports. A Bumblebee stereo vision camera by Point Grey Research was used to provide input to the stereo processor. A table of raw-to-rectified pixel positions was stored on the processor memory to carry out the rectification. Empty pixels in the rectified image were filled in using bilinear interpolation. To run the algorithm fast enough to be meaningful for real time applications, on board memory had to be carefully allocated and the algorithm carried out in steps. Depth maps produced in real time provided 3D information, which can be used to reconstruct the immediate environment around the camera. Tests were carried out in environments with varying texture and accurate results were obtained. The system has a lot of potential in robotic navigation, facial recognition, military and industrial surveillance.

#### **45.**

### **NEONATAL APNEA TREATMENT SYSTEM**

Katherine Blanton '08, Daniel Maturi '08, Willis Read-Button '08

Faculty Sponsors: Harry Blaise, Joseph Bronzino, Leonard Eisenfeld MD, Hartford Hospital

Apnea of prematurity is a common and dangerous condition occurring in infants born before 37 weeks of gestation where infants cease to breathe for longer than 20 seconds. In an effort to improve the current methods of waking the infant through a nurse's touch, medications and ventilators, vibro-tactile stimulation has been studied to be a safe and successful alternative for rousing an infant. Currently, infants are monitored according to their blood oxygen saturation levels, heart rate and thoracic impedance. These three signals are simulated into a laptop using appropriate waveforms in a LabView program. An apnea event is triggered when each signal hits a low threshold value. During apnea detection, the baby is automatically stimulated using a specialized skin sensor on the chest which applies a vibration. The vibrating output can be modified according to its frequency and voltage form in order to apply the necessary amount of stimulation. The program continues to monitor the baby and if the event is resolved, the alarm is

reset and monitoring continues on as normal. In the case of continued apnea, an auditory and visual alarm is set off to a nurse, in addition to a wireless computer message. The wireless message is sent through the network and appears at all nursing stations giving the location and condition of the baby. Lastly, all events are recorded including any nurse comments on the status of the baby and output to both a text and excel document for easy review. The design has successfully deciphered incoming signals, allowed for modification of parameters according to individual needs and generated the appropriate output signals. Future work in this area will include the direct integration of current apnea monitors with an automatic stimulation system to be used in both hospital and home apnea monitoring.

**46.**

### **DESIGN OF A ROBOTIC TRANSPORT VEHICLE FOR HUMAN-ROBOT COLLABORATION STUDIES**

Corwyn Canedy '08, Adam Fine '08, Alex Masi '08, David Pietrocola '08, Jeffrey Scalia '08, Jake Wallace '08

Faculty Sponsor: David Ahlgren

Robotics technology has reached a point at which useful and practical applications can be realized by augmenting tasks easily handled by robots with the advanced sensing and cognition of humans. BART, the Bantam Autonomous Robotic Transporter, has been designed as a test bed to explore this human-robot collaborating environment while offering a potential campus transport service and safety vehicle to the Trinity community.

The BART project centers on retrofitting a GEMcar E2 model electric car with systems and actuators that allows computer control of the car's steering, braking, and acceleration. A touch screen laptop and joystick peripheral allow a passenger or the computer to directly control the vehicle. An ultrasonic sensor array detects obstacles in the vehicle's path and informs the user via a GUI while performing primitive obstacle avoidance. BART is currently in the field testing stage with computer-controlled driving. Future work on BART could include GPS navigation for campus point-to-point transport, and an adjustable autonomy system that takes advantage of human sensing and cognition resources. The goal of this work would be to further develop this previously described interaction between a robot and operator.

**47.**

### **FLEXIBLE TELEPHONE DATA COMPRESSION ALGORITHM FOR IMPROVED T1 FREQUENCY TRANSMISSION**

John Giammattei '08

Faculty Sponsor: Taikang Ning

The purpose of this design project was to determine if the use of standard telephone (T1) bandwidth could be improved by implementing a compression algorithm based on the difference between audio samples. The compression allowed for the sampling frequency to be doubled, increasing transmittable frequencies by a factor of two while preserving the T1 data transfer rate of 64 kb/s. The compression algorithm was first modeled using Matlab, and was subsequently implemented in real-time using an Analog Devices DSP board. This board was configured to filter, compress, and decompress the data in real-time. Preliminary results show a tradeoff between frequency bandwidth and SNR. When the algorithm is employed, the transmittable

frequencies double and the SNR decreases. Future algorithm improvements could compand the sample differences resulting in an improved SNR while keeping the increase in transmittable frequencies.

**48.**

### **DESIGN OF A SLOW COMPRESSION MACHINE FOR IGNITION STUDIES**

David Maliniak '08

Faculty Sponsor: John Mertens

Approximately 25% of greenhouse gases are put into the atmosphere through CO<sub>2</sub> emissions during the production of electricity.<sup>1</sup> Increased amounts of CO<sub>2</sub>, primarily coming from coal power plants, are considered to be one of the main causes of climate change. An alternative solution needs to be researched.

NASA's Glenn Research Center has a branch dedicated to combustion research. Not only are they researching a low emission combustor, but also are currently building an Alternative Fuel Research Laboratory. The laboratory's focus is alternative fuels for jet engines. One of the fuels the Glenn researchers will be studying is liquid fuel derived from coal.<sup>2</sup> A fuel derived from coal is the basis for this project.

Syngas is a fuel created by the gasification of coal. During this process the coal turns into a gas composed mostly of hydrogen and carbon monoxide, and extra carbon which is easily removed. When syngas is burned much less CO<sub>2</sub> is generated per unit energy than if the original coal were burned instead. In gas turbines syngas is pressurized before combustion and the temperature increases. The increase in temperature and pressure raises concern of ignition before reaching the combustion chamber.

This project consisted of designing and building a test system at Trinity College to characterize the pre-ignition of syngas. The system will test pressures ranging from 10-20 atmospheres and temperatures ranging from 300-600 degrees Kelvin. It will also examine varying ratios of hydrogen to oxygen from 2:1 to 1:1. Data will be collected with transducers measuring pressure and temperature with respect to time.

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<sup>1</sup> Stern, Sir Nicolas. United Kingdom. Treasury. Stern Review on the Economics of Climate Change. 7 Oct. 2007 <[http://www.hm-treasury.gov.uk/media/4/3/Executive\\_Summary.pdf](http://www.hm-treasury.gov.uk/media/4/3/Executive_Summary.pdf)>.

<sup>2</sup> Veris, S. Jenise. Alternative Fuel Research Addresses Nation's Energy Independence. 2007. NASA. 4 Oct. 2007 <[http://www.nasa.gov/centers/glenn/news/AF/2007/Feb07\\_AltFuel.html](http://www.nasa.gov/centers/glenn/news/AF/2007/Feb07_AltFuel.html)>.

**49.**

**TREADY AFTERSCHOOL ROBOTICS PROGRAM FOR HARTFORD MIDDLE SCHOOL STUDENTS**

Marissa Powers '09, Orko Momin '10, Alex Bisson '10

Faculty Sponsors: David Ahlgren, Joseph Barber, Harry Solomon, Figure Foundation

TReady (Trinity Robotics, Engineering, and Autonomous Design for Youth) is an after-school robotics program for Hartford Public Middle School students designed, created, and taught by Trinity Robot Study Team members. This spring 2008 was TReady's inaugural year, starting the first week in February and running ten weeks through the April 12th Trinity International Firefighting Robot Competition. Four teams of two or three students worked together to build four robots to compete in the Competition. Eight students from Belizzi Middle and two from Hartford Magnet Middle came to Trinfo Cafe every Thursday afternoon for three hours to learn the basics of Engineering Design and Robotics. The students used Lego NXT Mindstorm kits to build the robots. TReady is funded by the Figure Foundation through an Urban Being Grant, and by the Trinity Engineering Department. The Grant provided four new laptops, four NXT kits, batteries and chargers, school supplies and log books, food for the students, and refurbishing costs for the basement of the Community Computer Center Trinfo Cafe. The future of TReady includes recruiting for next year, potential SGA funding, and plans for a long term continuation of the exciting new program. TReady hopes to become a strong withstanding venue for young potential Engineers in Hartford to pursue and explore their interests in the sciences in a vibrant, encouraging environment.

**50.**

**NEONATAL BOWEL SOUNDS MONITORING SYSTEM**

Amanda Rao '08

Faculty Sponsors: Harry Blaise, Joseph Bronzino, Leonard Eisenfeld PhD, Hartford Hospital

Currently in the Neonatal Intensive Care Unit (NICU) there are now bowel sound recorders or analyzers. There is very little known about the regularity of bowel sounds, especially in premature infants. In the NICU on-call nurses check the regularity of bowel sounds hourly with a traditional stethoscope to make certain the sounds are present. With the presence of bowel sounds nurses are able to distinguish hunger, which can be very difficult with such young infants. In monitoring bowel sounds it will also be more easily distinguishable the amount an infant has ingested through the feeding. The regularity of bowel sounds is dependent on each infant and the conditions they are in. Whether it be before or after eating, or sleeping or waking. While these bowel sounds are being monitored, certain problems which may otherwise be undetected, such as bowel obstructions, or certain diseases or complications will be more easily detected. The regularity of each infant's bowel sounds must be monitored, and thus an electronic stethoscope has been used for monitoring. Thus, the monitoring of bowel sounds will allow nurses to feed the premature infants in the Neonatal Intensive Care Unit when needed, and will allow certain health issues to be more readily exposed and remedied.

**51.**

**RHS2: BABY-FINDING ROBOT**

**HANDYMAN: FLAME-EXTINGUISHING ROBOT**

Anant Raut '10, Adam Wright '10

Faculty Sponsor: David Ahlgren

The Annual Trinity College Firefighting Competition has a special division, called the Robot Hide And Seek, in which a robot autonomously looks for a simulated hiding baby in a maze. The RHS2 is a robot built on an iRobot Create platform. It completes this task by detecting heat levels equal to that emitted by a human, which here was simulated by a black-painted 15-watt lamp. RHS2 utilizes a proportional control algorithm to intelligently navigate through the maze, even one that it is not familiar with. It makes use of two Sharp GP2D12 sensors to collect distance information, and a differential pyroelectric sensor (PIR) to sense the presence of heat. It also has a light dependant resistor in order to detect white strips on the floor which indicate the doorway of a room in the Hide-And-Seek maze. The RHS2 is successfully able to ignore burning candles in the maze and only find the baby. Robots such as these will in the future be able to locate a human child in a burning building, and notify the firemen of its location, or perhaps even rescue it, all without putting any other human lives at risk.

The Handyman is made of Legos, and uses sharp sensors to intelligently navigate the firefighting maze. This year one sponsor of the competition was Versa Valve, a manufacturer of solenoid valves and there was a special prize awarded the team that did best in their division and used a Versa Valve on their robot. Our team attempted this challenge, and designed a flame extinguishing CO<sub>2</sub> system for Handyman. This system can successfully put out a candle in a room in the firefighting maze. Non-air based extinguishing systems like these are important for future firefighting robots in the real world, since blowing air on a substantial fire is quite ineffective.

**52.**

**FLEXIBLE COMMUNICATION SCHEME ON AN FPGA**

Neil Robertson '08, Kashif Mohiuddin '08

Faculty Sponsor: Taikang Ning

This senior design project incorporates morphware design philosophy to develop a communication system on high-density Altera FPGA hardware.

The system is demonstrated using voice data. The signal is measured, amplified, sampled and digitized, then compressed using an in-house algorithm. The compression (source coding) increases transmission efficiency. Data redundancy (channel coding) is added to improve transmission accuracy. The transmission will be accomplished using frequency modulation (FM). The system has been developed on an FPGA development board. The FPGA system allows a flexible development environment but also provides the speed of a hardware system. It allows the inclusion of coding blocks developed in Hardware Design Language. Finally a CPU is programmed into the FPGA to coordinate all its functions.

The source coding is accomplished by using linear predictive coding (LPC) technique. It takes

advantages of a piece-wise stationary signal to derive prediction coefficients using the Levinson recursion formula. Channel coding is successfully implemented using an Hamming encoder and decoder. An 8-bit modulator has also been successfully implemented on the FPGA development board.

53.

### **REDESIGN OF THE TRINITY COLLEGE SHOCK TUBE**

Andrew Zoller '11, Rahul Shakya '11

Faculty Sponsor: John Mertens

Shock tubes are used extensively as a research tool to investigate the behavior of gases under high temperatures and pressures. Trinity College currently has a new shock tube that requires some design modifications to improve its test time during experiments. This research involved studying different driver and driven lengths of the shock tube to determine ideal lengths. Using Kasimir, a shock tube simulation program, different scenarios were modeled. Here, Helium and Argon were used as driver and driven gas respectively to achieve a T5 from 800K to 4000K. From these results, it was concluded that the length of the driven section should be increased to extend test time. SolidWorks was used to design the exact extension for the shock tube. This drawing will be sent to a machinist to construct the actual piece.

## **ENVIRONMENTAL SCIENCE**

54.

### **THE EFFECTS OF INDIRECT AND DIRECT CUES OF PREDATION RISK ON THE FORAGING BEHAVIOR OF THE EASTERN GREY SQUIRREL (*SCIURUS CAROLINENSIS*) OVER AN URBAN-RURAL GRADIENT**

Ben P. Butterworth '08, Baltazar Ramos '11

Faculty Sponsor: Michael O'Donnell

The stresses of urbanization have the ability to cause shifts in the behavior of wildlife. We examined the foraging and predator-avoidance behavior of the eastern grey squirrel (*Sciurus carolinensis*) in urban, suburban, and rural habitats. Giving-up densities (GUDs) in artificial food patches were measured to quantify the trade-off between foraging and predation-risk. The effects of both direct (predator scent) and indirect (distance from cover) cues of predatory risk were examined. High giving-up densities should indicate a detection of increased predatory risk among the study subjects. GUDs of urban squirrels were not significantly affected by either direct or indirect predation cues. GUDs of suburban squirrels were not affected by direct cues, but GUDs did significantly increase further away from cover, suggesting that suburban squirrels are sensitive to indirect cues of predation risk. A significant difference between the GUDs at feeding stations within the same site for both urban and suburban habitats suggests that foraging behavior is more dependent on micro-environmental differences within a small geographic area rather than the overall level of human-induced stresses over urban, suburban, and rural environments. One micro-environmental variable that warrants further study is the effect of shifts in natural food abundance at a particular location and the potential affect on the trade-off between foraging and predation risk.

**55.**

**MINERAL COMPOSITION OF SEDIMENT CORES DETERMINED BY XRD**

Elisabeth Cianciola '10, Samantha Dolgoff '08, Brittany Price '10, Zach Wissman '10

Faculty Sponsors: Jonathan Gourley, Christoph Geiss

The purpose of this study was to investigate the possibility of the presence of pingos in Wintergreen Woods Park, in Wethersfield, Connecticut. A pingo is a mound of sediment with an ice core. After the ice melts, the mound sinks to form a depression which may be filled with water, mud, or vegetation. In October 2006 and February 2007 five sediment cores were taken at the park. In order to find out what minerals were present in the cores, samples were prepared for x-ray diffraction analysis. Sampling from cores was done once at least every 100 centimeters. The focus of this project was to develop a method for identifying the minerals present in these sediment cores using samples from the core WIN-07-D. It is intended that this procedure will be refined and applied to the other core sediments in order to complete the assessment of the cores as a whole. If the cores were taken from a pingo, it would be expected that the same mineral patterns would occur in a concave shape when viewed across multiple cores. Minerals that have been found in a previous study include quartz, feldspar, illite, muscovite, kaolinite, and siderite. It is important to determine whether the mineral patterns in the cores from Wintergreen Woods Park support the idea that this area is characterized by pingos because the presence of pingos is indicative of a cold tundra climate. This opens a new perspective on New England's paleoclimate because these pingos would have formed during a glacial retreat. Other ways that these core samples have been interpreted include loss of ignition, smear slide analysis, and core diagramming.

**56.**

**QUANTIFICATION OF GOETHITE AND MAGNETITE ABUNDANCE IN SOILS THROUGH ALTERNATING FIELD AND THERMAL DEMAGNETIZATION OF HIGH-FIELD MAGNETIC REMANENCE**

Chamae Munroe '10

Faculty Sponsor: Christoph Geiss

Many soils show an increased abundance of strongly magnetic magnetite ( $\text{Fe}_3\text{O}_4$ ) or maghemite ( $\text{Fe}_2\text{O}_3$ ) in the upper soil horizons. However, the source of iron necessary for the formation of magnetite and maghemite is unknown. One possibility is that goethite ( $\text{FeOOH}$ ) is converted into magnetite or maghemite. The objective of this experiment was to quantify the abundance of magnetite and goethite in a loess sample using a set of rock-magnetic analyses.

Magnetite is a ferrimagnetic mineral characterized by low-magnetic coercivity at room temperature while goethite, an antiferromagnet, is characterized by extremely high magnetic coercivity at room temperature. However, its magnetic signal is easily destroyed by heating it to approximately 120 - 150°C.

We magnetized a sample of Peoria loess, the common parent material of many Midwestern soils by heating in a strong magnetic field produced by two permanent magnets. Next we demagnetized it in an alternating magnetic field (AFD) at room temperature to remove the magnetic remanence due to the presence of magnetite/maghemite. Then the sample was thermally demagnetized (TD) by heating it incrementally in zero field to remove the magnetic remanence due to the presence of goethite. The loss in magnetic remanence after each



demagnetization treatment is related to the abundance of magnetite (loss after AFD) and goethite (loss after TD). Our analyses showed that a Peoria loess contains about 0.4 ‰ magnetite and 0.15 ‰ goethite.

**57.**

### **USING MAGNETIC PROPERTIES OF PALEOSOLS TO RECONSTRUCT CLIMATE**

Emily Quinton '11, Pooja Shakya '11

Faculty Sponsor: Christoph Geiss

We analyzed magnetic properties of loessic soils from the Midwestern United States in an attempt to reconstruct paleoclimate patterns. Similar studies have been conducted in Chinese plateau and other parts of the Midwestern United States employing magnetic susceptibility, anhysteretic remanent magnetization (ARM) and isothermal remanent magnetization (IRM). Magnetic susceptibility gives a rapid estimate of the abundance of magnetic minerals while ARM reflects the presence of small (0.1 – 1  $\mu\text{m}$ ) single domain grains. IRM reflects the presence of all remanence-carrying grains. We applied these measurements to three sites from Nebraska - Wauneta Core, North Cove and Devil's Den. By normalizing the ARM by IRM, we have been able to obtain an indication of the relative amount of small single domain grains present in the samples. Overall, we have observed an increase in concentration-dependent measurements in the paleosols but have seen little increase or decrease in the modern soil horizons. Based on the magnetic properties of these buried soils, it appears as if our paleosols developed under relatively dry environments. Our results so far are one step in the process to applying paleoclimate reconstruction techniques to paleosol.

**58.**

### **AN INVESTIGATION OF TWO ANOINTING BEHAVIORS OF CATERPILLARS**

Catherine Rigoulot '08

Faculty Sponsor: Scott Smedley

Self-anointing occurs when animals apply materials to their outer surface and is thought to provide protection from predators, parasites, and pathogens. There are numerous examples of vertebrates utilizing this behavior, ranging from fish to mammals. Examples of insects self-anointing, however, are rare. This study investigated two anointing behaviors seen in lepidopterans. Self-anointment with anal fluid by newly emerged caterpillars has been observed in monarch (*Danaus plexippus*), and queen (*Danaus gilippus*) butterflies, both members of the family Nymphalidae, subfamily Danainae. A caterpillar, soon after hatching from the egg, will curl its rear end up to touch its head, forming a U-shaped configuration with its body (a behavior termed the U-maneuver). In this position, the caterpillar then releases a droplet fluid from its anus and anoints its body with it. Two goals of this project were to determine the chemical composition of the anal fluid and to also examine the phylogenetic distribution of the behavior. To determine the chemical composition, samples were collected in two ways; through both whole body collection and micropipette sampling. We are awaiting the results of the chemical analyses. To determine whether the U-maneuver occurs in other nymphalid subfamilies, the painted lady (*Vanessa cardui*; Nymphalinae) and the zebra longwing (*Heliconius charitonius*; Heliconiinae) were examined. For both species, the U-maneuver was not observed. The other anointing behavior studied is seen in the tobacco budworm moth (*Heliothis virescens*). In the larval stage this species acquires on its cuticular hairs droplets from the secretory trichomes of its host plant, tobacco (*Nicotiana tabacum*) by simply rubbing itself against the tobacco. The defensive role of the acquired droplets is being investigated.

**59.**

**ANALYSIS OF SOIL CORES FROM A POSSIBLE PINGO REMNANT IN WETHERSFIELD, CT**

Catherine Rigoulot '08, Ben Butterworth '08, Victoria Doñé '11

Faculty Sponsor: Jonathan Gourley

Five cores collected from Wintergreen Woods in Wethersfield, Connecticut were analyzed using various techniques in order to determine their composition. The goal of analyzing the cores was to determine whether or not the small, water-filled depression from which the cores were taken is a pingo remnant. If this is a pingo remnant the layers of soil in each of the five individual cores will be stratified and, correlating in depth with each other. The soil of the cores was compared for hue, value, and color using the Munsell<sup>®</sup> soil color chart to objectively identify soil colors. The program Grapher was then used to plot the data in a detailed core diagram. Additional samples taken from the core for supplementary analysis were also plotted in the core diagram. These supplementary analyses were performed by fellow members of Geoscience 204.

**60.**

**ANALYSIS OF PRECIPITATION SAMPLES FROM TRINITY COLLEGE IN HARTFORD, CT**

Lucille Schiffman '10

Faculty Sponsor: Jonathan Gourley

Acid deposition has become a widespread environmental issue in recent times due to the industrial revolution of the late 18th and early 19th centuries, which caused large amounts of precursor pollutants to be released into the atmosphere. These precursor pollutants are sulfur dioxide (SO<sub>2</sub>), various oxides of nitrogen (NO<sub>x</sub>), as well as reduced nitrogen (NH<sub>3</sub>) which react with water to oxidize and form sulfuric acid (H<sub>2</sub>SO<sub>4</sub>), nitric acid (HNO<sub>3</sub>), and ammonium (NH<sub>4</sub><sup>+</sup>), respectively. These pollutants are released into the atmosphere due to fossil fuel combustion, which occurs for example in cars, or power generating plants. These acid compounds form in clouds and are released through either wet or dry deposition.

Acid deposition is a problem in the Northeast because storms that formed over the many fossil fuel burning plants of the Midwest release their acid deposition in the Northwest. The Northwest itself is also a source of the precursor pollutants due to its large population.

Acid rain research was done at Trinity College from September-November 2007 and January-April 2008. Samples were collected from the roof of the Clement chemistry building and tested for pH, total free acid (H<sub>3</sub>O), total acid strength, and nitrate and sulfate concentrations. Storm track was also recorded. It was found that pH and concentrations of sulfates, nitrates, and chloride could be correlated to storm origin. There may also be a correlation between storm size and acid deposition content. Further research could help to more accurately predict future

**61.**

**DETERMINING THE DIRECTION OF MOVEMENT ALONG THE CHISHAN FAULT IN SOUTHWEST TAIWAN**

Stephen Sobolewski '10

Faculty Sponsor: Jonathan Gourley

The island of Taiwan is formed from the collision of the Philippine Sea Plate into the Eurasian Continental Plate. The collision occurs obliquely as the Philippine Plate moves Northwest relative to the continental plate. This causes lateral extrusion of southwest Taiwan to the southwest. The Chishan Fault is located in southwest Taiwan and its location is approximately the northern extent of the extrusion. Lacombe et al. (2001) found that GPS data indicates that the fault is reverse with a right-lateral component. Yet some faults just north of the Chishan Fault are left-lateral strike-slip faults. The movement along this fault could indicate whether the extrusion to the southwest begins north or south of the fault. A fault rock was taken from along the Chishan Fault and the sense of shear indicates the movement of the fault. The direction of movement along the Chishan Fault will lead to a better understanding of the lateral extrusion to the southwest and of the tectonic movement of the island as a whole.

**62.**

**ANALYZING A POTENTIAL PINGO REMNANT USING SMEAR SLIDES**

Stephen Sobolewski '10, Jeff McNamara '11, Jonathan Quinn '10, Lucille Schiffman '10

Faculty Sponsor: Jonathan Gourley

A pingo is a mound of earth-covered ice that forms in extremely cold conditions. Possible collapsed pingos were discovered in Wethersfield, Connecticut. If found to be pingos, they will provide evidence that climactic conditions in Connecticut were colder than previously thought. This can be determined by analyzing the change in grain size and the composition of the sediment. Five 50 to 550 centimeter cores were examined using smear slide analysis. If it is found that grain size and composition correlate across cores and display uniform u-shaped layering, it is evidence of a collapsed pingo. If no correlation is found, the pingo theory can be dismissed.

**63.**

**LOSS OF IGNITION ANALYSIS OF POSSIBLE PINGO FOUND IN WETHERSFIELD, CT**

Maggie Thomas '10, Brenna Spingler '10, Andrew Kennedy '10

Faculty Sponsors: Jonathan Gourley, Christoph Geiss

In this study we calculated the composition of sediment from core samples. Cores were taken from Wintergreen Woods in Wethersfield, CT where a suspected pingo resides. A pingo is a permafrost mound of sediment with an internal ice core. The presence of a pingo in Connecticut would suggest a prolonged cold period long after the Laurentide ice sheet retreated. By mapping the area and coring the largest water filled depressions, we were able to analyze the mud using loss of ignition. The loss of ignition analysis is predicated upon the fact that varying materials burn at corresponding temperatures. Samples were placed in a furnace and burned at various temperatures to determine the amount of water, organics, carbonates, and silicates in each core. Data was then correlated to determine if the study site does in fact suggest the presence of a pingo in Wethersfield, CT.

**64.**

**SPATIAL DISTRIBUTION OF RED-TAILED HAWKS (BUTEO JAMAICENSIS) IN HARTFORD, CT**

Maggie Thomas '10, Isabel Gottlieb '09

Faculty Sponsor: Joan Morrison

The Red-Tailed Hawk (*Buteo jamaicensis*) is a highly adaptable bird of prey found in habitats across North America. Red-Tailed Hawk populations can thrive in urban areas due to their adaptability and ideal habitat being open land with sporadic foliage. In this study we examined Red-Tailed Hawk territories in Hartford, CT. We tracked seven birds ( $n=7$ ) weekly, for a period of 19 months, including both the breeding and non-breeding seasons. Visual points on all birds were recorded on aerial photos and plotted using ArcGIS. Home ranges were calculated for each bird to determine territories and how these birds use the urban space. Results show Red-Tailed Hawks living in large green spaces (ie city parks) have smaller territories than those using highly developed urban space (ie residential and commercial). Possible explanations for the observed territory size difference are differences in food density between green and developed areas, differences in tree densities, and differences in road densities. This project is important, as Red-Tailed Hawks can be used as indicator species to determine the health and success of other wildlife found in urban areas with similar environments to Hartford.

**65.**

**COMPARING THE ABUNDANCE OF AVIAN BIOINDICATORS ON MAUNGATUATARI AND MT. PIRONGIA**

Colby Tucker '09

Faculty Sponsors: Joan Morrison, Ria Brejaart PhD, EcoQuest Foundation

Introduced mammalian species have decreased biodiversity in New Zealand's forests. The impact of these animals has created a need for ecological restoration. Pest control or eradication is the primary step that must occur in all habitats to allow the regeneration of flora and the recovery of fauna. Ecological monitoring is necessary to determine the success of these projects. Being an integral part of many environments, birds in New Zealand often serve as indicator species for various ecological monitoring projects as they are easily identifiable and are responsive to ecological change. This report is part of a longitudinal study that uses avian indicator species to track changes over time in the forest following the eradication of pests in Maungatautari Ecological Island (MEI) and Mt. Pirongia, where control of pests takes place, but no eradication, serves as a reference site. Over a seven day period in November 2007, a total of 40 bird monitoring stations were visited, 20 in MEI and 20 on Mt. Pirongia. Three five-minute bird counts were completed at each station totaling to 120 counts overall. The indicator species chosen for this study are honeyeaters (tui and bellbird), grey warbler, fantail, kereru, and tomtit. There were more honeyeaters and fantails observed in MEI and more kereru observed on Mt. Pirongia. Vegetation data compiled by Mathiot (2007) and knowledge of the elevations of the bird monitoring stations were used in conjunction with the bird findings of this study. Positive correlations between the abundance of flowering trees and shrubs and honeyeater abundance and elevation and tomtit abundance were found.

# **HEALTH FELLOWS**

**66.**

## **DEVELOPMENT AND VALIDATION OF THE VIOLENCE PREVENTION EMERGENCY TOOL (VPET)**

Nicholas Allen '09

Faculty Sponsors: Sarah Raskin, Sharon Smith MD, Department of Emergency Medicine, Connecticut Children's Medical Center

**BACKGROUND:** Youth violence is a local, state, and national problem. In order to mount any kind of violence prevention interventions, a means of identifying at-risk children must be developed. To our knowledge, no screening tool has been developed to identify adolescents at risk for future violence perpetration as the basis for an emergency department intervention.

**OBJECTIVE:** The goal of this pilot study was first, to determine the feasibility of administering a violence questionnaire to youth in the ED. Secondly, we wanted to evaluate the level of violence exposure in urban youth presenting to the ED. Another goal was to compare a validated 22-item measure to a newer unvalidated 35-item measure.

**METHODS:** A sample of children was screened in the ED at CCMC using both the Violence Exposure Scale for Children (VEX) and the Violence Prevention Emergency Tool (VPET). Inclusion criteria were children between the ages of 8 and 17 years and residency in Hartford. Children were excluded if they had a history of serious mental illness and if there was not a legal guardian accompanying them in the ED to give consent.

**RESULTS:** From VEX we observed that 84.6% of children in our study had been exposed to either mild or severe violence. Because this is the first pilot study using VPET and its evaluation is still in the processes of development, at this point in time we are unable to report results from the VPET analysis, nor comparisons between the validated VEX measure and the unvalidated VPET measure.

**CONCLUSIONS:** Although there was a relatively small number of subjects in this pilot, the number of positive responses supports the notion that it is possible to administer violence screening questionnaires in the ED. Furthermore, we observed that 84.6% of children sampled in this urban setting were exposed to mild or severe violence.

**67.**

## **VARIATION IN DURATION OF OUTPATIENT DIURETIC USE IN NEONATAL ICU GRADUATES WITH BRONCHOPULMONARY DYSPLASIA/CHRONIC LUNG DISEASE**

Urey Chow '09

Faculty Sponsors: Sarah Raskin, James Hagadorn MD MS, Department of Neonatology, Connecticut Children's Medical Center, Anita Bhandari MD, Department of Pulmonology, Connecticut Children's Medical Center

Diuretics are often used to wean premature infants with bronchopulmonary dysplasia (BPD) off mechanical ventilation and supplemental oxygen during their neonatal ICU hospitalization.

Diuretic therapy (DT) often continues after hospital discharge. BPD patients may experience varying durations of outpatient DT and diuretic wean.

Objectives of this study were: 1) To define usual duration of outpatient DT in NICU graduates with BPD; 2) To define usual duration of weaning of DT; and 3) To identify factors associated with early weaning of DT.

We performed a retrospective observational study using clinical databases and medical record review. Included infants were 2000-06 CCMC NICU graduates with birth weights 450-1500 grams with BPD, discharged on DT and followed in the CCMC Pediatric Pulmonology Clinic (PPC). Duration of DT and wean were followed using PPC records. Information regarding demographics, hospital course, and discharge were collected. Univariable and multivariable analyses were performed.

Inclusion criteria were met by 59 infants. Median (25th, 75th percentile) duration of DT was 94 (65, 115) days and 29 (7, 84) days for diuretic weaning. Parents weaned DT off in 4 cases including 2 prior to first PPC visit. In 34 cases (58%), DT was decreased or weaned off at the first PPC visit. African-American race, need for rehospitalization, higher Diuril dose at discharge, and shorter interval from discharge to first PPC visit were significantly associated with longer wean duration. After adjusting for these factors, other factors tested were not significantly associated with duration of diuretic wean. Discharge on supplemental O<sub>2</sub> was associated with duration of wean in univariate but not multivariate analysis.

Duration of DT and wean vary among NICU graduates with BPD. A majority of infants in the study cohort had diuretic discontinued or weaned at the 1st PPC visit. It may be possible to wean DT earlier than current practice.

## **68.**

### **MULTIDRUG-RESISTANT ORGANISMS: A HARTFORD HOSPITAL QUALITY INVESTIGATION**

Rachel Goodman '09

Faculty Sponsors: Sarah Raskin, Brian Cooper MD, Director of Infectious Diseases, Hartford Hospital

Analysis of the demographic and bacterial origins of increased antibiotic resistance among nosocomial VRE and MRSA isolates obtained from patients admitted to Hartford Hospital in 2003 and 2007 was conducted. Significant changes in the source population of VRE infection were shown to have occurred, including increases in the average patient age (61.00 in 2003, 69.32 in 2007) and number of patients status post heart/liver/kidney transplant, as well as a decline in the number of patients receiving hemodialysis at time of infection. A non-significant trend towards a decrease in number of comorbid diagnoses at the time of discharge was also observed among the nosocomially VRE-infected population. Additional analysis of antibiotic resistance in Hartford Hospital-borne MRSA isolates obtained from patients admitted in 2007 was also conducted. Samples were reconstituted, grown, selected, and inoculated onto MacConkey + 5% blood agar and glycopeptide tests were conducted. Growth patterns indicated that the average MIC value for 2007 samples was within the threshold for vancomycin susceptibility (MIC = 1.02) and heteroresistant growth was present in 32 of 59 samples grown (54%). Statistical analysis indicated this heteroresistant growth significantly increased the average sample MIC values above the CDC-defined threshold for vancomycin susceptibility into the intermediate range.

**69.**

**TIBIA FRACTURES IN PEDIATRIC POPULATION MONOPLANAR VS. MULTIPLANAR EXTERNAL FIXATION**

Kaitlin Haines '09

Faculty Sponsors: Sarah Raskin, Kristan Pierz MD, Department of Orthopaedics, Connecticut Children's Medical Center

Tibia fractures are one of the most common long bone injuries found within the pediatric population. The majority of diaphyseal tibia fractures can be treated non-operatively. Certain situations, however, such as open fractures, fractures associated with neurovascular injury, significant soft tissue injury, compartment syndrome or comminuted shaft fractures merit surgical stabilization, including flexible/nonflexible intramedullary nails, plating, monoplanar external fixators or multiplanar external fixators. Studies involving external fixation devices have been well documented in the adult literature; however only limited research has been conducted to investigate the effects of mono- or multi- planar external fixators in pediatric patients. The aim of this study was to assess, through retrospective chart review, the efficacy and complication rate associated with external fixation devices based on fracture type and frame type at a single pediatric institution (Connecticut Children's Medical Center) over a period of ten years (1996-2007). To date, trends involving complication rate and return to OR have been noted but further data collection is necessary before adequate data analysis can be performed and conclusions can be drawn comparing fracture type and frame type. Eventually, by analyzing the effectiveness of monoplanar and multiplanar external fixation devices, the Orthopedics Unit at CCMC will be able to better and more efficiently serve the Connecticut public, as well as contribute to the field of medicine regarding the best overall external fixators for specific tibial fracture patterns.

**70.**

**ENHANCED AWARENESS, EDUCATION, AND PREVENTION OF HIV INFECTION AND STDS IN NORTH CENTRAL CONNECTICUT PUBLIC SCHOOLS' YOUTH**

Jacqueline O'Boyle '09

Faculty Sponsors: Sarah Raskin, Juan Salazar MD, MPH, Connecticut Children's Medical Center

The rise in the number of youth acquiring sexually transmitted diseases (STDs) and Human Immunodeficiency Virus (HIV) in Connecticut has called for a program to increase STD and HIV awareness in this population in order to prevent future cases of infection and to identify those already infected. Connecticut Children's Medical Center (CCMC) has created a program in which a theater group uses humor to educate high school students in Hartford about the mechanisms of transmission of both STDs and HIV. In order to eliminate the barriers that youth face when seeking testing, the program also offers, immediate, on site free and confidential STD and HIV counseling and testing. The proportion of high school students who got tested for HIV after the implementation of the school-based education program is significantly higher compared to the proportion of students who had been tested before its inception. A greater proportion of high school students have and will get tested for HIV as a result of the implementation of the school-based education program. The program was successful in making kids aware of their risk for HIV and STDs, informing them of where they can go to get tested, and identifying and treating kids positive for Chlamydia and gonorrhea that otherwise may not have known they had an STD. In addition the proportion of positive STD test results was compared between schools with primarily Latino high school students, primarily African American high school students, and an adult education program. It appeared that the students in the adult education program did

not have positive STD results, possibly because they take the initiative to get tested on their own. Students tested from Weaver high school, a primarily African American population, had greater numbers of students with STDs than students tested from Hartford Public High School, a primarily Latino population.

**71.**

**NEURAL RESPONSE IN THE NUCLEUS ACCUMBENS TO THE PROSPECT AND ANTICIPATION OF MONETARY INCENTIVE REWARD IN ADOLESCENT MAJOR DEPRESSIVE DISORDER: AN FMRI STUDY**

Jacqueline Parrotta '10

Faculty Sponsors: Sarah Raskin, Michael Stevens PhD, Director, Clinical Neuroscience and Development Laboratory Olin Neuropsychiatry Research Center, Director, Child & Adolescent Research Hartford Hospital/The Institute of Living.

Neuroimaging studies have shown Major Depressive Disorder (MDD) to be associated with impairment in reward functioning. Functional magnetic resonance imaging (fMRI) studies in adults and adolescents have shown no differences in neural activation during reward anticipation within the nucleus accumbens (NAcc) of MDD patients in comparison to healthy controls. Within this study functional magnetic resonance imaging was used to (1) identify differences in NAcc activation during the prospect and anticipation of being rewarded and to (2) identify differences in NAcc activation between different magnitudes of reward. Twenty-seven adolescents 12-17 years of age participated in the study, including 18 diagnosed as having Major Depressive Disorder and 9 demographically matched control subjects. Event-related fMRI data were collected while participants performed a monetary incentive delay task, which measured brain activity in periods of reward prospect and reward anticipation. Participants with MDD showed hyperactivity of the NAcc in comparison to healthy controls during the prospect and anticipation of reward. There were mixed results for differences in NAcc activation during the anticipation of winning different magnitudes of rewards. The results indicate that reward sensitivity could contribute to MDD within adolescents and that the NAcc may be an important area to consider in future neurobiological theories of MDD.

**72.**

**DOES ENCEPHALOPATHY PREDICT CHILDHOOD ACUTE DISSEMINATED ENCEPHALOMYELITIS (ADEM) OR PEDIATRIC MULTIPLE SCLEROSIS (MS)?**

Rachel Reece '09

Faculty Sponsors: Sarah Raskin, Francis DiMario MD, Department of Pediatrics of the University of Connecticut School of Medicine at Connecticut Children's Medical Center

Childhood CNS inflammatory demyelinating disorders have clinical and radiological symptoms that can be indistinguishable from each other at the time of initial presentation. Three of these demyelinating disorders are pediatric multiple sclerosis (MS), acute disseminated encephalomyelitis (ADEM), and clinically isolated syndrome (CIS). Recently, the International Pediatric MS Study group proposed consensus definitions for pediatric MS and childhood ADEM and CIS, which emphasized encephalopathy as the characteristic that distinguished ADEM from both MS and CIS. Encephalopathy is defined as an altered mental state, progressive loss of memory or cognitive ability, lethargy, seizures, personality changes, or loss of ability to speak or swallow. It is hypothesized that encephalopathy will help to initially



differentiate ADEM from MS or CIS since the criteria are based on previous clinical experience. After IRB approval, all patients at CCMC with a diagnosis of CIS, ADEM, or MS were retrospectively identified by clinical, MRI, and/or pathologic diagnosis from 1996 to 2007. Patients with cerebellar ataxia, lyme disease, mitochondrial disease, cancer, immunosuppressive therapy, radiation injury, and/or prior or concurrent chemotherapy were excluded. Patient charts for clinical course, diagnostic laboratory, and neuroimaging procedures were examined and tabulated. Based on the diagnostic codes, 1325 potential subjects were identified and 171 charts were obtained for review. When the exclusion criteria were applied, there was a final cohort of 41 subjects (17 boys) with the required initial diagnosis: 15 CIS, 23 ADEM, and 3 MS. The purpose of this present study was to validate the current clinical hypothesis about early diagnosis of MS versus ADEM or CIS. By discriminating children who benefit from early therapy from those who do not, it can reduce long-term morbidity since immune modulation can potentially decrease the severity of such diseases.

**73.**

### **REVIEWING THE EPIDEMIOLOGY OF ALL-TERRAIN VEHICLE INJURIES IN CONNECTICUT'S YOUTH FROM 2002-2004**

Brice Vallieres '09

Faculty Sponsors: Sarah Raskin, Brendan Campbell MD, MPH, Department of Surgery, Connecticut Children's Medical Center

The number of ATV (all-terrain vehicles) accidents have risen annually since 2000 and have become an alarming epidemic within the pediatric population. From 2000-2004 alone, there were an estimated 58,254 ATV-related accidents. Often times, these children lack the experience, physical strength and mental/motor skills to operate these heavy vehicles safely. Although several legislative efforts have been passed to reduce the number of ATV-related accidents, enforcement of these laws can be difficult. The American Academy of Pediatrics has suggested helmet use for younger children, and such efforts have clearly shown to be a benefit to both bicyclists and motorcyclists in the prevention of head injuries. The purpose of this study is to characterize data from the Chime database in order to better understand the nature of ATV accidents in Connecticut and to offer some local solutions to reduce the number of injuries resulting from ATVs. The data will be summarized into these specific demographics: gender, age, race, ethnicity, Injury Severity Score (ISS), number of head injuries versus non-head injuries, length of stay, total hospitalization charges, location of hospitals, location of injury, primary diagnoses associated with the accidents and discharge dispositions for each patient.

## **MATHEMATICS**

**74.**

### **SMOKING HABITS OF DRUG USERS**

Sarah Brittain '08

Faculty Sponsor: Philip Brown

This project examines the smoking habits of drug users. The varying levels of smoking are categorized as nonsmoker, occasional smoker, or daily smoker. Using Markov Chains for analysis, the probabilities of changes in this habit will be estimated over time. Results indicate

that the vast majority of nonsmokers and daily smokers retain their smoking habit, whereas occasional smokers have a higher likelihood of becoming daily smokers over three years. The data utilized is from the UCLA Drug Abuse Research Center.

**75.**

**PREDATOR-PREY MODEL APPLIED TO ISLE OF ROYALE**

Jennifer Gifford '09, Catherine Rigoulot '08

Faculty Sponsor: Philip Brown

Isle of Royale provides a unique example of a single predator-single prey relationship, in which the predator (wolves) and prey (moose) are relatively isolated and therefore easily studied. This island, which is about 400 square miles and located 15 miles from any shore of Lake Superior, has been inhabited by moose since 1900 and wolves since about 1950. Wolves are the only prey for the moose on the island and moose make up approximately 90% of the wolves' diet. Since their relationship is very simple, with no human interaction and practically no other predators or prey involved, the moose and wolf populations here allow scientists to study an almost pure predator-prey relationship. This study used a typical predator-prey mathematical model to predict the populations of the two animals based on their relationship to one another. The results of the model were then compared to data on the moose and wolf populations collected by John Vucetich and Rolf Peterson, from Michigan Technological University, over the past 50 years.

**76.**

**A DETERMINISTIC MODEL FOR THE SPREAD OF INFECTIOUS DISEASE**

Emmy Handy '08

Faculty Sponsor: Philip Brown

Millions of people world wide die each year due to infectious diseases such as malaria, measles and HIV. Similar epidemics have been a problem throughout history, like the Influenza pandemic in 1919 and the plague in the 14th century. The spread of these infectious diseases can be studied using mathematical models. This project investigates two such deterministic models, the SI model and the SIR model for studying the progression of an epidemic.

**77.**

**AGING PREY**

Code Sternal '08, Nick Ryan '08, Paul Labella '08

Faculty Sponsor: Philip Brown

Predator Prey models examine population levels between two species. The model takes the form of two differential equations that represent the population growth of the predators and the prey and their interactions. The simple form of the model has the prey growing at a natural rate while the predators must eat the prey to survive and only eat prey on random encounters.

Often in real life the predator does not kill its prey on every encounter. Often if the prey are healthy they are able to avert the predator. This is especially the case between wolves and deer. The wolves are more likely to take down old and young deer. This model takes into account wolf hunting patterns and the predators can only eat the prey if they are young enough or too old.

# NEUROSCIENCE

78.

## **THE POTENTIAL ROLE OF PPAR $\alpha$ AND PPAR $\alpha/\delta$ IN PROTECTING PC12 CELLS DURING ISCHEMIC TREATMENT BY MINIMIZING OXIDATIVE STRESS.**

Shahzad Ahmed '08

Faculty Sponsor: Hebe Guardiola-Diaz

Neurons are particularly susceptible to harm from the generation of free radical species due to their intracellular physiology and interactions with glia. The reduction of molecular oxygen that is necessary for aerobic respiration produces harmful radicals such as superoxide and hydrogen peroxide. The release of nitric oxide from microglia also generates harmful radical species. Antioxidants function to neutralizing damage occurring from radicals and cells are able to express several enzymes that act as antioxidants. Neurons are always exposed to radical induced damage, but it is thought that during ischemia and neurodegeneration there is an imbalance between the number of radicals and antioxidants. This imbalance ultimately is thought to induce apoptosis as radical damage has been linked to the formation of protein aggregates, which is a hallmark of several neurodegeneration diseases. Peroxisome-Proliferator Activated Receptors (PPAR) are being examined as potential pharmacological targets for such diseases. PPARs have a well-characterized metabolic role and a potential role in mediating oxidative damage. The interactions of PPAR $\delta$  and PPAR $\gamma$  activation in PC12 cells were examined to assess whether protection from trauma is in part due to minimizing damage from radicals. Upon exposure to neural growth factor (NGF), PC12 cells adapt a phenotype similar to that of sympathetic neurons. An ischemic tolerance model was used to gauge whether PPAR $\gamma$  and PPAR $\delta$  activation protects cells by increased protein expression of superoxide dismutase (SOD), catalase (CAT), glutathione reductase (GR), glutathione peroxidase (GPx), and glutathione s-transferases (GST). Using the lactate dehydrogenase assay we found that PPAR $\delta$ , but not PPAR $\gamma$ , increased cell viability following glucose and oxygen deprivation. Results from assays of antioxidant enzymes were inconclusive, but there appeared to be no significant differences in SOD levels in treated cells in comparison to controls. Future studies could continue this investigation by assaying other antioxidant systems for a role in neuroprotection.

79.

## **THE EFFICACY OF MENTALLY-STIMULATING ACTIVITIES ON THE PROSPECTIVE MEMORY OF ALZHEIMER'S PATIENTS**

Andrew Castiglione '08

Faculty Sponsor: Sarah Raskin

Prospective memory is a key element in leading an independent lifestyle for many senior citizens. Unfortunately, Alzheimer's disease often robs its patients of this way of life, as degenerative memory deficits increase. Previous studies have hypothesized that continual use of mentally challenging activities such as chess and word searches may play a role in the prevention of Alzheimer's and dementia. This study set out to determine what therapeutic cognitive effects arise from weekly supplemental cognitive stimulation of patients already diagnosed with early-mild onset Alzheimer's, vs. those patients who did not receive any supplemental activity. 10 patients diagnosed with early-mild onset Alzheimer's were chosen from a community adult day

center. Participants were initially administered the Memory for Intentions Screening Test (MIST). Over the course of seven weeks, hour-long sessions of chess and other logic-based games, such as Sudoku and various puzzles, were individually administered to patients. At the end of the trial, the MIST was administered a second time, and with initial and final scores compared to look for any differences. Data will be analyzed to look for any statistically-significant changes in individual and average test results.

## **80.**

### **MITOCHONDRIAL FUNCTION IN RATS FED A KETOGENIC DIET**

Ritika Chandra '10, DJ Patrick '11, Tiffany Ruiz '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. The diet is known to be effective in children who do not respond well to anticonvulsant medications. Although it has 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 change in ATP and particularly adenosine may play a key role in the diet's effectiveness. ATP is a molecule of purine base, involved in intracellular energy transfer. Adenosine is an inhibitory neuromodulator and endogenous anticonvulsant. In order to test our hypothesis that the ketogenic diet alters mitochondrial function in specific brain regions, rats were fed either an 8% ketogenic diet, or a basal control diet for four weeks. The rats were sacrificed, and several brain samples were rapidly frozen and stored in neutral tris-base buffer at -70 degrees Celsius. The tissue content was normalized using the Bradford protein assay and then enzymatic activity of the mitochondria was tested using a succinate dehydrogenase assay. Our findings may help develop a new assortment of novel treatments for individuals suffering from epilepsy and other neurological disorders.

## **81.**

### **EFFECTS OF ARIPIPRAZOLE ON SUBJECTIVE AND PHYSIOLOGICAL RESPONSES TO ALCOHOL**

Kara Douglas '08

Faculty Sponsors: Sarah Raskin, Henry Kranzler MD, University of Connecticut Health Center

Aripiprazole (Abilify®) is an atypical antipsychotic with partial agonist activity at dopamine D2 receptors and serotonin 5-HT1A receptors. This molecular mechanism may reduce the euphoric, reinforcing effects of alcohol, and thus might provide an effective pharmacologic intervention for reducing heavy drinking. The present study examined whether aripiprazole modifies the behavioral and physiological effects of a moderate dose of alcohol in a group of social drinkers. Eighteen healthy subjects (9 men; mean age = 27.6 years) completed a double-blind, within-subject study with 3 experimental sessions in a randomized sequence, during which they received no medication, aripiprazole-2.5mg, or aripiprazole-10 mg on the day prior to the laboratory session. During the session, subjects consumed alcohol that was served as three standardized drinks, after which breath alcohol concentration (BrAC), heart rate, static ataxia (body sway), and subjective effects were measured regularly. Alcohol consumption produced physiological and subjective responses that were consistent with previous literature on its effects. Pre-treatment with aripiprazole was generally well tolerated, with tiredness being the most

commonly reported adverse event. The medication significantly and dose-dependently increased the sedative effects of alcohol and, to a lesser degree, decreased the euphoric effects of alcohol. Although these findings require replication in a larger sample that includes heavy drinkers and a placebo-control session, they suggest that aripiprazole could be of value in the treatment of alcoholism.

## **82.**

### **MEMORY DEFICITS IN FEMALE VICTIMS OF INTIMATE PARTNER VIOLENCE**

Carolyn Edwards '08

Faculty Sponsors: Sarah Raskin, Robert Astur PhD, Institute of Living-Olin Neuropsychiatry Research Center

Intimate partner violence (IPV) is a problem affecting women worldwide. Numerous mental health problems arise from IPV including traumatic brain injury, posttraumatic stress disorder (PTSD), and depression. However, only a few studies have looked at how these mental health outcomes resulting from IPV affect cognitive abilities. Various brain changes have been seen due to stress, PTSD, and brain injury, possibly influencing memory dysfunction. This study examined prospective, spatial, and verbal memory deficits in female victims of IPV. Memory tests included the Memory for Intentions Screening Test (MIST), the virtual radial arm maze, and the Hopkins Verbal Learning Test (HVLT). The aim of the study was to determine how various health outcomes such as brain injury, PTSD, and depression affect memory in women who have suffered intimate partner violence. Based on previous findings in combat veterans as well as victims of IPV that have shown PTSD and depression to result in memory deficits, we hypothesized that women who had suffered more severe IPV and mental health problems would be more likely to show memory deficits. Results showed that women with increased stress performed better on the memory tasks than women experiencing less stress, which could be explained by the Yerkes-Dodson curve. Other results verified previous findings that women who had suffered more severe intimate partner violence were more likely to experience PTSD, depression, anxiety, and a lower quality of life. Interestingly, women who had undergone more severe intimate partner violence were more likely to report having cognitive difficulties, when in this study, there was no correlation between increased IPV severity and decreased memory functioning.

## **83.**

### **PEROXISOME PROLIFERATOR-ACTIVATED RECEPTORS & NEUROPROTECTION**

Elijah Heckstall '08

Faculty Sponsor: Hebe Guardiola-Diaz

Oxygen and glucose are required for the brain to function. I am using a cell culture model of oxygen-glucose deprivation to study how peroxisome proliferator-activated receptor (PPAR) agonists protect brain cells from degeneration. PPARs are ligand activated nuclear receptors. An oxygen-glucose deprivation model (OGD) is available in the PC12 cell line, a line developed from the tumor cells of the rat adrenal medulla. This study proposes to evaluate the protective effects of two PPAR agonists in PC12 cell cultures grown under OGD conditions. While PPAR activity may be responsible for the mechanism underlying protection of neurons observed in clinical studies, the mechanism by which these receptors protect neurons is unknown. To determine whether the protective effect of PPAR on cell survival is mediated by increased mitochondrial efficiency, cytochrome c oxidase levels are being determined.

**84.**

**THE EFFECT OF A POLYMORPHISM OF THE GENE SLC6A2 ON PERFORMANCE OF THE AUDITORY ODDBALL TASK USING FMRI**

Alexandra Hoffman '08

Faculty Sponsors: Dan Lloyd, Godfrey Pearlson MD, Olin Neuropsychiatry Research Center, Institute of Living

Schizophrenia is an inherited condition characterized by disruptive cognitive impairments, including hallucinations, delusions, and disordered thought and speech. While it is clear that schizophrenia runs in families, and must therefore have a genetic component, the details of this inheritance are unclear. The disorder cannot be explained by selection of a single gene, but instead seems to be linked to a variety of “risk alleles.” A number of genes have been implicated as part of a larger schizophrenia endophenotype, but this study examines SLC6A2, a norepinephrine transporter gene, and its effect on performance of the Auditory Oddball Task (AOD) in healthy control subjects with no diagnosis of psychosis as determined by DSM-IV. Previous studies have implicated SLC6A2 in major depression and bipolar disorder, both symptomatically related to schizophrenia. These implications, as well as the known function of the gene, also identify SLC6A2 as a potential risk gene for schizophrenia. After undergoing genetic testing, subjects were grouped by genotype (AA, AT, or TT), and their performance during the AOD task was compared. Results showed a difference in the AOD performance of the subjects with the AA phenotype that is comparable to the AOD performance of subjects with schizophrenia, suggesting that SLC6A2 is indeed a risk gene for schizophrenia.

**85.**

**EVALUATING THE NEEDS AND WANTS OF POTENTIAL PARTICIPANTS IN A PROPOSED SUCCESSFUL AGING PROGRAM**

Bethany Ignatenko '08

Faculty Sponsors: Sarah Raskin, Patrick Coll, MD, University of Connecticut Health Center

Baby-boomers are reaching retirement, and a huge portion of the population will soon be over the age of 65. Successful aging occurs when people are able to avoid or limit progressive decrease in physiological capacity and maintain physical and cognitive functioning during their senior-most years. Many studies have shown that adoption of life style changes and the application of certain medical interventions can decrease mortality, morbidity, and cosmetic changes commonly associated with increasing age, thereby increasing successful aging. Dr. Patrick Coll of the University of Connecticut Health Center is working to develop a program that will promote successful and healthy aging before people reach retirement. The purpose of this study was to evaluate what the target audience, men and women aged 40-70, would want in a successful aging program, and to determine whether they would be interested in Dr. Coll's program. Focus groups and interviews determined that people generally have negative views of aging, but expressed a strong interest in the proposed program. Participants also gave suggestions for elements to add, modify, and improve the proposed program.

86.

### **ANALYSIS OF PROSPECTIVE MEMORY USING MEMORY FOR INTENTIONS SCREENING TEST**

Élan Jones '11, Alexandra Rogers '09

Faculty Sponsor: Sarah Raskin

Prospective Memory (PM) is *remembering to remember*. This ability to remember is controlled by the frontal lobe of the brain. PM is used by most individuals in everyday life: remembering to pick up the groceries, remembering to take medicine and/or remembering to take out the trash are all prime examples of prospective memory use. Tests have also shown PM deficits in a number of cases such as Traumatic Brain Injury patients, Attention Deficit Disorder, increasing age, and Schizophrenics. In this study, the Memory for Intentions Screening Test (MIST) was used to test for prospective memory in PM efficient test subjects. These subjects did not have a history of any type of traumatic brain injury, learning disability, drug abuse, etc. (no known PM deficits). The MIST measures how variables affect performance. If a subject fails at a task, is it more probable to observe failure at long delays? Is it more likely to observe failure when the cue is time-based versus performance-based? Is it more likely to observe failure if a task is verbal or if it is an action? Overall the basis of this research was to obtain a control group of subjects for the MIST. In the future, results from this study of PM efficient test subjects will be used as a control group for a basis of comparison to tests taken by subjects with known PM deficits (ie: schizophrenics).

87.

### **CHARACTERIZATION OF THE ROLE OF CA3 IN THE TRISYNAPTIC CIRCUIT OF THE HIPPOCAMPUS**

Rachel Lynch '11, Alejandro Lerma III '11

Faculty Sponsor: Harry Blaise

The hippocampus is the primary area where information is processed for memory consolidation. Area CA3 is the least understood region in the hippocampus and the role of CA3 neurons in this memory processing circuit is still unclear. Long-term potentiation (LTP), the strengthening of the efficacy between synapses, is thought to be a physiological mechanism for learning and memory and studying it can give insights on how the brain processes information from environmental stimuli. Research was conducted using freely behaving adult male rats (n = 11). Electrodes were chronically implanted into the dentate gyrus (DG) and CA3 of the hippocampus in order to stimulate and record synaptic responses. After a week of post-surgical recovery, baseline responses were recorded in CA3 in response to DG stimulation. Following tetanization, post-stimulus brain activity was recorded and compared to baseline recordings to determine changes in synaptic efficacy. Using an initial trial pattern of stimulus (4 trains of 5 Hz TBS with 20 seconds between train), long-term depression was induced in three rats. Since LTP was not produced, the stimulus protocols were changed on all further test subjects. Using a new protocol (2 trains of 100 Hz stimulation separated by 20 seconds), four rats displayed significant increases in synaptic efficacy immediately following tetanization, which lasted for at least 48 hrs. In addition, four rats only showed increases in synaptic efficacy after 3 hours; this increase lasted at least 48 hrs. Paired-pulse (PP) analysis was also performed prior to tetanization. Results indicate no significant differences in PP curves between rats that showed immediate or delayed potentiation. Further studies are needed to properly determine under what conditions CA3 synapses reliably show LTP, however it is important to point out that this is the first stimulation

protocol we have applied in which synaptic efficacy did not decrease. This information obtained in these studies will lead to a better understanding of the role that CA3 neurons play in the information processing circuit of the hippocampus.

**88.**

**EXPLORING THE RELATIONSHIP BETWEEN MEDICATION MANAGEMENT AND PROSPECTIVE MEMORY IN SCHIZOPHRENIA**

Jacqueline Maye '08

Faculty Sponsor: Sarah Raskin

Schizophrenia is a prevalent mental disorder that affects about 1% of the U.S. population aged 18 and above. Research has shown that schizophrenic individuals generally have poor medication management skills, with rates of medication noncompliance reaching as high as 73% in some cases. Previous research has also shown that deficits in prospective memory, the ability to follow future intentions through to execution, are prevalent in schizophrenia. The current research sought to determine the relationship between medication compliance and prospective memory in schizophrenia. Medication management assessments as well as prospective memory tests were administered to patients of the Schizophrenia Rehabilitation Program at the Institute of Living at Hartford Hospital. Data collection is ongoing.

**89.**

**EXPLORING THE EFFECTS OF ADENISONE ON EPILEPSY VIA THE KETOGENIC DIET**

Tracey Suter '11

Faculty Sponsor: Susan Masino

The ketogenic diet is a treatment for epilepsy, is not well understood. The ketogenic diet is high in fat and very low in carbohydrates and results in the body using ketones as its main source of energy rather than glucose. In past experiments with ketogenic diet, there have been mixed reports in behavior in the individuals placed on the diet. To examine this effect more closely, the mice and rats fed the ketogenic diet, along with their control diet counterparts, are placed in a Y-maze for 5 minutes. During that time all arm entries are sequentially scored in order to determine the number of arm entries without repetition, called alternations. The greater the percentage of alternation indicates the animal's ability to remember which arm was entered last. Y-mazes allows the comparison of the memory of rats and mice on the ketogenic diet versus a normal, control diet, to see if there is any difference in their behavior. The data collected thus far show no statistically significant differences. However, trend suggests that, with more data, the results may become statistically significant. This information will be useful for patients using this treatment for epilepsy. Other aspects of this research may lead to clues about the mechanisms underlying how the ketogenic diet helps reduce seizures.



**90.**

## **EXPLORING THE RELATIONSHIP BETWEEN THE KETOGENIC DIET AND ENDEOGENOUS ADENOSINE LEVELS IN THE BRAIN**

Caleb Wasser '08

Faculty Sponsor: Susan Masino

In recent years, the ketogenic diet (a low-carbohydrate diet) has been used as an alternative method to suppress seizures in patients suffering from epilepsy. However, while the diet has been proven effective, it is currently unknown why it is effective. We propose that it is an increase in the neuromodulator adenosine that produces the anti-convulsant effects of the ketogenic diet. This hypothesis is supported by preliminary evidence and published research. To test this hypothesis more directly, we observed seizure activity in an adenosine A1 receptor knockout mouse model and in rats with adenosine receptors blocked.

At weaning, male mice that were wild type, heterozygote or knockout for the adenosine A1 receptor and normal Sprague-Dawley rats were placed on either the ketogenic diet or a control diet of normal rodent chow for at least three weeks. The relative resistance of these three mouse genotypes to seizures and to the anticonvulsant effects of the diet was tested. Seizure testing was performed on rats maintained on either a ketogenic or control diet pretreated with either caffeine (50 mg/kg) or a control vehicle (0.9% NaCl). Based on our hypothesis of the relationship between the ketogenic diet and adenosine, we expected that 1) the knockout mice would be more susceptible to seizures than the wild type mice with intact adenosine A1 receptors; 2) the ketogenic diet will be more effective at reducing seizure activity in the wild type mice than in the knockout mice; and 3) pretreatment with caffeine would negate the antiepileptic effects of the ketogenic diet in rats. To date, we have preliminary electrophysiological and seizure data supporting this hypothesis and results from seizure testing presented here are very promising. Further experimentation with a larger sample size is necessary to obtain conclusive data.

# **PHYSICS**

**91.**

## **RAMAN SPECTROSCOPY OF DIAMOND THIN FILMS**

Emily Allen '08

Faculty Sponsor: Barbara Walden

Raman spectroscopy can be used to distinguish different forms of carbon, such as diamond and graphite, within a single sample. These materials can be formed together and investigated when carbon is deposited into thin films. Diamond thin films are less than a micrometer thick and are created by the use of a plasma chamber. Small variations in deposition conditions change the bulk atomic arrangement of a film. For example, changing the amount of hydrogen gas present during deposition can change the amount of graphitic carbon or diamond arrangements in a sample. These changes can be investigated using Raman spectroscopy which differentiates between atomic arrangements from the different vibrational energies associated with specific interatomic bonds. Unlike scanning electron, optical light, and atomic force microscopy, which give topographical information about a sample, Raman spectroscopy gives information about atomic bonding. In this study, Raman spectroscopy was used to investigate changes in atomic arrangement such as graphitic, diamond, nano-crystalline diamond, and amorphous carbon structures within diamond thin films due to variations in hydrogen gas percentages.

92.

## **LOW-COST COINCIDENCE COUNTING ELECTRONICS FOR UNDERGRADUATE QUANTUM OPTICS.**

Sarthak Khanal '11

Faculty Sponsor: David Branning

Coincidence counting is an essential component of quantum optics experiments at the undergraduate level; however, cost has created an entry barrier for many schools. Presented here is a design for a coincidence-counting module (CCM) that replaces the traditional method based on time-to-amplitude conversion and pulse height analysis. This module accepts inputs from up to four detectors, has a coincidence-time window of less than 10 ns, and has throughput of more than triple the traditional method. All of this is achievable for less than 5% of the cost of the traditional method. With the use of new and improved electronics, the size and cost of the CCM will be drastically reduced. This will make coincidence counters affordable and easily usable for quantum optics experiments and hence encourage undergraduate research work in quantum optics. Further work will be directed towards the use of field programmable gate array (FPGA) in order to perform complex logic operations for the CCM.

# **PSYCHOLOGY**

93.

## **IMAGERY FACILITATES AUTOBIOGRAPHICAL MEMORY RETRIEVAL**

Rebecca Brill '08

Faculty Sponsor: Karl Haberlandt

In two experiments I examined the effect of imagery on the retrieval of autobiographical memory. The experiments were based on a cued-recall study by Williams et al. (1999). I hypothesized that high imagery cue words would facilitate the retrieval of personal memories. Using latencies as the measure of retrieval, I predicted that participants would retrieve memories faster when prompted with high imagery cues. For Experiment 1 I used the list of cue words from the Williams study. The set of words covaried the imageability and word occurrence frequency yielding four groups of cue words: high imagery-high frequency (*lake, fire*), high imagery-low frequency, low imagery-high frequency, and low imagery-low frequency (*boredom, reminder*). The experiment supported my prediction. High imagery words resulted in faster retrieval than low imagery words. Additionally fewer high imagery words were omitted compared to low imagery words.

Using a new list of cue words, I conducted Experiment 2 to replicate Experiment 1 and to eliminate potential confounds. Again there were fewer omissions of high imagery words and high imagery words prompted faster recall. These results of Experiments 1 and 2 were consistent with the findings of Williams and colleagues. There are several hypotheses for the effect of imagery on latency, including the following three accounts. First, cue words high in imagery activate different hierarchies in the store of autobiographical memory, which allows the individual to access a certain time period. Additionally, these cues are easily elaborated, which leads to personalization of the stimulus. Finally, high imagery words provide connections between general and specific events resulting in the activation of more detailed memories. The robustness of the effect of imagery on autobiographical imagery retrieval illustrates the potency of images in retrieval. In general the imagery effect in my thesis reflects the beneficial effect of imagery that has been widely demonstrated in episodic and semantic memory studies.

**94.**

**ADOLESCENT PUBERTAL DEVELOPMENT, SEXUAL ACTIVITY, AND SELF-ESTEEM IN WOMEN**

Liana Brown '09, Monica Chung '09, Melissa Harris '09, Rachel McHugh '09,  
Michelle Synder '09

Faculty Sponsor: Dina Anselmi

Simmons, Blyth, Van Cleave, and Busch (1979) found that females who entered puberty early suffered from lower self-esteem. It is then hypothesized that females that go through sexual development earlier than those in their peer group will engage in sexual activities earlier and thus suffer from lower self-esteem than their peers. Using an online study a random sample of female undergraduates at Trinity College, were assessed to determine the ages at which participants began developing sexually, based on the age of their first menstruation and how these factors were related to self esteem. We hypothesized that the participants who entered puberty earliest would report younger ages of sexual activity and incidentally lower self-esteem than their peers.

**95.**

**THE AFFECT OF FAMILY SIZE ON SOCIABILITY**

Laura Cutler '08, Chandler Barnard '09, Ian Hendry '08, Erin Fitzgerald '08, Keisha John '08

Faculty Sponsor: Dina Anselmi

A general misconception about sociability is that only-children tend to be more introverted than children with siblings. Research findings suggest that only-children tend to be more extroverted because of their need to interact. Using an online survey over 120 Trinity College Students were surveyed for a variety of personality characteristics to see how introversion, extroversion, and other sociability characteristics differed depending on family size. We hypothesize that individuals who are only children will have the most sociable and friendly personality characteristics, followed by individuals of large families and individuals of medium sized families in descending order.

**96.**

**SPORTS AND GENDER AT TRINITY**

Karli DelRossi '09, Amanda Garbatini '09, Kimberly Palterman '09, Stephen Valentin '08,  
Matthew Wolock '09

Faculty Sponsor: Dina Anselmi

In America, women's professional sports are underrepresented in comparison to men's. The athletic achievements of men often overshadow the success of women. As a consequence, women's sports do not attract the same resources of attention especially in terms of attendance as men's sports. Based on casual observation Trinity College attendance for women's sports is generally lower than that of men's, mirroring the trend of professional sports. The Purpose of this present study was to investigate reasons why men's sports attract greater support than women's sports. In a study of 179 male and female athlete and non-athletes, we sought to determine what influences attendance of sporting events. We expected to find that negative attitudes towards women's sports are a strong factor in explaining why attendance is lower for women's sports.

**97.**

**PATTERNS OF VISUAL GAZE TO SPEAKING FACES IN CHILDREN WITH AUTISM SPECTRUM DISORDERS (ASD) AND TYPICAL DEVELOPMENT**

Kathleen Fentress '08

Faculty Sponsors: Julia Irwin, William Mace

For typically developing individuals, the face holds important affective and communicative information. Individuals with autism spectrum disorders appear to show deficits in face perception (Lindner & Rosén, 2006; Golan, Baron-Cohen Hill, and Golan, 2006). and less influence of the face on heard speech (Mongillo, Irwin, Whalen, Klaiman, Carter & Schultz, 2008). The present study investigated visual gaze patterns of individuals with ASD to speaking faces in comparison to IQ-matched controls. Previous research comparing gaze patterns in ASD versus typically developing (TD) individuals has yielded conflicting results. Some research has found that ASD individuals display different patterns of gaze when viewing a human face (Denver, 2004; Klin, Jones, Schultz, Volkmar, and Cohen, Klin et al., 2002). Other research has found no difference between gaze patterns in ASD and TD individuals (Bar-Haim, Shulman, Lamy, and Reuveni, et al., 2006; Van der Geest, Kemner, Verbaten, and van Engeland, van der Geest et al. 2002). The present study used a priori look zones on a speaking face to assess gaze patterns of ASD and TD participants when viewing a speaking face. Results show that in two out of three conditions analyzed, ASD and IQ-matched controls showed significantly different patterns of gaze. The most salient difference between ASD and typically developing participants' gaze patterns was that ASD participants spent significantly less time looking at the mouth than their IQ-matched controls. Significantly different patterns of gaze toward a speaking face may shed light on the underlying causes of the social and linguistic deficits associated with ASD. For instance, the significantly different patterns of gaze found in this study may implicate that ASD individuals have trouble perceiving the facial cues that are so integral for typical perceivers.

**98.**

**THE EFFECTS OF PARENT-CHILD RELATIONSHIPS ON COLLEGE STUDENTS' SELF-ESTEEM**

Kathleen Fentress '08, Syd Meckler '08, Mandy Williams '08, Taraneh Khosrowshahi '08

Faculty Sponsor: Dina Anselmi

Parenting styles have been shown to affect a college student's ability to adjust to and succeed in college (Strage & Brandt 1991). A students' perception of their parents' involvement and support affects students' own sense of autonomy (Ratelle, Larose, Guay, Senecal 2005). Parental relationships play a significant role in a student's self-image and achievements (Ratelle et.al). Our investigation focused on how positive child-parent relationships relate to self-esteem in freshman and senior men and women at Trinity College. First, we hypothesized that positive parent-child relationships would be correlated with higher self-esteem. Second we hypothesized that positive parent-child relationship would result in higher self-esteem in female students than in male students. Finally we hypothesized that positive parent-child relationship would result in higher self-esteem in freshmen than in seniors. One hundred Trinity College freshman and senior men and women were recruited from dorms and other public areas to complete measures of self-esteem and perceived child-parent relationship. We found a significant relationship between child-parent relationships and self-esteem with more positive relationships relating to higher self-esteem. However, we did not find any significant relationships between gender or class year and self-esteem.

**99.**

**TEXT MESSAGING: EXAMINING THE SIGNIFICANCE OF ROMANTIC RELATIONSHIPS**

Sydney Meckler '08

Faculty Sponsors: Dina Anselmi, Randolph Lee

Text messaging has reached new heights all around the world. It has become a communication phenomenon that has transformed the way we interact with our friends, family, romantic interests, and even teachers. There are millions of texts sent each day ranging from simple one-word answers to important information. Some 4.7 billion text messages were sent in the U.S. last December, the latest figures available, compared with 2.1 billion a year earlier and 253 million in December 2001, according to CTIA-The Wireless Association (The Wall Street Journal, 2005). There has been little research done on text messaging and relationships but it has undoubtedly changed the way we communicate (Robinson, 2004). In the current generation, sending text messages has exponentially increased and has become an important communication technique. The current study will assess the impact "texting" has on this generation's relationships. Through means of a self-designed questionnaire, students will answer a set of questions pertaining to their interaction with text messaging and relationships. I hypothesized that females would send and receive more text messages than males and that women would also feel more comfortable texting people they have a crush on rather than call them. It was also hypothesized that in general one is more likely to respond to a text with a text message and not a phone call.

**100.**

**THE EFFECTS OF COGNITIVE AND SOCIAL INTERVENTIONS ON PRESCHOOL CHILDREN'S GENDER STEREOTYPING**

Larwence King '08, Amanda Williams '08, Marissa Zanno '08

Faculty Sponsor: Dina Anselmi

The goal of our study was to examine gender stereotypes to see if different interventions would influence the rigidity and flexibility of children's stereotypes. Gender stereotyping is one of the mechanisms that are used to classify individuals into male and female categories. While some sex differences are biologically based, most of the stereotypic attributes linked to an individual's sex arise primarily from social roles. This can have lasting effects on people's lives, including the talents they cultivate, the conceptions they hold on themselves and others, their social lives, and the occupational paths they choose (Bussey & Bandura, 1999). One theory attributes cognitive processing to the development of gender stereotyping (Liben & Bigler, 1990). Other theorists believe gender stereotypes arise from social influences and interactions (Kats & Walsh, 1991). Although most researchers agree that gender stereotyping has negative consequences, there is significant disagreement about how to lessen such stereotyping. We administered a measure developed by Liben and Bigler to assess preschool children's gender stereotypes in personal measures and attitudinal beliefs. Participants were then randomly selected into one of three conditions: a cognitive intervention was aimed at changing the schematic aspect of children's stereotypes, a social intervention which was aimed at influencing socialized behaviors, and a control group did not receive either intervention. We believe that the children in both the social condition and the schema condition will show a larger change in their personal measures and attitudinal beliefs of stereotypes than those children in the control group. We also believe that effects of the intervention will be different based on the sex of the participants. We expect the girls to be more affected than the boys in the social condition. The child's personal

measures will be more affected by the social condition. The child's attitude measures will be more affected by the schema condition.

### **101.**

#### **THE EFFECT OF HOME ENVIRONMENT ON PRESCHOOL CHILDREN'S LITERACY AND LANGUAGE SKILLS**

Erin Fitzgerald '08

Faculty Sponsor: David Reuman

Many studies have been conducted on the influences that affect children's literacy and language skills. Different factors, such as school programs, teaching styles, and home environment, have been known to be crucial to children's reading performance. This study examined specifically the relation between home environment and emerging literacy and language skills of preschool-aged children. Parents of preschoolers filled out a survey, which included questions about their own reading habits, parent-child interactions related to reading, parental demographics, as well as the Parent Reading Belief Inventory (DeBaryshe, 1994). Data collected from parents was matched with their children's performance on the Peabody Picture Vocabulary Test (PPVT) that was administered to each child individually at the preschool. I hypothesized that the Parent Reading Belief Inventory scores would correlate positively with preschoolers' PPVT scores. I also predicted that the more time parents spent reading on their own, as well as with their children, would correlate positively with their children's PPVT scores. Findings from this study can help preschools develop partnership programs with parents that will promote the development of literacy and language skills in early childhood.

### **102.**

#### **EFFECT OF INTERNET USE ON DEVELOPMENT OF SELF-ESTEEM AND SOCIAL SKILLS**

Christine Grant '08, Caroline Boiardi '08, Kelly Mearns '08, Julia Rosenthal '08,

Bianca Sims '09

Faculty Sponsor: Dina Anselmi

Since the expansion of the internet, there has been contradictory evidence as to whether internet use has a positive or negative impact on mental health. More recently, the internet has become an avenue for fostering social, romantic, and business relationships. The current study sought to determine the impact of internet use on two generations; one who began logging on past their formative developmental years, and one who developed simultaneously with the internet revolution. A random sample of 114 college freshman and baby boomers were surveyed to assess their frequency of internet use, motivations for internet use, self-esteem, and social anxiety. The study found that college freshman had significantly higher levels of social-anxiety, preferring internet interaction over face-to-face communication. The younger generation also experienced higher levels of social pressure online and placed more importance on their online appearance. However, we found that both groups had similar measures of self-esteem.

**103.**

**METROSEXUALITY IN TRINITY COLLEGE MALES**

Mignon Hills '08, Rebecca Freedman '08, Laura Cutler '08, Elizabeth Rich '08

Faculty Sponsor: Dina Anselmi

Our society places an immense amount of pressure on males and females to act a certain way based on their gender. Individuals who exhibit socially-accepted displays of gendered behavior are often rewarded, while individuals who exhibit behavior which fall outside these norms may be ostracized or excluded. Metrosexuality, a recent cultural phenomenon which is marked by the display of traditionally female characteristics in heterosexual males, serves as an example of a deviation from conventional expectations of how males should act. In our study, we examined views surrounding metrosexuality and masculinity in Trinity College males using the Levant Masculinity Scale and a series of questions regarding personality and behavioral traits of Metrosexuality. We hypothesized that Trinity College males would exhibit traits characteristic of metrosexuality but would not self-identify as metrosexual. We also hypothesized that individuals who had high ratings of masculinity would be less likely to identify with the label metrosexual.

**104.**

**COLLEGE STUDENTS' VIEWS ON CHILDREN'S RIGHTS AND FAMILY DECISION-MAKING IN RELATION TO ADOLESCENT PSYCHOLOGICAL MATURITY**

Courtney Jones '08

Faculty Sponsor: Dina Anselmi

In 1989, the UN Convention on the Rights of the Child (CRC) was adopted as a mechanism to codify basic rights that children should be afforded. Within the CRC there are three groups of rights, protection rights, provision rights, and participation rights. Protection and provision rights have been classified as nurturance rights, while participation rights have been classified as self-determination rights, which focus on the rights that give children an amount of control over their lives (Ruck, Abramovitch, & Keating, 1998). The purpose of the present study was to understand two aspects of children's rights. The first issue related to how college students view nurturance and participatory rights for children and to see how that is linked to their views of how much freedom they felt they received in a variety of situations as adolescents. The right to make important decisions as a child or adolescent is often associated with psychological maturity (Steinberg and Cauffman, 1996). Therefore, this study extended previous research by seeing if there was a link between college students' perception of their maturity as a teen and their perception of freedom over decision making as a teen. I hypothesized that students who were considered more mature as teens would report that they had more control over decisions as teens. Contrary to my hypotheses, the results showed no significant correlation between overall decision-making and level of maturity. There was however, a significant correlation between perceived decision-making score and support of self-determination rights, showing that those who supported self-determination rights believed they had more freedom in decision-making as a teen.

**105.**

**CUED-RECALL: HIGH IMAGERY WORDS ELICIT DISTANT, PLEASANT MEMORIES**

Stephanie Keith '08

Faculty Sponsor: Karl Haberlandt

In two cued-recall studies, I prompted the retrieval of autobiographical memories with 32 words. In order to observe the effect of cue word imagery on retrieval, I divided cue words into high and low imagery categories. High imagery words (e.g. grass, robbery, river) are thought to evoke visual images more readily than low imagery words (e.g. amount, law, upkeep). The first study used a set of words compiled by Williams et al. (1999), while the second study used a set of words developed by the experimenters.

Replicating Williams et al.'s (1999) study, Rebecca Brill and I found that high imagery cues promoted faster retrieval of autobiographical memories than low imagery cues. Participants were more likely to retrieve memories when cued by high imagery words. In addition, memories cued by high imagery words were older and more pleasant than those cued by low imagery words. Presumably, high imagery words allowed participants to search further back in their memory to retrieve distant events. Once participants had retrieved distant events, they were likely to rate them as pleasant experiences. This pleasantness effect is consistent with the Fading Affect Bias. According to this bias, affect associated with negative events fades over time to a greater extent than affect associated with positive events (Walker et al., 2003). Finally, my analyses revealed that autobiographical memory is positively biased (Walker et al., 2003; Herter, 2007); overall, participants recalled more pleasant memories (987) than unpleasant memories (608).

These two studies demonstrated the effectiveness of the cued-recall method. Future studies may address: (1) whether cue word pleasantness can be manipulated experimentally so as to influence the retrieval of memories, and (2) to what extent the imagery level of cue words influences the specificity of autobiographical memories.

**106.**

**BIMANUAL TASKS: VARIATION OF HAND USE IN DIFFERENT HOCKEY SHOTS.**

Sarah Kohn '11

Faculty Sponsor: William Mace

Studies of handedness traditionally have focused on the distinction between performances of a dominant hand compared to a nondominant hand. Guiard [1987] introduced an approach that focused on natural tasks in which the hands play different roles instead of one just being a poor version of the other. Using a hockey stick is a good example of such a bimanual task. Variation of hand use in the swinging function of a hockey stick was studied in order to measure lower hand movement during a slap shot and wrist shot. A hockey stick was taped in segments to allow for measurement of bottom hand shifts in video playback. Measurements on the movement of the bottom hand on the hockey stick were found in skilled ice hockey players throughout several trials of two different types of shots: the slap shot and the wrist shot. A comparison between the positions of the lower hand in these two conditions showed how players adapt to a demand for power within the bimanual task of a hockey shot.



**107.**

**THE ROLE OF STANDARDIZED TESTING IN COLLEGE ADMISSIONS: IMPACTS ON INSTITUTIONS AND INDIVIDUAL APPLICANTS**

Vanessa Lee '08

Faculty Sponsor: David Reuman

The requirement and usage of standardized testing in college admissions in the United States has been the subject of controversy since the inception of the SAT I in the 1920s. While the majority of colleges and universities in the United States require submission of some form of standardized testing results as part of their application processes, a small but growing group of schools has made submission of standardized testing scores optional in recent years. This study examines how current college students interpret and make use of testing-optional college admissions policies. An online questionnaire was sent to all first year students at Trinity College. Results indicated that a majority of respondents feel that certain standardized tests, including the ACT and AP Exams, are better representations of their abilities than the SAT I; however, a majority also reported feeling that the SAT I is a better representation of their abilities than SAT II subject tests. Relatively few students in the sample reported having applied to testing-optional schools. The SAT I Critical Reading and Quantitative Reasoning scores of students who had applied to testing-optional schools did not differ significantly from the scores of students who did not apply to testing optional schools, but contrary to prediction, those students who had applied to testing-optional schools earned significantly higher SAT I Writing scores. Results also showed that a majority of current Trinity first year students did not report believing that testing-optional colleges are of lower quality than colleges that continue to require standardized testing. Implications of these findings for Trinity College's admissions policies will be discussed.

**108.**

**SYNCHRONIZED TAPPING WITH VISUAL AND AUDITORY STIMULATION**

Chao Liao '11

Faculty Sponsor: William Mace

Prior research shows that timing precession in self-paced tapping is independently limited by the central timing process, which is presumed to regulate movement initiation, and the motor implementation process, which is presumed to determine when the actual response occurs. In tapping, the motion command to the finger is generated before the onset of auditory stimulus, suggesting a process of anticipatory timing control. These results lead to the statement that no matter what kinds of stimuli objects get, their performance remains the same. At the same time, some research indicates that synchronized tapping performance is far worse with flashing visual stimuli than with auditory stimuli. By periodic analyze and kinetic analyze, the differences of visual stimulated and auditory stimulated synchronization tapping are discussed. Preliminary results suggest that visual stimulated tapping is not as good as auditory stimulated tapping in both frequency and accuracy.

**109.**

**EFFECTS OF BIRTH ORDER ON SELF-ESTEEM AND RISK TAKING**

Dana Paulson '08, Vanessa Lee '08, Danielle Wortman '08, Emily Moore '08,  
Alexandra Schmidt '08

Faculty Sponsor: Dina Anselmi

Studies have shown that birth order is significantly related to a number of developmental outcomes including achievement, and personality characteristics. More specifically, first and last born children have been found to have higher levels of self-esteem than middle born children. This study examined the effects of birth order on the self-esteem and risk taking behaviors of a random sample of Trinity College students. We hypothesized that first and last born children would have higher self esteem and exhibit more risk taking behaviors than middle born children, and that in a two-child family, the first born child would have higher self esteem and exhibit more risk taking behaviors than the second born child. We also expected that children of only-child families would possess higher self-esteem and exhibit riskier behaviors than children from families with more than one child. Results of this study confirmed our second hypothesis and demonstrated that the first born child in a two-child family had significantly higher self-esteem than the second born child.

**110.**

**THE GENDER LIGHT SWITCH: AN EMPIRICAL ANALYSIS OF MEN'S GENDER  
ROLE EXPRESSION IN THE WORKPLACE AND IN MARRIAGE**

Steven Schmidt '08

Faculty Sponsor: David Reuman

This study analyzed men's gender role balance across social contexts, specifically the contexts of being a manager and a spouse, and the resulting influence on marital satisfaction. A sample of 270 married male managers completed self-report questionnaires assessing gender role expression in managerial and spousal roles. Additionally, relationship satisfaction was measured using the Hendrick Relationship Assessment Scale, and marital satisfaction (with a focus on work-family conflict) was measured using the newly developed Marital Assessment Scale. Regarding role balance, the overall findings indicate that for married male managers across these social contexts, feminine traits were reported to be more strongly expressed than masculine traits, and traits expressed in the managerial context were reported to be more predominant than in the spousal context. More specifically, almost twice as many men were high in masculinity as a manager than were high in masculinity as a spouse, while femininity was more consistent across social contexts. These results indicate that, for male managers, the expression of feminine traits across social contexts is more stable than is the expression of masculine traits. Men are indeed balancing their gender roles, specifically masculinity, across social contexts, and situational contexts may help shape the expression of these traits. Furthermore, in the spousal context, femininity, not masculinity, appears to be the predominant set of traits affecting marital satisfaction. While masculinity appears to be a construct that varies more so than femininity does across social domains, these results suggest the maintenance of higher levels of femininity in the spousal role is a stronger predictor of marital and relationship satisfaction than is the balance of masculinity across contexts. Additional analyses of various demographic variables were explored for effects on gender role expression and marital/relationship satisfaction and are discussed.

**111.**

**UNDERSTANDING DIVERSITY AT TRINITY COLLEGE: FIRST-YEAR STUDENT PERCEPTIONS RELATED TO ACADEMIC AND SOCIAL OUTCOMES**

Jesse Wanzer '08

Faculty Sponsor: David Reuman

The face of Trinity College has changed dramatically over the past ten years. The College has made several efforts towards increasing diversity on campus. However, this change has also brought along some problems including racially-charged incidents in the fall of 2006. The current study focuses on how Trinity students form perceptions of diversity and the academic and social consequences of those perceptions. Using a stratified random sample on the basis of race and gender, qualitative interviews were conducted in the spring of 2007 with 32 first-year students from the class of 2010. Interview data was linked to self-report survey data as well as archival data from the Registrar's office. Students varied greatly in defining what diversity means to them. Asian, Black and Hispanic students were more likely to mention race/ethnicity than White or International students. There was also a discrepancy between students' personal perceptions of diversity and what students believed the College's perceptions were. In addition many students, regardless of race, mentioned campus events from the fall of 2006 when talking about diversity. Academic and social consequences of these perceptions will be discussed. These findings suggest that continual dialogue about diversity is needed to help alleviate climate issues on campus.

## **SCIENCE AND SOCIETY**

**112.**

**MEASUREMENT OF SOCIOECONOMIC POSITION AND ITS HEALTH IMPLICATIONS IN RURAL ECUADOR**

Cristina Wheeler Castillo '08

Faculty Sponsor: James Trostle

Background: Although it is widely accepted in epidemiological research that socio-economic position (SEP) is an important determinant of health outcomes, comparably little evidence exists from the developing world to validate and demonstrate the strength of this correlation. Furthermore, even fewer studies exist that validate measures of appropriate variable selections for SEP in developing countries. This study asks questions of 1) how best to measure SEP based on objective and subjective measures in a rural region of Ecuador, and 2) how best to construct indices of wealth and status in low-income countries in the context of global health disparities research.

Methods: Various measures and indices of SEP were constructed by combining qualitative and quantitative data. Qualitative: Ethnographic work was conducted in a rural costal area of Ecuador during the summer of 2007 to assess local understandings of status and wealth. Culturally appropriate measures of position were then proposed.

Results: Local perceptions of wealth indicators included well constructed and furnished houses, ownership of land, ownership of farm animals, ownership of a business, having steady employment (versus seasonal), and not receiving welfare from the state. Perceptions of determinants of status included education outside of the village, professionals who return to the

village, leaders of popular groups, working hard for one's family, having a "desire" to ascend economically, and status is lost by wasting money on drink or clothes.

Conclusions: Despite poor conditions in the region and relatively low wealth levels in the village, gradients in wealth and status were evident from both direct observation and local perspectives. Additionally, local interpretations included variables not typically included in global health studies. Cognitive validation of measurement techniques is necessary for measurements to be appropriate within studies that include variables measuring social position.

### **113.**

#### **COMPARISON OF ASTHMA IN HARTFORD AND TRINIDAD & TOBAGO**

Samantha Alcala '11, Melissa Blake '11, Devin Fuller '11, Oladayo Oyedele '11,  
Khine Pyone Wai '11, Cristina Wheeler Castillo '08

Faculty Sponsors: Alison Draper, Milla Riggio

In the fall of 2007, students in the Scientific Discovery Program (SDP) studied asthma in Hartford and completed an educational service project in two Hartford elementary schools. In March of 2008, the SDP students enrolled in the seminar "Science and Asthma- Trinidadian Perspectives" and traveled to Trinidad and Tobago to investigate asthma from a global perspective. With a grant from the Mellon Foundation, students learned about the different triggers that exist in the Caribbean environment. Through meetings with professors, physicians, and interviews with the general public, students learned how the history of Trinidad and Tobago, and how IMF structural adjustment policies in particular, have shaped the country's wealth distribution and health care system. Further more, students learned about the role of nutrition and traditional remedies in asthma management. Although Trinidad and Tobago is a less wealthy country than the United States, their public health care system is able to offer some level of care to all people. In the United States those without insurance have to rely on Emergency Room visits and do not have access to preventative care. Funded by the Mellon Foundation.

## **SOCIOLOGY**

### **114.**

#### **ADOLESCENT CONTRACEPTIVE USE**

Liana Brown '09

Faculty Sponsor: Theresa Morris

Teen sexual activity is a topic that causes anxiety in today's society. Sex education in the United States varies from abstinence-only to teaching about safer sex practices, including contraception. Through research and data analysis, I've studied contraceptive use among adolescents. The data I used for my research comes from the "2005 Youth Risk Behavior Surveillance Survey" conducted by the Center for Disease Control. My plan was to examine condom use and the use of the birth control pill by adolescents and to see how this varied according to gender, race, and age. In my attempt to answer this question, I applied race and feminist theory. I hypothesized that males will be more likely to use condoms than females and female will be most likely to report using the birth control pill. Racial minorities will be less likely to use contraception than their white counterparts due to lack of access. I also hypothesized that contraceptive use will

increase with age. My research showed that racial minority adolescents are more likely to use condoms than their white counterparts, but white females are more likely to report using the birth control pill than black females.

### **115.**

#### **ANALYSIS OF STRESS RELATED TO EARLY CHILDHOOD INTEGRATION**

Sheila Coleman '10

Faculty Sponsor: Theresa Morris

In this study the dynamics of preschool classrooms were examined to observe the effects of diversity on young children. Interactions among children were studied to determine whether various ethnic backgrounds, diversity and income levels are contributing factors for early childhood stress. In this study I have conceptualized stress as being manifested in a child's unwillingness to attend school. The likelihood of children becoming intolerant of children outside their ethnic group increases with levels of heterogeneity. Supportive studies show peer rejection being witnessed among children that exhibit moodiness or emotional negativity during periods of group interaction. Typically young children have fears surrounding unfamiliar objects, noises and strangers. This study examines the willingness of children to accept unfamiliar people, mainly children, into their everyday situations with the minimum amount of stress involved. Through bivariate correlation I have tested the relationship between variables such as social economic status, diversity, and social interaction. My preliminary findings show that the level of diversity within a classroom has a regression coefficient of  $-.003$  when I control for all other variables, and is not statistically significant (Sig.  $=.516$ ) to support my hypothesis. Correlations indicate that the greatest significance is among children new to the kindergarten environment and the level of unwillingness to attend school. Further study will be directed toward the benefits of early integrated socialization of children.

### **116.**

#### **UNINSURED AND INSECURE? AN EXAMINATION OF THE EFFECTS OF RACE AND SOCIOECONOMIC STATUS ON HAVING HEALTH INSURANCE COVERAGE**

Molly FitzGerald '10

Faculty Sponsor: Theresa Morris

Race is a deciding factor of many aspects of life in the United States. Many racial groups have been systematically disadvantaged over time, resulting in the vast inequalities that exist in America today. Health insurance is a key component to living a healthy and safe lifestyle, but all too frequently, people are forced to live without insurance coverage, leaving them vulnerable to the effects of injury and illness and unable to seek medical attention when necessary. Using a data set from The Interuniversity Consortium for Political and Social Research (ICPSR) study number 3927, the "National Survey of American's Families (NSAF), 1999," I examine the effects of race and income on the likelihood that a person has health insurance coverage, with the expectation that members of minority groups, because of their status in America society, make less money on average, and are therefore less likely to have a health insurance plan, than Americans who identify themselves as "White." An examination of past studies conducted on this subject, both empirical and theoretical in nature, provide a background for my study of the impact of race and income on health insurance in the United States. Although a chi-square test of significance shows no relationship between race and health insurance coverage ( $.460 > .05$ ), the

addition of income as a rival factor demonstrates that the race of people living close to the poverty line (both below and slightly above) does impact a person's chances of having health insurance. This relationship is indicative of the stacking up of inequalities that can be seen throughout American society, and serves to further disadvantage those who are already at the bottom of the social spectrum. This research study attempts to answer some of the vital questions regarding the connections between race and income as factors impacting health insurance, as coverage becomes more expensive and harder to secure, but remains as crucial to living a secure life as it has ever been.

**117.**

**ANTI HOMOSEXUAL AND BISEXUAL HATE CRIMES AND ASSAULT: HOW THE U.S. AIDS EPIDEMIC IMPACTS VIOLENCE**

Justin Hall '09

Faculty Sponsor: Theresa Morris

The purpose of this study is to test whether or not the AIDS epidemic in the U.S. influences homophobic violence. The construction of "homosexual" (both male and female), "heterosexual", and "bisexual" sex acts or preferences is an extremely violent process. So many labels are behind the meanings of these words and yet only one of them actually describes the action that creates them, sex. This leads to the construction of knowledge about the different behaviors in which they become rank-ordered; a part of this violence is its justification. One justification is the belief that homosexuals are responsible for the AIDS epidemic in the U.S. The previous examples are forms of social or structural violence, but there is also a physical violence that results from this process. Almost twenty-two percent of all hate crimes committed in the U.S. in 2005 were against homosexuals or bisexuals. This study relies on individual acts of hate crimes as its unit of analysis; focusing on the levels of assault on victims who were chosen because they were seen as homosexual or bisexual. The reason for this focus is that assault requires a physical interaction between the assailant(s) and victim(s), making it a much more personal encounter. The preliminary findings in this study show that there is a relationship between the level of AIDS per state and the rate of anti-homosexual or bisexual hate crimes of all other hate crimes.

**118.**

**ANALYZING ATTITUDES TOWARD OBESITY**

Kimberly Lewis '09

Faculty Sponsor: Theresa Morris

Diabetes, high-blood pressure, bad eating habits, low self-esteem, we have heard of all the studies accessing obesity. We have become too familiar with diet regiments and gastric bypass surgery. This review analyzes attitudes toward obesity. Looking at how people in general, not just obese individual, feel about men and women who are obese. Using empirical data of surveys, and previously conducted studies I examine the effect of social class on attitudes toward obesity. The results show that as social class increases, negative attitudes toward obese men and women increase. These findings indicate that there is a direct correlation between social class and the negative attitude toward obese men and women.

**119.**

**EDUCATIONAL INEQUALITIES TIED TO ECONOMIC BACKGROUNDS**

Julian Loo '09

Faculty Sponsor: Theresa Morris

I have chosen to examine the inequalities that exist in our educational system. I have specifically chosen to focus on examining academic success/achievement amongst high school students. My measure of academic success/achievement is through standardized tests composite scores both in math and reading at the high school level. My research has found that there is a direct correlation between a student's level of academic success/achievement and their Total Family Income. For the majority of my research I have found that the higher a student's family income, the more academic success/achievement they are able to attain. This goes vice versa.

I feel that this is an important topic to look at because there is an obvious inequality that exists in our educational system amongst different students. I would like to find out not only that this is happening, but why it is happening as well. As a country, we preach equality and freedom not only in our educational system but as a whole. It is obvious that equality does not exist in education if those who come from wealthier families are able to do better than those who don't.

**120.**

**EVENTS OF 911 AND THAT DAYS EFFECT ON INCREASING ANTI-SEMITIC HATE CRIMES**

Deborah Pham '09

Faculty Sponsor: Theresa Morris

In 2001 the world changed due to the terrorist attacks of September 11. In the days, weeks, months, and even years that have followed the focus in sociological research has been on the ramification of these events to Muslims and Middle Eastern natives. There has been a great deal written about misunderstandings of beliefs, hate crimes against Muslims, and who is a terrorist. What I have not seen is any study looking into the effect of 9/11 on the Jewish communities in the United States (US). Anti-Semitic attitudes have long been apart of US society creating a system of oppression for anyone of Jewish descent and I have explored a belief that anti-Semitic actions were on the rise prior to the events of 9/11, with a decline immediately following 9/11, and have continued to increase in the years post 9/11. In studying this issue I have used data from the Department of Justices Uniform Hate Crime annual reports along with information obtained in the Anti Deformation Leagues (ADL) Annual Audit of anti-Semitic incidences. Looking at this data one can clearly see a rise in anti-Semitic behaviors through hate crimes reported and incidents reported to the ADL, between 1986 and 1991 incidents rose from 900 per year to 1900, with a leveling off occurring between 1991 and 2000 (ADL 2006). In the year following 911 there was a sharp decline in incidents but with in a year incidents began to climb back up. What impact did the events of 911 have on anti-Semitic hate crimes within the United States? Since there was a significant decrease in anti-Semitic hate crimes post 911 this question deserves exploring.

**121.**

**NATURE V NURTURE: MODERN ART AND SOCIAL CLASS**

Katherine Pierce '11

Faculty Sponsor: Theresa Morris

Although a popular topic of research from the 60s, modern art and public opinion have gotten only a small fraction of the attention they once did from social researchers. The question is simple: why are some people more open or receptive to modern art, meaning contemporary and usually controversial pieces. What links the more receptive population? What impact does social class or higher education have, if any on forming the opinions of people and therefore how significant of a role does one's social class or education play in shaping personal preferences? Does social class affect how strongly one feels about this subject? These are questions I seek to answer through this research paper. Some of the earlier studies on this topic, although providing important empirical data, have looked at personal traits or other factors. Although with other topics people have studied the roles of social class and education on individuals, few have done so with something as personal and as objective as art. Also because I have differing opinions on the subject and reception of modern art than my parents, I felt that opinion in this arena was not a product of my specific childhood environment, but rather some other aspect that was not present in the my life and the lives of my parents. This paper addresses the possible correlation between modern art appreciation and social class, via measures of education and income. The dependent variable is opinion towards modern art, whether it is overall intolerant or accepting. The independent variable is social class, as to be measured by income and education level. The major hypothesis is that there is correlation between social class and modern art appreciation. On an individual level, it is hypothesized that education will have less of a correlation than income when compared. Earlier studies, which looked at art through public opinion and are few and far between, have been used as data sources. My data showed that there was some correlation between the factors and opinion on modern, controversial art but this data was not strong enough to rule out the null hypothesis.

**122.**

**USE OF CONTRACEPTION IN HIGH SCHOOL STUDENTS**

Mary Rose '09

Faculty Sponsor: Theresa Morris

This paper focuses on contraceptive use of high school students in relation to their age, race and grade-level. The hypothesis, formed through the use of deviance theory and feminist theory, is that those students with more education (higher grade-level) will report a greater frequency of contraceptive use. The 2003 National School-based Youth Risk Behavior Survey, which randomly sampled 195 schools, provided the data set for this study. This study was a cross sectional study of the high school students. The survey, done by the CDC, yielded qualitative information which was then analyzed in a quantitative manner using chi-square measurement. The findings indicate that as a teenager's level of education increases so does there use of contraception. The data also indicates that men have a greater frequency of contraceptive use as they get older than females