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FOURTH ANNUAL SUMMER RESEARCH SYMPOSIUM TRINITY COLLEGE

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BIOLOGY

1.

SCANNING ELECTRON MICROSCOPY OF THE PLACENTAE OF THE VIVIPAROUS SQUAMATES *NERODIA SIPEDON* & *SCELOPORUS JARROVI*

Kristie Anderson '10

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 scanning electron microscopy were used to investigate the structure and function of the placentas of embryos of the viviparous water snake, *Nerodia sipedon*, and viviparous mountain spiny lizard, *Sceloporus jarrovi*. Early results suggest that *N. sipedon* exhibits similar morphological features to those of other thamnophiine snakes, including a vestigial shell membrane, a yolk sac placenta, and an attenuated, highly vascularized allantoaplacenta, which appears to be specialized for interhemal exchange. *S. jarrovi* also exhibits two placentas, which persist through the end of gestation: an allantoaplacenta and a yolk sac placenta. The yolk sac placenta of *S. jarrovi*, previously described as simple and transitory, shows unusual specializations for maternal – fetal exchange, including intimate folding of the maternal and fetal epithelia over a region containing a concentration of debris, including shed pieces of shell membrane, large yolk droplets, and degenerating cells. Contrary to previous belief, the yolk sac placenta of *S. jarrovi*, is associated with a true omphalallantoic complex. Through the loss of the shell membrane, the highly vascularized uterine epithelium and chorioallantois of *S. jarrovi* are directly apposed, making the allantoaplacenta an ideal site for gas exchange. *S. jarrovi* is an ideal species for study, as the genus *Sceloporus* also includes oviparous species, from which viviparity has independently evolved four times. Likewise, the similarity between the cellular structure of the placentae of the thamnophiine snakes, including *N. sipedon*, and the extraembryonic membranes of the more distantly related oviparous corn snake, *Pituophis guttata*, suggest a common ancestral origin. Thus, cellular features of the placentas of *S. jarrovi*, and *N. sipedon* can provide insight into the function of squamate placental membranes and ultimately, their evolution.

2.

POTENTIATION OF CHIRPING IN BROWN GHOST ELECTRIC FISH, *APTERONOTUS LEPTORHYNCHUS*, TO ELECTRIC SIGNALS OF HETEROSPECIFIC ELECTRIC FISH, *BRACHYHYPOPOMUS PINNICAUDATUS*

Michael Chung '11

Faculty Sponsor: Kent Dunlap

Previous studies show that intraspecifically, both low frequency (0 - 300 Hz) and high frequency (300+ Hz) signals potentiate chirping in *Apteronotus leptorhynchus*. This study investigates whether or not the low frequency component of the electric signal of *Brachyhypopomus pinnicaudatus* potentiates chirping in *A. leptorhynchus*. A tubular chamber, connected to a speaker and a computer for recording and playback, was used to prevent the fish from moving during recording and playback. Software Canary was used to record electric signals of *B. pinnicaudatus* and to filter out low frequency components of the signal to generate a "high

frequency only" signal. High frequency and low+high (the entire signal) frequency components of the signal of *B. pinnicaudatus* were played to nine *A. leptorhynchus*. Fish were allowed ten minutes to adjust to the playback tank's water, played the first signal, allowed three minutes rest then played the final signal. Signal frequency sequence combinations were either low+high followed by high or high followed by high. Chirps were counted by ear. The total numbers of chirps from all nine *A. leptorhynchus* in response to initial low+high frequency playback, initial high frequency playback, secondary high frequency playback after initial low frequency playback and secondary high frequency playback after initial high frequency playback were obtained. Neither low nor high signals of *B. pinnicaudatus* potentiate chirping in *A. leptorhynchus*. Because potentiation was not observed, further studies are needed to assess whether or not the low frequency component of the electric signal of *B. hypopomus* is responsible for chirping potentiation in *A. leptorhynchus*.

3.

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

Laura Eckman '09, Rick MacLeod '11, Patrick McCarthy '09
Faculty Sponsor: Scott Smedley

This study investigated compounds found in the defensive secretions of two life stages of the ladybird beetle *Delphastus catalinae* (Coleoptera: Coccinellidae). In the larval and pupal forms, this beetle is covered in hollow setae that secrete a liquid shown to deter certain predatory insects. In this study, we employed scanning electron microscopy to image these structures. While many ladybird beetles possess defensive alkaloids, *D. catalinae* is unique in producing quinonoids, with novel structures, and germacrene sesquiterpenes. We used *D. catalinae* larvae 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. 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. When the pupal secretion was analyzed, the sesquiterpenes contained within showed no incorporation of the label. This conflicts with preliminary evidence as it suggests that the sesquiterpenes are sequestered from the environment. The quinonoids in the secretion were shown to incorporate the label however, suggesting that these compounds are produced *de novo*. Additionally, we performed a bioassay using the ant *Crematogaster lineolata* to determine whether the germacrene sesquiterpenes serve a defensive role. Isolated sesquiterpenes were applied to dead fruit flies (*Drosophila*), which, along with solvent controls, were then presented to foraging colonies of *C. lineolata*. The colonies were observed for one hour and their behavior towards the flies was then analyzed to determine whether the sesquiterpenes had a deterrent effect. The ants' removal rate of sesquiterpene-coated flies was significantly lower than their removal rate of controls, suggesting that the germacrene sesquiterpenes function as a chemical defense for the pupal *D. catalinae*.

4.

THE EFFECTS OF MUTATED SERRATE LIGANDS ON THE NOTCH SIGNALING PATHWAY IN *DROSOPHILA MELANOGASTER*

Gina Filloramo '10

Faculty Sponsor: Robert Fleming

In *Drosophila melanogaster*, communication between neighboring cells is accomplished via the highly conserved Notch signaling pathway which is associated with the ligands, Delta and Serrate. Interaction between these ligands and the notch receptor induces a cascade of reactions to induce a cell's specific fate. Comprised of 36 epidermal growth factor-like repeats, notch receptors have both a transmembrane and intracellular domain. The ligand serrate has a small hydrophobic intracellular domain and an extracellular hydrophilic portion with 14 EGF-like repeats. A unique hydrophobic region exists between the fifth and sixth EGF-like repeat and is believed to give the ligand its unique properties. Unlike other ligands, serrate has the ability to inhibit notch expression on its own cell surface (cis-inhibition) and to activate notch on neighboring cells (trans-activation). Expression of notch is observed with analysis of imaginal wing discs.

When a mutated form of serrate was created in which the hydrophobic region as well as neighboring amino acids were removed, serrate lost its ability to cis-inhibit. To understand this phenomenon, the mutated ligand was altered by removing only the hydrophobic region of the extracellular domain. Both cis-inhibition and trans-activation occurred. Phenotypically, the imaginal wing discs were similar to the wildtype. Another altered form of the mutated ligand was constructed by deleting the entire sixth EGF-like sequence. This research aimed to insert the DNA without the sixth repeat into a PUASt vector which is compatible with the *Drosophila* genome to observe how this modified form affected the expression of notch.

A separate experiment sought to explore another facet of the serrate ligand. The dominant negative form of the wildtype serrate ligand, Serrate Transmembrane (SerrTM) lost its intercellular domain and failed to activate notch in adjacent cells. In comparison, the mutated form lacking the hydrophobic region (Hydro Δ) acted like the wildtype and still possessed the ability to activate neighboring cells. To determine if it is possible for cells to gain the ability to activate notch on its own cell surface, this research attempted to build a new construct by inserting these forms in a bluescript vector.

Due to repeated unsuccessful ligations, both experiments analyzing the properties of various forms of serrate were not carried out in full. Continued attempts at creating each respective construct will allow for a better understanding of how the original mutated serrate ligand functions within *Drosophila Melanogaster*.

5.

WOUNDED-CELL MONOLAYER ASSAYS: THE EFFECT OF MICRORNAS ON CELL MIGRATION

Stacy Hathcox '09, Sammy Kim, M.S., Merck

Faculty Sponsor: Irena Ivanovska PhD, Merck Advisor/Manager

MicroRNAs (miRNAs) are short sequences of non-coding RNAs that influence gene expression and have been found to play a role in cell proliferation, tissue specification, and development of cancer. Today, scientists are researching miRNAs in order to determine their cellular functions, and to determine possible therapeutic usage. The mechanism of cancer metastasis is also of interest to the scientific community from the direct correlation of cancer metastasis to cancer caused death. Cell migration is linked to cancer cell metastasis, and this research project was focused on developing and discovering microRNAs that may affect cell migration, and thus also affect metastasis. RKO, a colon cancer cell line, was transfected with various microRNAs. miR126 enhanced cell migration slightly more than the mock, while transfections with miR204 and miR335 did not increase cell migration.

6.

THE ROLE OF CORTISOL IN SOCIALLY INDUCED CELL ADDITION IN THE BRAIN OF WEAKLY ELECTRIC FISH, *APTERONOTUS LEPTORHYNCHUS*

Denisa Jashari '10

Faculty Sponsor: Kent Dunlap

In weakly electric fish, *Apteronotus leptorhynchus* long term social interaction increases plasma cortisol levels, modifies both electrocommunication behavior and promotes brain cell addition. Social interaction may achieve its effects on brain plasticity through cortisol, or it could have an independent effect on brain plasticity. To distinguish between these two possibilities, we experimentally blocked the glucocorticoid receptors using RU486 in isolated and paired fish to see if it diminishes the effect of social interaction on brain plasticity.

Our preliminary results suggest that the glucocorticoid receptor blocker decreases rates of cell proliferation in both the paired and isolated treatment groups. Paired fish implanted with RU486 show higher rates of cell proliferation than the isolated fish, which suggests that social interaction has an influence on cell proliferation beyond its action through cortisol.

7.

ELYSIA CHLOROTICA: AN INVESTIGATION OF A POSSIBLE FOOD SOURCE

Elizabeth Molano '09

Faculty Sponsor: Kathleen Archer

Elysia chlorotica are a variety of sea slugs whose diets tend to be very specific: slugs found in Martha's Vineyard are known to eat *Vaucheria litorea* algae that grows in the region, and maintain a symbiotic relationship with the undigested chloroplasts of the algae. *E. chlorotica* are also in Nova Scotia, as is the algae type *Vaucheria compacta*. Since *V. compacta* is more

abundant in the Nova Scotia region, we investigated the diets of *E. chlorotica* from Martha's Vineyard and *E. chlorotica* from Nova Scotia to determine whether the latter also eat *Vaucheria compacta*. We sought to distinguish one algal sequence from another by comparing the DNA sequence of a certain region of the chloroplast genome present in all plants, specifically the *rbcL* gene. Slight differences in the sequences would determine which algae the slugs in Nova Scotia eat. To obtain the DNA sequence, we employed PCR induced by primers from the *rbcL* gene. Continuing with gel electrophoresis, we were able to amplify the gene in both types of slugs and both types of algae. The amplified DNA has been sent to the University of Maine's sequencing facility to be sequenced.

8.

LONG-TERM CHIRPING BEHAVIOR IN THE WEAKLY ELECTRIC FISH *APTERONOTUS LEPTORHYNCHUS*

Kristina Pappas '10

Faculty Sponsor: Kent Dunlap

The brown ghost knife fish *Apteronotus leptorhynchus* produces an electric organ discharge (EOD). When interacting socially, the fish emit brief modulations in the frequencies in their EODs called chirps. Previous studies have shown that long-term social interaction promotes neurogenesis in *A. leptorhynchus*, but long-term chirping behavior has never been studied. To examine long-term chirping behavior, fish were housed in isolation, paired with other fish, exposed to only electrocommunication signals from another fish, or exposed to a generated quasi-sinusoidal electric signal for one week with recordings taken at predetermined intervals. Preliminary results show that fish continue their chirping behavior throughout the week and that fish chirp more often at night.

9.

A STUDY OF NEST PREDATION IN AN URBAN ENVIRONMENT

Jessica Scordamaglia '10

Faculty Sponsor: Michael O'Donnell

In urban and suburban environments, development has resulted in the fragmentation of extensive forests into small patches. These forest fragments have an increased edge area and are thus more vulnerable to nest predation due to predators that have adapted to edge environments. In an attempt to both survey the types of small to medium nest predators that dominate in an urban environment as well as to compare activity and rates of predation of small forest fragments to larger ones, two methods were used. Both track tubes and artificial nests were studied within different sites around the Hartford, CT area in an attempt to acquire a small mammal predator index, as well as to compare predation in different edge environments. Camera monitoring was also used at some randomly chosen nests to help confirm predator activity by comparing pictures to teeth or bill marks. Because of the short time period of the study, not enough data was collected to come up with significant results or trends. It was found, though, that most nest predation was attributed to avian predators, followed by small rodents, medium carnivores, sciurid rodents, and small carnivores. Although no difference was found in nest survival among

the different sites, the rate at which nests are disturbed appear to be higher in edge environments than in larger wooded fragments. Further large-scale experiments are suggested to reveal true patterns of nest predation.

10.

COMPARISON OF ANNUAL SURVIVAL OF SIX FOREST NESTING BIRDS IN NORTHEASTERN CONNECTICUT

Nathan Sell '10

Faculty Sponsors: Joan Morrison, Carol Millard, St. Joseph College

Little is known about the survival of both migrant and resident passerine birds. Without this information it is difficult to know how quickly a population could rebound or become extinct. Many bird populations have been decreasing in recent years. Migrant birds may have a longer lifespan than residents that must survive harsh winters. On the other hand, migrants might have lower survival rates if they fail to survive long trips to and from wintering grounds. Human activity threatens all wildlife, and the fragmentation of forests throughout North America threatens many species that depend on large tracts of old forest. In Connecticut, bird populations nesting in forested areas, particularly those nesting on the ground incur a variety of threats from forest fragmentation such as habitat loss and exposure to more edge habitat which can result in increased exposure to nest parasitism. Over the past eight years, the MAPS (Monitoring Avian Productivity and Survivorship) protocol has been used at the Trinity College Field Station in Ashford, CT. The goal of the MAPS program is to monitor population dynamics and provide conservation and management information of over 120 species in North America. In this study, we estimated annual survival probabilities for six forest nesting species in Northeastern Connecticut: three Neotropical migrants (Ovenbird, Veery and Wood Thrush), one short distance migrant (Gray Catbird), and two residents (Tufted Titmouse and Black Capped Chickadee) using program MARK which calculates survival estimates based on recapture histories. Of the migrants in this study, the Wood Thrush had the lowest survival rate (0.25) which is consistent with recent reports of declining populations, whereas the ground-nesting Veery and Ovenbirds had the highest survival rates (0.56 and 0.72). The catbird also had a relatively low survival rate (0.38), and the residents had highly variable survivorship (Titmouse, 0.33; Chickadee, 0.75).

11.

DETERMINATION OF *NOCTILUCA SCINTILLANS* DIGESTION RATE

Santiago Varela '09

Faculty Sponsor: Kathleen Archer

The sea slugs of the species *Elysia chlorotica* and *E. crispata* are capable of kleptoplasty; a phenomenon in which these slugs incorporate plastids acquired from algal food sources into their own bodies. Although the plastids are ingested, they are retained alive and functional in the slug's digestive system. The sea slug can then use those plastids to undergo photosynthesis, and supplement its energy sources. In order to better characterize the relationship between the slugs and the symbiotic chloroplasts, the objective of this experiment was to see if symbiotic chloroplasts have any advantages against digestion in comparison to non-symbiotic chloroplasts.

The protist *Noctiluca scintillans* was used in digestion rate experiments in which these unicellular organisms were presented with non-symbiotic baby spinach chloroplasts, symbiotic *Vaucheria litorea* chloroplasts, and *Dunaliella tertiolecta*. Preliminary results for *N. scintillans* digestion rates were compared using $t^{1/2}$, the time at which 50% of the original number of fed cells still contained food. The $t^{1/2}$ times were 3 hours for baby spinach chloroplasts, 4.25 hours for *V. litorea* chloroplasts, and 4 hours for *D. tertiolecta*. These preliminary results suggest that symbiotic chloroplasts such as those of *V. litorea* chloroplasts may be better capable of survival against digestion than non-symbiotic chloroplasts.

12.

MICROSCOPY OF THE PLACENTAL TISSUES OF THE VIVIPAROUS SQUAMATES, *NERODIA SIPEDON* AND *SCELOPORUS JARROVI*

Andy Weisenfeld '11

Faculty Sponsors: Daniel Blackburn, Ann Lehman

Light Microscopy (LM) and Scanning Electron Microscopy (SEM) are powerful tools for understanding the form and function of placentas of live-bearing (viviparous) animals. This poster describes two ongoing, concurrent studies. The first is a continuation of an LM study of the placental tissues of the water snake *Nerodia sipedon*. The second is a new, long-term study of the placental tissues of the lizard *Sceloporus jarrovi*. 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_4 , dried at the critical point, sputter coated with gold/palladium, and viewed with a JEOL JSM-IC848A scanning electron microscope. Initial LM slides of the chorioallantois have shown expected features such as thin epithelial cells, extensive capillary networks, and near-apposition of maternal and fetal tissues. These features suggest the placental role of maternal-fetal gas exchange. Sectioning of *S. jarrovi* tissues has been going smoothly, and we expect interesting finds in the near future, as previous work has shown the placentas of *S. jarrovi* are extremely specialized.

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, and we quantified urban green space using Arc GIS mapping program. I found a positive relationship between the amount of green space present per transect and the average number of squirrels. I also found through preliminary analyses that approximately 82% of hawk locations identified using radio telemetry were found to be in urban green space areas. These results support our hypothesis that red-tailed hawks are more likely to be found in urban green space areas where there is a higher density of squirrels. I also found that there was a positive relationship between temperature and squirrel counts along transects. Thus, there were major seasonal variations among squirrel numbers in hawk territories.

CHEMISTRY

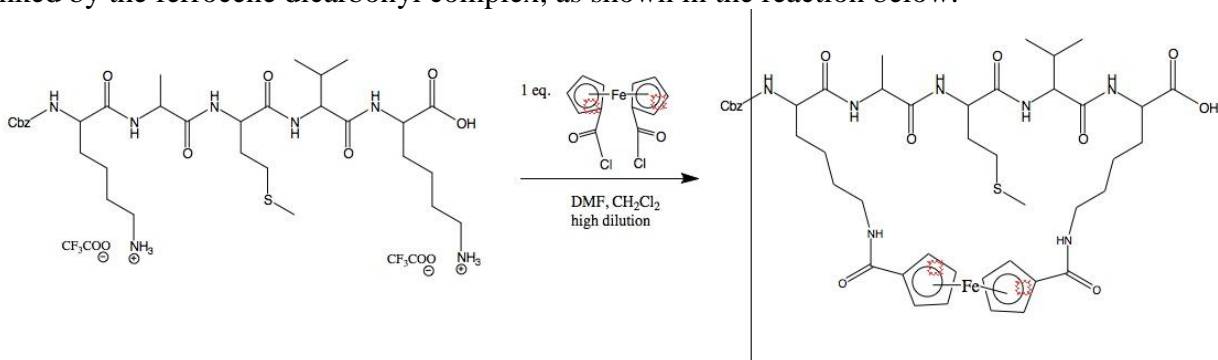
14.

SYNTHESIS OF A METALLACYCLIC PENTAPEPTIDE

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 ferrocenyl dicarbonyl complex. The first steps toward this final product is the synthesis of the pentapeptide Z-Lys-Ala-Met-Val-Lys-OH using solid phase peptide synthesis (SPPS). The lysine side chains will then be linked by the ferrocene dicarbonyl complex, as shown in the reaction below.



It is predicted that the coupled peptide will form an α -helix. The secondary structural conformation of the final coupled pentapeptide will be analyzed through instrumental techniques such as electro-spray mass spectrometry (ESI-MS), and COSY, ^1H , and ^{13}C experiments using nuclear magnetic resonance (NMR).

15.

SYNTHESIS OF METALLACYCLIC PEPTIDES

Carrie Disa '09

Faculty Sponsor: Timothy Curran

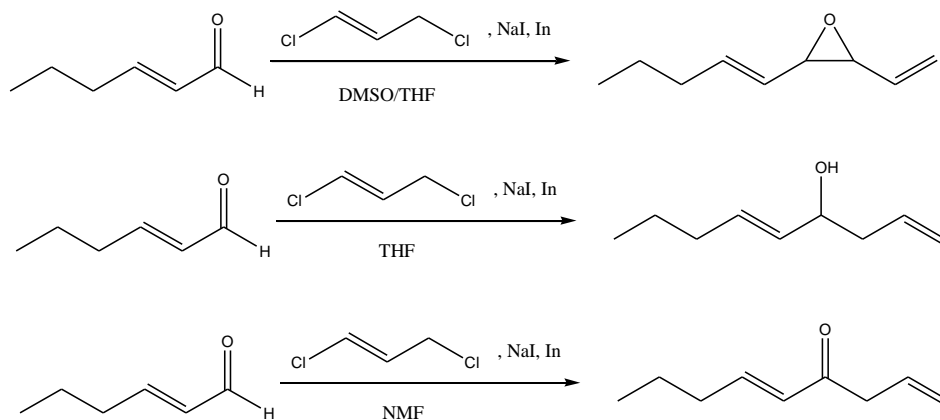
Peptide chains can exist in a variety of conformations. When these chains are arranged in a specific secondary structure the peptide may have an important biochemical function. For example, helical peptides have the potential to trigger apoptosis in cancer cells. In order to achieve these secondary conformations, amino acid residues within a peptide can be linked by a metal complex to form a cyclic compound. Fully understanding the specific conformations of these compounds is essential in developing them for future use in treating diseases. The goal of this project was to synthesize and study such molecules to better understand their exact structures using different methods of synthesis. A ferrocenyl dilysine peptide was synthesized via solution phase synthesis in which the lysine side chains in the dipeptide, Boc-Lys-Lys-C₆H₄-OCH₃, were covalently linked to 1,1'-ferrocenedicarboxylic acid. The compound was successfully created and analyzed by ¹H NMR, including COSY, and ROESY experiments. A hexapeptide, Z-Lys-Ala-Val-Lys-Met-Phe-OH, was also synthesized, but by solid phase synthesis. The lysine side chains in this peptide will also be linked to 1,1'-ferrocenedicarboxylic acid; this cyclization is currently being pursued.

16.

INDIUM PROMOTED COUPLING IN EPOXIDE SYNTHESIS

Alden Gordon '10

Faculty Sponsor: Thomas Mitzel



Formation of differing functional groups of products usually requires a change in both reactants and reaction solvents. A number of reactions have been studied in an attempt to control functional group formation in products beginning with identical reactant mixtures. Our lab is focused on use of solvent conditions to control formation of ketone, alcohol, and epoxide functional groups beginning from identical reactants. This poster will present my steps toward that goal.

17.

NUCLEATION OF β -SHEETS USING TUNGSTEN-ALKYNE CHEMISTRY

Peter Hendrickson '09

Faculty Sponsor: Timothy Curran

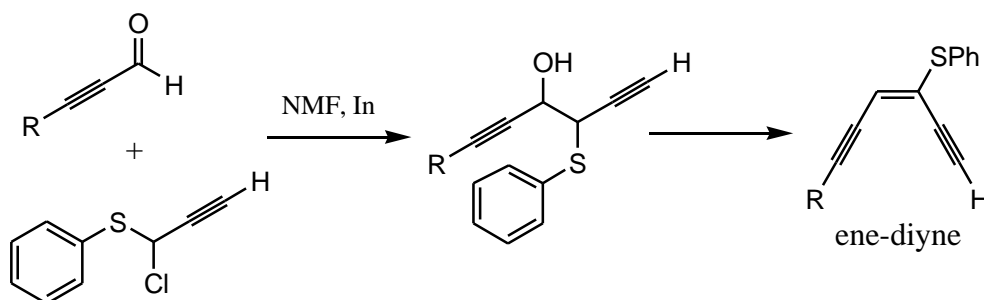
Beta sheets are a protein secondary structure made up of two strands of amino acids that are linked together by hydrogen bonds. Previous research has shown that the ends of two peptide chains can be coordinated to a tungsten-alkyne complex. However, it was found that this conformation did not promote hydrogen bonding between the amino acids. The goal of this project was to create a beta-sheet with both ends of the peptide coupled to a tungsten complex. This was to be achieved by synthesizing an alkynylamino acid and coupling it to a tungsten complex with two amino acids per tungsten. Then two more alkynes were to be added to the free ends of each of the two alkynylamino acids. Finally, the added alkyne on the free end of each peptide was to be coupled to another tungsten complex. This would result in a bis(alkynylaminoacid) tungsten complex that is predicted to induce hydrogen bonding. This summer, the tripeptide was synthesized and coupled to tungsten with good yields. The addition of the second alkyne, however, was not successful. Future work includes solving this problem, finishing the synthesis, and characterizing the final complex.

18.

DEVELOPING A METHOD TO DESIGN ENE-DIYNE STRUCTURES

Jo-Ann Jee '10

Faculty Sponsor: Thomas Mitzel



Ene-diyne structures are able to inhibit growth of mutated DNA strands which impede the development of cancer cells and tumors. The difficult synthetic routes and low yields of the target ene-diyne structures has made it hard to conduct further research on ene-diyne structures and mutated DNA strands. Thus, the goal is to use shorter, simpler synthetic routes in order to increase the yield of the ene-diyne structures. The proposed method is to form ene-diyne structures under aqueous conditions using indium metal. Indium metal is known to assist in the formation of carbon-carbon bonds in aqueous conditions. As these ene-diyne structures are required to work within a biological system, formation of these molecules carried out under similar, aqueous conditions would provide an understanding in their biological stability. The system carried out requires only two steps, making it simple to alter the conditions if needed. Results of early work in this area will be discussed.

19.

DESIGNING A MORE COST-EFFETIVE METHOD FOR THE SYNTHESIS OF GAMMA-CARBOXYGLUTAMIC ACID

Renee Jensen '11

Faculty Sponsor: Richard Prigodich

Gamma-carboxyglutamic acid (gla) is an amino acid that is essential for the functioning of proteins that bind calcium. However, the published syntheses of gla are not only tedious, but also very expensive. In a collaborative research endeavor, Dr. Mitzel and Dr. Prigodich proposed an alternative method to producing this particular amino acid in a more cost efficient manner. Although the desired results of this experiment would be most applicable to biochemistry, the experiment/procedure was an acid/base reaction carried out using strictly organic chemistry. This synthesis is based on research that demonstrated the utility of SmCl₃ as a catalyst for forming adducts at the 2-position of malonate. (Quansheng Shen, Wen Huang, Jialiang Wang, and Xigeng Zou Organic Letters, Vol. 9, No. 22, 4491-4494 - SmCl₃- Catalyzed C-Acylation of 1, 3-Dicarbonyl Compounds and Malononitrile) First an experiment to exactly replicate a published procedure was attempted. Using twenty ml of toluene as a solvent, 25.6mg of samarium chloride as a catalyst, and 320.34mg of diethyl malonate, 242.87mg of triethylamine and 309.2mg benzoyl chloride, as reagents, the mixture was added by syringe to a flame-dried flask. The desired compound from this reaction was 2-benzoyl-di-tertbutyl malonate. The reaction was allowed to reflux for four hours. Results varied and were inconclusive.

20.

IMAGING THE OSTEOCALCIN BINDING SITE ON TYPE I TROPOCOLLAGEN

Piper Klemm '09

Faculty Sponsor: Richard Prigodich

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 µg/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.

21.

USING H/D EXCHANGE-MS TO DETERMINE PROTEIN DYNAMICS OF AhpC, A PEROXIREDOXIN-TYPE ANTIOXIDANT ENZYME

Piper Klemm '09

Faculty Sponsors: Richard Prigodich, Claudia Maier PhD, Department of Chemistry, Oregon State University

Hydrogen Exchange Mass Spectrometry (HXMS) is a developing technology to determine protein structural changes and dynamics. The rate with which an amide hydrogen will undergo exchange is largely a function of protein dynamics and solvent accessibility. Protein structural changes associated with the disruption of the protein hydrogen bonding network impacts the solvent accessibility of backbone amide hydrogens and results in deuterium incorporation. Using the shift in protein mass as analytical readout, we can analyze how peroxiredoxins respond to changes of their redox states.

AhpC (T77V) is a bacterial peroxiredoxin and an important antioxidant enzyme that reduces H₂O₂ in cells and removes alkylhydroperoxides. During the catalytic cycle, the active site cysteine thiol (the peroxidatic cysteine) is oxidized to a sulfenic acid by the peroxide substrate and recycled back to a thiol employing a reductase. We use protein backbone amide hydrogen exchange in combination with pepsin proteolysis and liquid chromatography mass spectrometry analysis (LC-MS) to probe changes in the structural dynamics upon changes of the thiol redox state. In the present study we compare the structural changes of the oxidized and reduced forms of AhpC (T77V).

22.

OPTIMIZATION OF SUPERCRITICAL FLUID EXTRACTION CONDITIONS FOR THE ISOLATION OF THE HALLUCINOGENIC DRUG DIMETHYLTRYPTAMINE FROM BOTANICAL FORMULATIONS

Michael Lee '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 an inert matrix 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. These experiments demonstrated moderate recoveries

of DMT using carbon dioxide modified with methanol; however, the recovery data suggested that between-extraction carryover of DMT was significant. Current experiments are aimed at improving recovery and eliminating carryover by using an on-line derivatization reagent for the *in-situ* formation of a DMT-analog which is both more soluble in SF-CO₂ and which exhibits better chromatographic characteristics. The results of these optimization experiments will be presented.

23.

STUDY OF DNA BINDING SITES USING MALDI TOF MASS SPECTROMETRY

Madelyn Light '09

Faculty Sponsor: Richard Prigodich

Hydroxyl radical footprinting is a widely used technique for identifying protein bonding sites on oligonucleotides. Hydroxyl radicals react with the ribose-phosphate backbone of DNA, ultimately achieving strand cleavage. Interference from proteins bound to DNA diminishes the rate of this reaction, and analysis of the resulting cleavage pattern provides a "footprint" of the protein binding sites. In the past, experiments have been carried out using gel electrophoresis to analyze these cleaved DNA strands. Development of matrix-assisted laser desorption (MALDI) time-of-flight (TOF) mass spectrometry (MS) provides faster, higher resolution and sensitivity analysis, as well as small sample consumption, making it an advantageous tool for studying DNA fragments. The aim of this study is to identify protein bonding sites by utilizing the hydroxyl radical footprinting technique and analyzing the MALDI-TOF spectra of the resulting oligonucleotide strands.

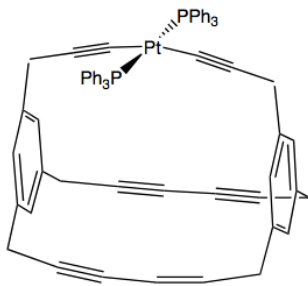
24.

SYNTHESIS OF PLATINUM-COUPLED, HOMOCONJUGATED, HYDROCARBON CAGES

John Love '10

Faculty Sponsor: Thomas Mitzel

Fully conjugated hydrocarbon cages have been studied extensively due to their unique electronic properties. Introduction of an sp³-hybridized carbon into such a system creates a structure that retains some of the electronic properties of the fully conjugated system, while increasing the overall flexibility of the system. Platinum metal, which has been shown to bind to alkynes, may be inserted into these systems to help overcome cyclic strain while maintaining electronic delocalization around the skeletal structure. The synthesis of the small 3-dimensional cage shown below is a good example of a homoconjugated hydrocarbon cage system. Studies toward the synthesis of this unique and interesting product will be discussed.

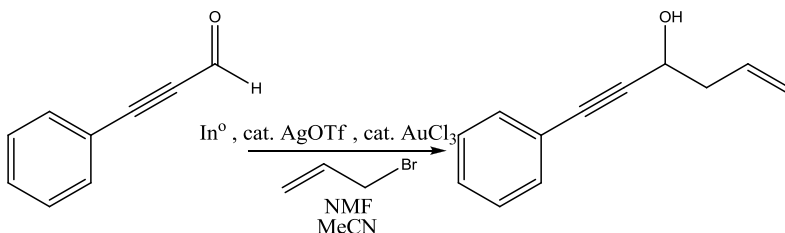


25.

USE OF GOLD LEWIS ACIDS IN AN ATTEMPT TO CATALYZE A COPE REARRANGEMENT OR 5-EXO/6-ENDO CYCLIZATION

Jonathan Nyce '09

Faculty Sponsor: Thomas Mitzel



Indium metal is becoming very popular for use as a catalyst in Barbier Reactions due to its ability to control stereo- and regio-selectivity under mild conditions. Past research using n-methylformamide as a solvent in indium metal promoted transformations has shown that polar reaction conditions further increase stereoselectivity in product formation. Research accomplished this summer studied a variety of Lewis Acid catalysts in an attempt to control the regioselective nature of the reaction pathway. This poster will focus on a 1,2- vs.1,4- addition reactions in indium promoted reactions in NMF catalyzed by Lewis acids, as well as the use of pi-philic Lewis acids to control possible cope rearrangements or cyclizations in the indium-coupled products.

26.

CYCLIZATION OF AN IMINE USING INDIUM METAL

Katie Pearson '10

Faculty Sponsor: Thomas Mitzel

A main focus of the world today is improving the environment. The use of more environmentally friendly reaction conditions to carry out chemical transformations would aid a great deal in this area. This research focuses on the introduction of different reagents and solvents into reactions to form molecules, that are popular templates in organic synthesis, but are currently formed under "harsh" conditions. Indium metal has been shown to promote C-C bond formations under environmentally benign conditions, including the use of water as an "organic" solvent, with good regio- and stereocontrol. Previous research in the Mitzel laboratory has shown that the use of indium metal has led to not only an oxy-cope rearrangement but also a cyclization of an alcohol product. This research focuses on the attempt to repeat this experiment using an imine functional group in place of the aldehyde as the beginning electrophile.

27.

SELECTIVE INDIUM PROMOTED COUPLING REACTIONS OF ALLYL AND ALDEHYDE SYSTEMS IN VARIOUS SOLVENTS

Merry Smith '09

Faculty Sponsor: Thomas Mitzel

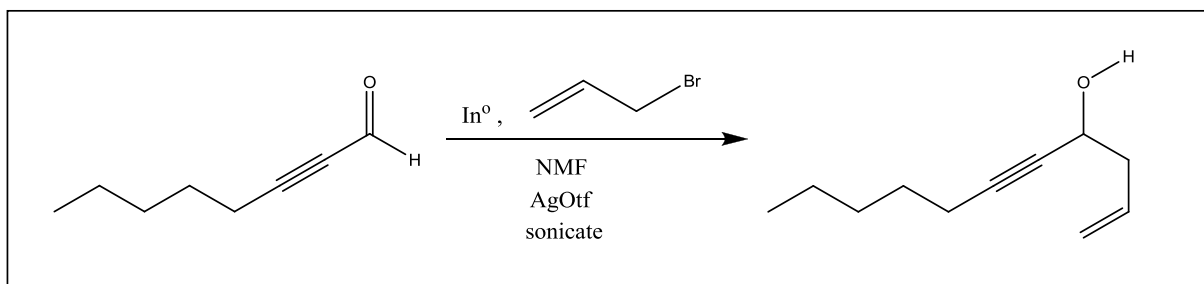
The research conducted during the 2008 summer term was focused on characterization of products from selective indium-promoted coupling reactions of di-halogenated allyl systems with aldehydes in various solvents. The goal of this project was to control functional group formation in the product by varying initial solvent conditions of the reaction mixture. This poster will outline methods used and results obtained.

28.

ACCELERATING EFFECTS OF SILVER AND GOLD CATALYSTS

Linda Tam '10

Faculty Sponsor: Thomas Mitzel



The Oxy-cope re-arrangement is a chemical reaction that has been studied extensively; and, it has become an interest in the lab. From previous research, adding increasing amounts of gold catalysts did not lead to the desired product. To further understand the electron flow during this particular chemical reaction, the catalyst *silver triflate* was used this summer to facilitate the structure re-arrangement. From a supply of propargyl aldehyde (*oct-2-ynal*), an alcohol product was synthesized.

29.

SYNTHESIS AND CYCLIZATION OF DIPEPTIDE AND HEXAPEPTIDE USING A FERROCENE LINKER

Khine Wai '11

Faculty Sponsor: Timothy Curran

The ability of ferrocene to constrain peptides to defined conformations was explored in this research. In the first part of research, the dipeptide, Boc-Lys-Lys-NHCH₃ was synthesized by solution phase peptide synthesis. The dipeptide was then cyclized by reaction of the lysine side chain amines with 1, 1'-ferrocene dicarboxylic acid chloride. The product was purified by flash chromatography. After purification, the metallacyclicpeptide was analyzed by HPLC, ¹H NMR,

including COSY and ROESY spectra. All of these methods confirmed that the desired peptide had been made. The results also showed that one of the NH protons in the peptide is involved in an intramolecular hydrogen bond. Next, the hexapeptide, Z-Ala-Met-Lys-Ala-Val-Lys-OH, was synthesized by solid phase peptide synthesis. Analysis by ¹H NMR indicated that the hexapeptide had been successfully synthesized. However, the first attempt to cyclize the hexapeptide by reaction of the lysine side chain amines with 1, 1'-ferrocene dicarboxylic acid chloride was unsuccessful. Future research is to successfully cyclize the hexapeptide and then to determine the solution conformation of the resulting metallacyclicpeptide.

COMPUTER SCIENCE

30.

CREDENTIALING APPLICATION FOR DISASTER RESPONSE

Antonio Alcorn '09, Dimitar Gochev '11, Eli Fox-Epstein '10, James Jackson '10

Faculty Sponsor: Ralph Morelli

Credentialing is the act of certifying a person's credentials. This is especially important in a disaster response when responders assert medical or professional credentials. The Volunteer Credentialing System (VCS) developed in collaboration with Prof. Frank Fiedrich of the Institute for Crisis, Disaster and Risk Management (ICDRM) at George Washington University, is designed to provide a flexible mechanism of credentialing in the Sahana disaster management system to validate a responders licenses, training experience, competence, and ability, for an emergency response environment. The VCS system integrates with Volunteer Management capabilities of Sahana.

Sahana is name of a Free and open source (FOSS) disaster management system built initially by Sri Lankan volunteers in the aftermath of the 2004 Asian tsunami (www.sahana.lk). Sahana is a collaboration tool that addresses the common coordination problems during a disaster, such as finding missing people, managing aid and volunteers, and otherwise assisting recovery efforts. Sahana has received various accolades and awards including the Free software foundation Social benefit award in 2006 and been deployed in numerous disasters around the world, most recently in Burma and China.

The development group, part of the Humanitarian FOSS Project (www.hfoss.org) Summer 2008 Institute, comprised of students from Trinity College, Wesleyan University, Connecticut College and University of Connecticut.

31.

“APPTRAC” LAB MANAGEMENT SOFTWARE FOR LITERACY VOLUNTEERS OF GREATER HARTFORD

Christopher Fei '10, Sarah Thayer '10, Ernel Wint '09, Myles Garvey '10
Faculty Sponsors: Ralph Morelli, Trishan de Lanerolle, H-FOSS

AppTrac is a free and open source software application developed for the Literacy Volunteers of Greater Hartford (LVGH) provided to them at no cost. LVGH is an organization that helps local Hartford residents learn Basic English literacy skills. AppTrac provides a single point of entry for LVGH to track student use of various specialized literacy software suites. Prior to AppTrac, LVGH operated mainly by recording events by hand on paper. It became apparent that their operations needed to be streamlined for ease of use and student accessibility. Working closely with the technology manager and end-users at LVGH, AppTrac was designed, with an initial version of the software built over the course of 10 weeks, as part of the Humanitarian FOSS Project (www.hfoss.org) summer 2008 institute by a team of developers from Trinity College, Connecticut College and the University of Hartford.

AppTrac automates and tracks data previously recorded by hand, including but not limited to sign in/out, student web usage, literacy application usage statistics, and hours worked by volunteers. AppTrac functions by presenting a kiosk style input screen to the user upon start up, with limited access to a predefined set of applications, with specific care taken to cater for users with limited computing knowledge. For systems administrators and instructors, AppTrac provides statistical reports on student computer usage for evaluation purposes and eliminating system maintenance required due to user errors.

AppTrac will be implemented in the LVGH computer labs in the Fall of 2008. Future plans include making it available for free under an Open Source software license for other Literacy groups throughout the country to use.

32.

STRUCTURED NUMERIC AND IMAGE UPLOAD SUPPORT FOR OPENMRS

Rachel Foecking '11, Vinit Agrawal '10

Faculty Sponsors: Ralph Morelli, Norman Danner, Wesleyan University

OpenMRS (www.openmrs.org) is an open-source electronic medical record system framework for developing countries. It has been developed to specifically respond to those actively building and managing health systems in the developing world, in countries such as South Africa, Kenya, and Rwanda, where AIDS, tuberculosis, and malaria afflict the lives of millions. While most of the OpenMRS framework has been designed, it still lacks certain capabilities.

Working closely with mentors from OpenMRS project, contributions were made to two significant areas by participants in the Humanitarian FOSS Project(www.hfoss.org) summer 2008 institute. Contributions included developing an efficient way of storing "structured numeric" values for clinical observations and images in OpenMRS.

Although numeric results for a clinical observation are either stored as whole integers or fractions, there are a number of numeric values that have more of a structured form, for example, ranges such as "5-10", "<=5" or ">10"; ratios such as "1:2"; and qualitative responses mixed in with numeric responses such as "too many to count". An efficient way of representing structured numeric's at the database and API level was implemented.

OpenMRS has no support to store images such as x-rays or MRIs. A module was written to allow upload, saving, and editing capabilities including image cropping and rotating. Future changes will be made to incorporate more types of images, a robust design, and additional editing capabilities.

33.

PORTABLE OPEN SEARCH AND IDENTIFICATION TOOL

Prasanna Gautam '11

Faculty Sponsors: Ralph Morelli, Trishan de Lanerolle

POSIT stands for Portable Open Search and Identification Tool, a phone-based tool for data gathering from search and rescue, scientific field research to staking out your favorite coffee shops, built on the Google Android Phone platform. Android is a Linux based phone operating system, similar to the apple iPhone. POSIT lets users take pictures, give descriptions to them, collect other valuable field data and save it for future retrieval in the phone's internal database. We used Android's technologies like XML, SQLite database, Global Positioning System, Camera and touch screen to provide an easy and intuitive interface to collect data, which can be accessed on another cell phone or a computer across the 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. The summer work, carried out as part of the Humanitarian FOSS Project (www.hfoss.org) summer institute expanded on work started in the Spring 2008, to develop a web application to generate customized instances of POSIT based on user preferences. Instances ranged from tracking hawks, monitoring spread of invasive species, to recording victims or points of interest following a disaster. The web application also works as a data storage server for the phone application, with the ability to synchronize with multiple handheld units across the internet, making POSIT a great tool that can be quickly customized and adopted to individual scenarios. POSIT will be made available to anyone who needs to collect location based data, as a free and open source application.

34.

USING FREE AND OPEN SOURCE SOFTWARE TO DETECT THE SPREAD OF DISEASE

Juan Pablo Mendoza '10, Qianqian Lin '11

Faculty Sponsors: Ralph Morelli, Daniel Krizanc, Wesleyan University

Detecting the spread of disease as early as possible can save many lives during an epidemic. Humans, however, usually cannot process information quickly enough to be able to detect the spread before it cannot be contained anymore. This is why the introduction of computers to help

solve this problem is necessary. Computers can analyze data millions of times faster than humans, and, given the appropriate training, can be useful tools to stop epidemics.

Throughout this project we worked with mentors from the InSTEDD, a lab that works to improve disaster response and early disease detection. We contributed to the RNA project, which is an application to detect the spread of disease by analyzing news reports from different sources. This program will analyze thousands of articles and determine if there is a higher than normal presence of some disease in a given area at a given time. If there is, the machine will suggest a possible outbreak of a disease. We contributed in more than one way to this project. We built a Bayesian Classifier that, after given the necessary training, will be able to assign new topics to an article based on other topics that have already been assigned to it. We also helped test another classifier built by people in InSTEDD.

Finally, we put several pieces of software together into ALPACA, a program for parsing news articles in different formats and then classifying them into different categories based on various possible algorithms. This program will be useful for other people working on early disease detection as well as for people working on Machine Learning in general, since it provides an easy way to compare different classifiers and articles from different sources. The development was carried out as part of the Humanitarian FOSS Project(www.hfoss.org) summer 2008 institute.

ENGINEERING

35.

REAL TIME IMPLEMENTATION OF EDGE DETECTION ALGORITHM USING FPGA

Sagar Bhandari '09

Faculty Sponsor: Taikang Ning

Real time edge detection is critical in many real-world applications ranging from medical imaging to video surveillance. In this poster, we present the real time implementation of sobel edge detection algorithm using FPGA in order to extract the shape of the objects which allows for further predictions such as human or object detection, motion detection, fire movement detection, human behavior detection and so on. The implementaion of sobel edge detection algorithm along with the results are presented. The results obtained suggest that the proposed algorithm is able to detect shapes of objects in real time.

36.

CORRELATION DIMENSION AND DIMENSIONAL COMPLEXITY ESTIMATION OF REM EEG SIGNALS

Adam Grare '10, Ankit Saraf '10

Faculty Sponsor: Taikang Ning

In Chaos Theory, the Correlation Dimension measures the complexity of a set of points in m-dimensional space. These sets of points can be represented by vectors, created using delay time embedding. The signals were collected from rats at 15 and 90 days by Trinity students from the Dentate Gyrus and CA1 points in the brain in order to cross check for reduction in the dimensional complexity with age and at the different parts in the brain. A modified Grassberger-Procaccia algorithm was implemented using Fortran 90 to compute the dimensional complexity with high efficiency. Matlab was then used to plot and graph the output from Fortran for interpretation.

37.

HEART SIGNAL ANALYSIS

Ankit Saraf '10, Adam Grare '10

Faculty Sponsor: Taikang Ning

Heart auscultation is the technique of listening to heart sounds and is commonly used as a primary detection tool for diagnosing heart valve disorders. This process, which has traditionally been carried out by doctors using stethoscopes, can be automated using digital signal processing techniques. Automatic QRS-wave detection can be used to simplify the detection of heart murmurs by plotting both the ECG and phonogram signals. Obtaining a noise-free heart sound signal is the first step in this process. An electronic microphone was used to detect heart sounds, followed by a second order Sallen-key low-pass filter to remove the unwanted high-frequency noise. A notch filter was also added to remove the 60 Hz ambient noise corrupting the signal. A similar filter was designed to remove noise in the ECG signal. Both circuits were able to acquire and display clean phonogram and ECG data, thus preparing it for further processing.

38.

AUTOMATIC LIGHT TRACKING SYSTEM

Rahul Shakya '11

Faculty Sponsor: Taikang Ning

An automatic light tracking system is built using C8051F120 microcontroller and a DC servo-motor. The tracking system includes two major components, mechanical servo-control and microprocessor based embedded system. A platform situated on top a servo-motor is built to provide the rotating mechanism. A moving light source is tracked via the rotating platform equipped with two infra-red (IR) sensors. A bridge circuit that differentiates the light intensities received at the IR sensors will provide the input for direction control. The difference input is read by a microcontroller based system that generates the control signal for the servo-motor through pulse-width-modulation (PWM). A current amplifier is also built to provide the driving current for the servo-motor. The complete system has been successfully tested to track a moving light source at varying distances.

ENVIRONMENTAL SCIENCE

39.

A CHEMICAL WATER QUALITY ASSESSMENT OF THE NORTH BRANCH PARK RIVER AND ITS TRIBUTARIES

Vicky Done '11

Faculty Sponsor: Jonathan Gourley

For ten weeks data was collected from the North Branch of the Park River and the four tributaries that feed into it. Because the water quality of the southern branch of the Park River is not up to EPA standards, there were concerns that the northern branch was not healthy. The goal of the research was to determine the health of the North Branch Park River watershed by testing for several chemical parameters. These included pH, conductivity, total dissolved solids, dissolved oxygen, salinity, hardness, and temperature. Excel was used to graph these parameters so that we could analyze the change of each parameter across the watershed and their change over time. The results from the testing were then compared to the standards set forth by the EPA so that it could be determined whether the North Branch Park River Watershed was healthy. We then submitted the results to the Department of Environmental Protection and an engineering company, Fuss & O'Neill Inc., so that they could create a management plan for the watershed. Other members of the research group performed supplementary analyses, in conjunction with the chemical parameters, to be able to better determine the water quality of the watershed.

40.

ENVIRONMENTAL SCIENCE FIELD TRIP TO ICELAND, AUGUST 2008

Susan Juggernaut '09, Colby Tucker '09, Steve Sobolewski '10, Chamae Munroe '10, Elisabeth Cianciola '10, Nathan Sell '10, Katie Sausen '10, Brittany Price '10, Jeff McNamara '11, Emily Quinton '11

Faculty Sponsors: Christoph Geiss, Joan Morrison, Jonathan Gourley

From August 6th through the 20th a group of ten students and three professors went to Iceland on the Environmental Science program's annual summer field study. Iceland's location on both the mid-Atlantic Ridge- where the Eurasian and North American continental plates are separating by about 2 centimeters each year- and a geological hot spot, as well as Iceland's recent glacial history have helped to create a variety of unique landscape features. We each traveled with just a backpack, camping in various places throughout the two weeks. Our first days in the capitol city of Reykjavik were spent touring the diverse art and history museums available and learning about the island's Viking heritage. As a group, we went to Thingvellir National Park, a World Heritage Site and former meeting place of the Alþingi or National Parliament, Gulfoss, the "Golden Waterfall," and the world-famous Geysir hot springs. The trip included a six day, eighty-one kilometer hike from Skógar to Landmannalauger that brought us through various landforms including glaciers, rivers, mountains, lava fields, waterfalls and geothermal hot springs. The trip also took us by ferry to the Westman Island of Heimaey, well-known for volcanic activity and bird colonies. Some of our group climbed Eldfell, the volcano that erupted from January to July in 1973, nearly devastating the community. Others hiked the island in search of birds, in particular, puffins. The Westman Islands, formed by volcanic activity

thousands of years ago, are home to the world's largest puffin population as well as many migrating bird species. During the trip we learned much about the geology of Iceland and its flora and fauna – not to mention its culture. This trip was an excellent experience, being physically challenging, educational and fun.

41.

WATER QUALITY ANALYSIS FOR THE NORTH BRANCH PARK RIVER: MACRO INVERTEBRATES AND FECAL COLIFORM

Caroline Lewis '09

Faculty Sponsor: Jonathan Gourley

We established twelve sites on the North Branch Park River and some of its tributaries, including the Filley Brook, Beaman's Brook, Wash Brook, and Tumble Brook. We sampled each site three times between the end of May through July. Two of the parameters we tested were macro invertebrate populations and coliform colonies. Fecal coliform and other waterborne coliforms can be detected using Coliscan® Easygel®. No fecal coliform colonies were found in the Park River, Filley Brook, Beaman's Brook, or Tumble Brook from any samples. One fecal coliform colony (type 1B) was found at EWB 8 (end of Wash Brook) on June 24th, 2008. Another fecal coliform colony was found from a storm water sample at the top of the North Branch Park River from 6/23/2008. This was also type 1B. This occurrence of fecal coliform could be due to storm drains carrying urban runoff, especially since no fecal coliform colonies were found in the North Branch Park River during baseline conditions.

We collected macro invertebrates from each site using a kick net, and identified specimens in lab. We used the biotic index, Simpson's index, percent EPT, and taxa richness to evaluate water quality. On average, the quality of the Park River, Tumble Brook, and Wash Brook can be classified as "good" according to the Biotic Index. On average, the Beaman's Brook and Tumble Brook tributary have "substantially likely" organic pollution and fair water quality according to the Biotic Index. Percent EPT and the biotic index indicate the Wash Brook was the healthiest section, followed by the Park River.

42.

FORAGING RESPONSE TO PREDATION RISK OF GREY SQUIRRELS IN AN URBAN ENVIRONMENT

Baltazar Ramos '11

Faculty Sponsor: Michael O'Donnell

With the rapid increase in urbanization, animals are impelled to adapt their behaviors in order to adjust to their new urban environment. We analyzed and compared the differences in the foraging behaviors of the eastern grey squirrel (*Sciurus carolinensis*) in response to the manipulation of direct and indirect cues of predation risk in urban and suburban environments. Also, we compared how their foraging behavior differed with the change of the seasons. The effects of direct cues were studied by placing predator and non-predator urines in foraging trays with water as a control while the indirect cues were manipulated by either placing the trays near

or far from cover. The response to these cues were measured by giving-up densities (GUD), or the amount of food left in a specified patch after foraging has ended. A higher GUD would suggest a greater sense of predatory danger perceived by the squirrels under those circumstances. The presence of predator urines was not found to have a significant effect on GUDs of urban squirrels when compared to the water control. On the other hand, GUDs of trays far from cover were found to be much higher ($P < 0.0001$) than those of trays close to cover. Data from a previous study performed during the winter months found no effect from neither indirect nor direct cues for urban squirrels. However, in this summer study, it was found that urban squirrels did alter their foraging behaviors based on distance from cover. This could be due to the fact that red-tailed hawks, an aerial predator, are the most common predators in urban environments and squirrels therefore alter their behavior in correspondence with available canopy cover, which is not available for both near and far trays during the winter but is available for the near trays during summer months.

43.

WATER QUALITY PROFILE OF THE PARK RIVER WATERSHED

Lucille Schiffman '10, Caroline Lewis '09

Faculty Sponsor: Jonathan Gourley

The Park River watershed drains into the Park River and its tributaries, which are the Filley Brook, Tumble Brook, and Wash Brook, all located in Hartford, West Hartford, and parts of Bloomfield. Runoff containing pollutants can contaminate the watershed from a variety of factors such as sewage overflow, traffic pollution, and nearby industry. A water quality profile was performed on the north branch of the Park River and its tributaries. Several different water quality and soil tests were performed, such as pH, hardness, dissolved oxygen, fecal coliform, macroinvertebrates, anion content, and sediment analysis. There were several testing locations that were less healthy overall, and this may have been due to nearby golf courses, which require considerable fertilization. It was found that the overall health of the north branch of the Park River and its tributaries were healthy, with no severe contamination.

44.

CLIMATE RECONSTRUCTION ON THE BASIS OF MAGNETIC PROPERTIES OF LAKE SEDIMENTS

Pooja Shakya '11

Faculty Sponsor: Christoph Geiss

We analyzed magnetic properties of lake sediments from Lake 396 in Northern Manitoba, Canada in an attempt to reconstruct paleoclimate patterns. The analysis has been conducted employing magnetic susceptibility, anhysteretic remanent magnetization (ARM), isothermal remanent magnetization (IRM), macroscopic charcoal analysis and loss on ignition (LOI). 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. LOI measures the organic and inorganic sediment fractions. These measurements have been applied to the samples from Lake 396. The values for ARM

normalized by IRM, indicate the presence of biogenic magnetite which suggests a possible occurrence of erosion in the site. The peak in the charcoal area from macroscopic charcoal analysis corresponds to a greater percentage of inorganic matter in the LOI data. This observation could be explained by an increase of inorganic runoff into the lake after a period of fires.

45.

CHARACTERISTICS OF RED-TAILED HAWK (BUTEO JAMAICENSIS) NEST SITES IN HARTFORD, CT

Frances Thomas '10

Faculty Sponsor: Joan Morrison

The Red-tailed hawk (*Buteo jamaicensis*) is an 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. It is important to understand Red-Tailed hawk nesting ecology in urban areas to better manage and protect these birds. Past studies have shown that both urban and rural hawks nest in larger trees with more canopy cover and trees that are taller than randomly selected non-nest trees. In this study we located 12 nest sites known to be active in either the 2007 or 2008 breeding season in Hartford, CT. Nest sites were identified by the presence of a nest structure and associated activities of adult hawks. Nest sites were characterized at 3 spatial levels: the nest substrate, a 12 m radius plot, and a 300 m radius plot, each centered on the nest location. Measurements were taken to describe the diameter, height, and species if the substrate was a tree, and height if the nest substrate was man made. We measured average ground cover, shrub cover, and canopy cover within the 12m radius plot, and road density, housing density, and percent green space within the 300m radius plot. Nine of the twelve nests were located in trees and three were located on man made structures, including a billboard, a light post, and the edge of a building. Average nest height among all substrates was 16.5 m. Nests stands were generally characterized by few trees and otherwise generally open habitat with few shrubs and low ground cover. Red-tailed Hawks are important as indicator species to evaluate the health and success of other wildlife found in urban areas.

MATHEMATICS

46.

EXPLORATIONS INTO MULTIDIMENSIONAL CONTINUED FRACTIONS

Saroj Aryal '09

Faculty Sponsor: Nancy J. Wyshinski

For any $x \in \mathbb{R}$, the continued fraction representation is given as: $x = a_0 + \frac{1}{a_1 + \frac{1}{a_2 + \frac{1}{a_3 + \dots}}}$, where

a_0 is an integer and a_i is a positive integer $\forall i = 1, 2, \dots$. One of the most common shorthand

notations used is $x=[a_0;a_1,a_2,\dots]$. Continued fractions are important tools in studying the properties of rational and irrational numbers. For example: a continued fraction is finite if and only if the number is rational and the continued fraction expansion of an irrational is unique. More often they are also used to approximate the values of irrational numbers.

Multidimensional continued fractions, although been studied for more than a century now, is still a difficult topic. Several mathematicians have made attempts to generalize the ordinary continued fraction algorithms into the multidimensional ones. A k -dimensional continued fraction can be denoted as $[b_0,b_1,b_2,\dots]$ where each b_i is associated with a k -tuple (a_1,a_2,\dots,a_k) by some algorithm. For example, a three dimensional (ternary) continued fraction looks like: $(x,y)=[(p_1,q_1);(p_2,q_2);(p_3,q_3);\dots]$, where $p_i,q_j \in \mathbb{Z}, \forall i,j$. Jacobi's algorithm is one of the first such generalization algorithms. Minowski and Woronj are also considered to be the pioneers of the field. After that, several mathematicians have taken up this subject again and again. In this research we mostly focused in understanding and applying the Jacobi's algorithm.

NEUROSCIENCE

47.

EFFECTS OF ACUTE STRESS ON THE ELECTROPHYSIOLOGY AND NEUROCHEMISTRY OF THE BRAIN IN NEONATALLY ISOLATED ADULT RATS

Kaitlin Gaffney '09

Faculty Sponsor: Harry Blaise

Stress remains a prevalent factor of everyday life, the effects of which are not yet completely understood. The electrophysiological effects of neonatal isolation on long term potentiation (LTP) in the hippocampus in conjunction with an acute stressor has not yet been examined. The goals of the present study are to determine whether acute stress can alter the electrophysiological and neurochemical properties of the amygdala and hippocampus in neonatally isolated rats. Two groups of rats were used in this study. An experimental group consisting of neonatally isolated (ISO) rats which were separated from postnatal days 2-9; and a control group consisting of rats which were not handled (NH) and remained together until weaning. Once rats reached 70 days of age, surgery was performed on both groups to implant electrodes in the hippocampus and amygdala for electrophysiological recording, as well as a cannula in the hippocampus for neurochemical collection. A week after surgery, neurochemical collection and electrophysiological recordings took place. To record and collect, the rat was connected to the recording apparatus and a neurochemical probe was inserted into the cannula. Baseline electrophysiological and neurochemical assays were collected following a tetanization with trains of 5Hz theta burst stimulation (TBS). Electrophysiological recording and neurochemical collection were taken immediately and 1 hour following tetanization. Then each animal was subjected to the acute stress protocol which consisted of placing the animal in a rodent restrainer for 30 minutes, after which electrophysiological recording and neurochemical collection were taken at the 2, 3, 24, and 48-hour period. The neurochemical assays were frozen until analyzed using high pressure liquid chromatography (HPLC). The protocol for this thesis research, including cannula implantation, neurochemical collection and HPLC analysis techniques, was

developed and mastered this past summer. The research is currently ongoing this fall and will be my neuroscience thesis.

48.

THE EFFECTS OF NEONATAL ISOLATION ON SYNAPTIC PLASTICITY IN THE MPFC-BLA PATHWAY IN FREELY BEHAVING ADULT RATS

Kaitlin Haines '09, Urey Chow '09, Angela Colantonio '11

Faculty Sponsors: Harry Blaise, Jessica Koranda

The amygdala has been implicated in a variety of roles in both the stress response and memory formation. The basolateral amygdala (BLA) mediates the neuronal response to neonatal stress within the hippocampus, which subsequently affects normal hippocampal processing related to memory. We have recently demonstrated in our own laboratory that neonatal isolation affects bidirectional synaptic plasticity in the BLA-DG synapse, whereby both LTP and LTD are increased in adult animals isolated as neonates compared to their non-handled counterparts. Although there have been numerous studies exploring the relationship between neonatal isolation and hippocampal plasticity, there have been no studies investigating the effects of this chronic early stressor on the neuronal connections between the BLA and the medial prefrontal cortex (mPFC). The mPFC governs memory storage and controls the emotional limbic system. Interactions between the mPFC and the BLA have been shown to be essential for integrating emotionally salient information. In order to assess the effects of neonatal isolation on the bidirectional pathway between the mPFC and BLA, neonates were isolated from their mother for one hour each day from PN2 to PN9 and then were permitted to normally mature into adulthood. Between 70-120 days of age, isolated and non-isolated animals underwent surgery to chronically implant electrodes in the BLA and mPFC. Our objective for this summer was to determine the coordinates for the BLA-mPFC and mPFC-BLA pathway using signals obtained in existing literature. Coordinates for the BLA-mPFC pathway were confirmed, but the mPFC-BLA coordinates have yet to be determined. Future research includes determining the BLA-mPFC coordinates, obtaining LTP electrophysiological data, and taking neurochemical assays.

49.

PROSTAGLANDIN E2 REDUCES ROTENONE-INDUCED APOPTOSIS IN SH-SY5Y CELLS

Ariana Mullin '09

Faculty Sponsor: William Church

Parkinson's disease (PD) is a chronic and progressive neurodegenerative disease resulting from the specific loss of dopaminergic neurons in the substantia nigra. Rotenone is a neurotoxic pesticide that induces Parkinsonian-like pathologies when administered in cell cultures as well as when absorbed in vivo. Rotenone induces apoptotic cell death through complex I inhibition, causing oxidative stress and pro-apoptotic signaling. Prostaglandin molecules have been shown to increase levels of several anti-apoptotic molecules, including heat shock proteins, which can prevent activation of the caspase cascade as well as the JNK pathway, in addition to activating cell survival pathways. Prostaglandin E2 (PGE2) was investigated as a neuroprotective agent for

its known role in protecting against toxin-induced neuroinflammation. Human neuroblastoma SH-SY5Y cells underwent preincubation periods of 1 or 6 hours at 0-25nM PGE2 concentrations before 24hr exposure to rotenone (500nM). Following the 24hr rotenone exposure, cells were treated with the nuclear DNA stain Hoechst 33342. Apoptotic cells are identified by the appearance of fragmented nuclei, while live cell nuclei are intact when stained. The number of apoptotic cells was used as a marker for viability and apoptotic cells were counted in ten random fields of each well at 20x magnification. PGE2 attenuated rotenone-induced apoptosis in a dose-dependent manner when applied 1 hour before rotenone exposure. When applied 6 hours before rotenone exposure, PGE2 not only attenuated rotenone-induced apoptosis, but also reduced apoptosis levels to below the level of the no treatment group. Future research will investigate the specific neuroprotective pathway by which PGE2 acts in alleviating rotenone toxicity, as well as explore its potential neuroprotective role in other forms of PD toxicity, such as MPTP exposure.

50.

MITOCHONDRIAL FUNCTION IN RODENTS FED A KETOGENIC DIET

Tiffany Ruiz '10, Julia Svedova '11, DJ Patrick '11, Ritika Chandra '10

Faculty Sponsors: Susan Masino, David Ruskin

The ketogenic diet 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. However, the mechanism behind the diet's anticonvulsant effects remains unknown. Since the diet is very high fats and very low in proteins and carbohydrates, the body's metabolic processes are significantly altered. ATP production and mitochondrial respiration seemed to be enhanced through glucose restriction, consumption of long chain-saturated triglycerides and ketone bodies. In addition, previous studies reveal that adenosine, an inhibitory neuromodulator and anticonvulsant agent, may play a key role in the diet's effectiveness. It has been previously shown that mitochondrial respiration rates are substantially higher in mice fed the ketogenic diet than in mice the control diet. However, the changes in these rates have not been explored regionally. Since some areas of the brain might be more relevant to epilepsy than others (for example, hippocampus), we predict that the changes in mitochondrial function alter in specific brain regions. In order to test our hypothesis, rats were fed either an 8% ketogenic diet or a control diet for four weeks. When the animals were sacrificed, brain samples from five different regions were taken and homogenized in neutral tris-base buffer. Each sample was divided into 2 parts and one part was centrifuged to obtain mitochondrial cell fraction. The activity of a mitochondrial enzyme called succinate dehydrogenase served as an indication of the mitochondrial respiration rates. The values were calculated using the Bradford protein assay and the succinate dehydrogenase assay. The methodology of this experiment is still being improved in order to collect more accurate data. Our findings may help develop a new assortment of novel treatments for individuals suffering from epilepsy and other neurological disorders.

51.

TESTING THE EFFICACY OF THE KETOGENIC DIET (KD) AS AN ANTI-INFLAMMATORY AGENT

Tracey Suter '11, David Patrick '11, Ian Hendry '07

Faculty Sponsor: Susan Masino

Despite the many different pre-existing treatments for epilepsy, there is one, the ketogenic diet, which has yet to be completely understood. The ketogenic diet is high in fat and low in carbohydrates; as a result, the body uses ketones as its' main source of energy rather than glucose. Since ketolytic metabolism should produce fewer free radicals and reactive oxygen species, less inflammation in the body should occur. In order to check this theory, youth and adult male Sprague Dawley rats on the ketogenic diet were tested with CFA or control injection (in either hind paw), in both ketogenic and control animals. After allowing time for inflammation to set in, the paws were then measured. These experiments are ongoing. If the effects of the ketogenic diet on pain and inflammation can be established, the use of this diet may expand to cover many other health-related fields.

PHYSICS

52.

QUANTUM RANDOMNESS IN OPTICAL PROCESSES

Matthew Bermudez '09

Faculty Sponsor: David Branning

Many methods exist to produce random numbers useful for computer applications. Among them are ways of using inherently random quantum phenomena as a source of randomness. One such process is the reflection or transmission of a photon through a beamsplitter. Laser light was directed through a downconversion crystal, simultaneously creating two photons. A detection apparatus was set up to determine which of two equally probable paths each photon took through two symmetrically positioned beamsplitters. The rate of photon generation was purposely kept to less than one in ten per time bin to prevent errors from multiple simultaneous detections. The experiment was run over a weekend. Only simultaneous detections for each of the two photon paths were considered valid events. Two bitstrings were produced from sequence of coincidences, each millions of bits in length. A series of tests for cryptographic security were implemented in Mathematica and run on the datasets to determine their randomness.

53.

COINCIDENCE COUNTING USING FPGA

Mahmudul Chowdhury '09

Faculty Sponsor: David Branning

Coincidence counting is the simultaneous detection of two subatomic or nuclear particles. In this research the subatomic particles were the photons. An electronic pulse is sent from two detectors and the pulses are then passed through an AND gate. The output of the AND gate is used for

coincidence counting. For this purpose an FPGA(field-programmable gate array)was used. FPGA is a programmable logic blocks containing semiconductor device. The logic blocks can be programmed to act as basic logic gates. The FPGA was programmed using active serial programming through the USB-blaster port of the FPGA board so that the program remains in the memory even if the board was disconnected. The program was able to send pulses through four channels. These channels were connected to the computer. LabView was used to count the number of pulses from each channel. It was seen that LabView could not get the proper reading from one of the channels. The next to step is to fix that channel and then use NIOS II to send pulses from the FPGA to an external device through a USB port.

54.

LOW COST COINCIDENCE COUNTING MACHINES USING FIELD PROGRAMMABLE GATE ARRAY FOR INTERNAL SIGNAL GENERATION AND ENHANCED DATA OUTPUT

Sarthak Khanal '11

Faculty Sponsor: David Branning

Coincidence counting is an essential part of quantum optics experiments at the undergraduate level but cost has created a serious entry barrier for many schools. We present two new versions of Coincidence Counting Modules (CCMs) that not only promise to reduce the size of CCMs used in undergraduate labs but also decrease their cost by an astronomical 95%. Both versions make use of a series of logic gates which are triggered by signals arriving from four different detectors. The CCMs are equipped with a pulse-shaping mechanism which allows the user to choose the desired pulse width and moreover the use of a Field-Programmable Gate Array (FPGA) allows the user to not only feed the results directly into the computer but also generate clock signals in the CCM itself making pre-experimental tests extremely easy. Further work will be directed towards providing the user freedom to choose the input impedances while performing experiments via the use of dip switches.

PSYCHOLOGY

55.

HUMAN TIMING UNDER AUDITORY AND VISUAL STIMULATION

Chao Liao '11

Faculty Sponsor: William Mace

Prior research shows that timing precision in self-paced tapping is independently limited by central timing process, which is presumed to regulate movement initiation, and 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 introducing hybrid subdivision comprised by both visual

stimulation and auditory stimulation, synchronized tapping are discussed. Results suggest that visual stimulated tapping is not as good as auditory stimulated tapping in both frequency and accuracy and that auditory stimuli are apt to generate strong beat in a hybrid sequence. The relationship of tapping frequency and space variable is also examined.

56.

THE ROLE OF CULTURAL VALUES IN COPING WITH STRESS AMONG LATINO COLLEGE STUDENTS

Radmila Paneva '09

Faculty Sponsor: Janet Chang

The purpose of this study was to gain an understanding of how Latino cultural factors promote and hinder coping mechanisms, the use of social support in particular. Collectivist cultures (e.g., Latino, Asian, African, and Southern European) emphasize interdependence and relationships with others, while individualistic cultures, such as Anglo-American and Western European culture, emphasize independence and the importance of the individual. Because Latino culture has been characterized as collectivist, it was expected that relational concerns would affect coping with stress. Relational concerns are ones that aim to preserve relationships with others, which are prioritized in collectivist cultures. Research has shown that Latinos seek out social support in family members due to close family bonds, while relational concerns (e.g., preserving group harmony, saving face, and being self reliant) have been noted to hinder the use of social support in collectivistic cultures. Very little research has been conducted examining the effect of relational concerns on social support in Latinos. In this study, seven Latino Trinity College students participated in a focus group discussion and completed a demographics questionnaire. Family bonds, concern for family reputation, religion, and respect for elders were important Latino cultural values. The results showed that certain Latino cultural values promoted the use of social support, but there were also exceptions to using this coping strategy. Maintaining group harmony, being self-reliant, and avoiding worrying parents were significant relational concerns, which seemed to hinder the use of social support. Further research in this area would contribute to a better understanding of Latino culture and would help improve professional health services for Latinos.

AV DAVIS FELLOWS

57.

LIVING ART AS FESTIVAL PERFORMANCE: RAMAYANA REENACTMENTS IN TRINIDAD AND CAMBODIA

Jean Ahn '09

Faculty Sponsors: Milla Riggio, Cambodian Living Arts

The Ramayana, a Hindu epic from India, has been printed in multiple languages and illustrated in many paintings. Depictions of this story are also visually performed in reenactments, as I have seen in Trinidad through Ramleela, a multi-night play cycle, and in Cambodia through shadow puppets. This examination of the Ramayana performance tradition pertains to 'living art,'

defined by UNESCO as intangible, transient heritage, in that it is performed by human beings, but that represents part of a cultural legacy as surely as more tangible heritages. In developing a comparative study, I was able to link performances preserved in Cambodia to the diasporic Indo-Trinidadian traditions and Ramleela as performed in Ramnagar, India. After conducting background research at Trinity, I was able to continue research at the Cambodia National Library and the Center for Khmer Studies. As an artist-in-residence with Cambodian Living Arts, a project of World Education, I got in contact with three shadow puppet troupes: Ty Chien, Wat Bo, and Sovanna Phum. Despite being in Cambodia during the rainy season, which is the low season for the traditionally outdoor shows, I was able to see multiple performances. With a translator, I filmed interviews with masters and performers. While shadow puppetry has seen effects of tourism and preservation for what is ‘traditional,’ it also connects Cambodia to its ancient past since the Ramayana is carved into the walls of Angkor Wat. Conversely, through Ramleela, Indo-Trinidadians link Trinidad to their homeland in India and relate the story of Lord Rama's exile to their own ‘exile’ as indentured laborers. Further work will be directed towards my English thesis, which will analyze the literature that tells the story of the Ramayana and how it is visually translated into performance, supplemented with a documentary film and photo essay.

58.

OLD NORTH: A HISTORIC CEMETERY IN DISTRESS

Henry Arneth ‘10

Faculty Sponsors: Susan Pennybacker, Laura Knott-Twine, Hartford Preservation Alliance

Old North Cemetery, founded in 1807 is the third of Hartford's early burial grounds; it is the resting place for some of Connecticut's early politicians, Revolutionary War and Civil War veterans, African-Americans and home to Hartford's first Catholic burial ground.

Some people resting in this cemetery are: Frederick Law Olmstead, The Reverend Horace Bushnell, Daniel Watkinson, Daniel Wadsworth, John Colt, Mason Fitch and Alice Cogswell, William Wolcott Ellsworth and Samuel Bowles. In addition to the above mentioned, there are veterans from every war from the Revolutionary War to World War II—with many black Civil War soldiers and veterans (most from the 29th Connecticut Volunteers).

When I arrived at the cemetery to begin my work, it was completely overgrown and in a very distressed condition. Historic stones were beginning to crumble. The future looked bleak for this cemetery. To compound matters, a grass roots organization, the Clay Hill Improvement Organization, with no experience in historic preservation, took over the management of the cemetery shortly before my arrival.

During my time at the cemetery I saw accidental destruction of stones by the City of Hartford while mowing the overgrown grass, vandalism by parties unknown at this time, and littering by neighbors of the cemetery who not only use the space to pass through to the main street, but also druggies who retreat to the cemetery for peace and quiet while shooting up.

Some of that changed, however, when CREC (Capitol Region Education Council) sent eight local teens to help with our projects in the cemetery. I specifically worked with one teen and

with her assistance I have identified nearly two thousand graves. This identification includes inscriptions, photographs, condition issues, and any manufacturer's information that could be found on the stones themselves. I also worked on tracking down plot numbers for all of the identified graves.

As part of my work at the cemetery, I worked with the City of Hartford's newly formed Cemetery Group. This is a council of representatives from the seven historic cemeteries in Hartford as well as working under the auspices of the Hartford Preservation Alliance.

59.

TECHNOLOGY LITERACY IN THE MIDDLE OF THE WORLD: TRINFO CAFÉ'S INTERNET TECHNOLOGY TRAINING IN SÃO TOMÉ AND PRINCIPIÉ AND IN HARTFORD

Jason Azevedo '08

Faculty Sponsors: Carlos Espinosa, Ned Seligman, STEP UP (São Tomé and Príncipe Union For Promotion)

Since the introduction of the first personal computers in the mid-1970s, the lives of individuals around the globe have changed in ways incalculable. For developed countries, what has emerged is a world in which access to the Internet is a utility equivalent to heat, water, and electricity. In developing countries, the Internet and personal computers remain a luxury reserved for the wealthy and urban middle-class. Consequently, in the developing world, technology literacy is markedly low. Closing this technology gap is a complex endeavor. First, it involves providing free and subsidized computers to feed and augment emerging demand. Second, it involves providing technology training for new users, and in public and private schools. Finally, it involves training a network of technicians to maintain and repair broken computers.

São Tomé and Príncipe, the African microstate and former Portuguese colony, is one of many countries working hard to develop technology literacy and infrastructure. For my fellowship Technology Literacy in the Middle of the World I worked with the American NGO STEP UP (São Tome and Príncipe Union for Promotion) to bring technology education to young adults in São Tome. I spent June 3rd - 27th on the island training young adults in basic computer repair, software installation, and the use of office applications. For this endeavor I borrowed curriculum from Trinity's Trinfo Café and translated it into Portuguese. This curriculum was left with local teachers for future technology education. During my stay I was able to instruct over sixty young men and women in basic and intermediate computer literacy. I was also able to repair and restore ten computers used in a free Internet café run by STEP UP. Upon my return to Hartford, I worked at Trinfo Café promoting the café's services to Hartford's growing Brazilian community. In August, I taught a basic computer skills course to seven Brazilian and Portuguese adults from Hartford. The efforts to advance technology literacy in São Tomé and in Hartford continue. For more information, to volunteer, or to make a donation contact STEP UP at [www.stepup.st] or Trinfo Café at [www.trinfo cafe.com].

60.

RACIAL DISPARITY AND CONNECTICUT'S DRUG POLICY

Michael Blottin '10

Faculty Sponsor: Sonia Cardenas

The acute racial disparity in Connecticut's incarcerated population, one of the most extreme cases in the United States, is a matter of much concern. Although African Americans and Hispanics make up less than 25 percent of the general population, they constitute 70 percent of those incarcerated. In the case of the most common sentenced offenses, drug law violations, research indicates that Whites, African Americans, and Hispanics all violate the law at rates of negligible difference. Thus racial disparity produced by drug law enforcement is unwarranted. However, little research has addressed how Connecticut's drug policy produces racial disparity. As pronounced socioeconomic and demographic disparities divide Connecticut's communities along the same racial lines as its incarcerated population, this research analyzes the impact of Connecticut's drug policy on the state's many communities. To this end, Connecticut's substantive drug laws and enforcement policies were identified and their demographic impacts studied. All existing Connecticut-specific research data on racial differences in the criminal justice system was analyzed. This report finds that, although facially race-neutral, geographical enforcement and drug-free-zone laws have an unwarranted, racially-discriminatory effect. Further, racial disparity caused by the drug policy both exacerbates and is exacerbated by other socioeconomic and demographic disparities. Criminal justice policies that unjustly discriminate in effect, even if not in purpose, put great strains on all the state's communities, but cannot be addressed by United States law, because proof of intent to discriminate is required. International law addresses race-neutral laws that have a discriminatory effect. While a drug policy that emphasizes drug abuse rehabilitation and efficacy would produce less racial disparity, one must look beyond the criminal justice system, to the myriad of interactions between individuals, communities, and all state policies, if research is to effectively analyze discrimination.

61.

AV DAVIS FELLOWSHIP: INTERNSHIP AT ACLU OF CONNECTICUT

Ariana Davis '09

Faculty Sponsors: Sonia Cardenas, Andrew Schneider, Director of the ACLU of Connecticut

I spent the summer working for the ACLU of Connecticut. The Executive Director of the Connecticut branch of the ACLU, Andrew Schneider, served as an excellent mentor and advisor for the summer. I was a legislative intern, so I was primarily involved in writing articles for the upcoming newsletter and website, doing public outreach, creating charts on recent Connecticut legislation, and preparing for upcoming events the ACLU is hosting. In addition, I was able to work with the legal interns by meeting with inmates at prisons and jails all over Connecticut and writing up reports for the staff attorney. I read letters and files and helped evaluate the cases. My goal of working at the ACLU was to learn about advocacy and how action was implemented on both a national and local level. I hoped to be involved in the legislative and legal process of enforcing civil liberties in Connecticut. My goals were fulfilled and my opportunities surpassed my expectation.

62.

POPULAR MOVEMENTS OF THE BOLIVARIAN REPUBLIC OF VENEZUELA

Dzheni Dilcheva '09

Faculty Sponsor: Luis Figueroa

The existing academic and journalistic discourse on populism and democracy in Venezuela tends to concentrate on Hugo Chavez's style and personality while overlooking the significance of the president's socio-economic policies and underestimating the role of the popular classes in the political processes. Chavez's supporters, commonly referred to as Chavistas, are largely misrepresented as the poor, uneducated, unorganized, and sometimes violent masses who blindly follow a charismatic leader.

In order to fill the void in theoretical and empirical data left by top-down analysis, I have employed a bottom-up methodology in my study that focuses on the actions and thinking of Chavista popular movements and individual activists. During 17 days of field research in Caracas, Venezuela, I conducted semi-structured interviews with representatives from various autonomous and state-initiated popular movements, ranging from community media, political groups, and urban culture collectives to governmental programs and institutions.

In my interviews with community organizers and activists I sought to explore the goals and stances of Chavista organizations—their internal structure, links to the president, and position with regard to the government's political agenda. Furthermore, I sought to penetrate the complex interactions between the autonomous organizations of the popular sector, the state and state-sponsored movements.

My findings counter popular misconceptions about Chavista movements in two important aspects. First, popular urban activists are characterized by political sophistication, high levels of social consciousness, genuinely democratic goals and methods, and autonomous identities grounded in community ties and historical struggles. Second, links to the state – of financial, organizational, or ideological nature—do not undermine the movements' potential to bring about social transformation. In fact, the Venezuelan example shows that the alliance between popular movements and a progressive government can serve as the driving force to deepen democracy, extend citizens' rights and public power to the whole population.

63.

THE POWER OF ART IN EDUCATION: MOVEMENT, CONTROL, AND THE FUTURE

Cagney JeanBaptiste '08

Faculty Sponsor: Judy Dworin

Art in education expresses art as a means to survive as human beings and to preserve culture. It gives a voice and vision to new ideas and provides a different language of seeing and understanding the world that words and logic can't simply express. Arts power to increase one's learning ability and promote a unique way of learning was demonstrated with a group of 6 and 7 year olds. The students were given movement/dance as a tool to project into their future. With dance each student articulated what their future goals and professions are, developed a strategy

of how they would reach these goals, and created a dance piece that expressed triumph through the face of adversity. The students used art as a means to plan out their dreams and realize there would be obstacles, however with hard work and determination they will be victorious. Arts education makes a tremendous impact on the developmental growth of every child and has been proven to help level the "learning field" across socio-economic boundaries. Arts education has a measurable impact on at-risk youth in deterring delinquent behavior and truancy problems while also increasing overall academic performance among those youth engaged in after school and summer arts programs targeted toward delinquency prevention. I have concluded that art in education encouraged the students to take risks, cooperate, problem solve, and work together.

64.

HARTFORD'S ARTS AND CULTURAL INSTITUTIONS AS CIVIC AND ECONOMIC ENGINES

Michael Magdelinskas '11, Julianne Garbarino '11

Faculty Sponsor: Andrew Walsh

Arts and Cultural institutions are well established in Hartford, as the Places Rated Almanac "ranked Hartford among the top 6 percent of North American cities for arts and culture; and noted economist Richard Florida picked Hartford as one of the 'Top 20' best places to live, work, start a family and have fun in the U.S. However, Hartford is a city in constant flux, whose arts institutions are constantly adapting to the changing social and economic climates. As such, we set out to find out how the numerous institutions are dealing with current depressing economy as well as making strides to engage the community and increase attendance.

Furthermore, we studied the national trends regarding the use of arts and culture venues as economic stimuli. These include the creation of arts districts, performance festivals, and the publishing of economic reports to garner public attention. As these tactics are critical components in urban revitalization strategies, their benefits are widely debated. However, we have taken care to present both the point and the counter point to each tactic presented.

All this leads to our final conclusion that the "creative class," one required for economic success by Richard Florida, may be an important component but clearly is not the end-all be-all as evident from the current state of Hartford and its surrounding community.

65.

AN EXPLORATION OF THE HOMELESSNESS PROBLEM IN HARTFORD, CT AND HARARE, ZIMBABWE

Christine Mwaturura '09

Faculty Sponsor: Diane Zannoni

The aim of this paper is to explore two different causes of homelessness in two very different cities in the world: Hartford, CT and Harare, Zimbabwe. This paper will also explore some of the initiatives that have been taken to mitigate the homelessness problems in these two cities. The paper shall be divided into two sections with each section having a sub-section. The first

section shall focus on the role that exclusionary zoning practices in Connecticut's suburbs has had in keeping housing costs and housing development costs high in the suburbs, which has exacerbated the homelessness problem in Hartford. This section's sub-section shall give a description of the relatively recently passed legislation: the HOMEConnecticut statute, as an avenue to creating more affordable housing options in Connecticut's suburbs by providing incentives to municipal governments to practice inclusionary zoning policies. The second section of this paper shall discuss the heated topic of the political land issue in Zimbabwe, which has resulted in many of Zimbabwe's farm workers becoming homeless, and the role that the economy has had in exacerbating homelessness in Harare. This section's sub-section, shall describe some of the efforts being made by NGOs and cooperatives to try reach solutions to the homelessness problems in Harare.

66.

A DREAM...

Bryan Quick '10

Faculty Sponsors: Michael Preston, Michael Lenaghan, TheaterWorks Production Manager

My community fellowship was spent at TheaterWorks in downtown Hartford. Working for both Michael Lenaghan (the companies Production Manager) and Jacques Lamarre (the Marketing Director), the power of theater as a tool for social change became an overwhelming reality for me. While doing outreach to members of the Hartford community, ranging from religious leaders to elected officials, it became apparent to me that the arts and particularly the performing arts offer the community a chance to come together and collectively question their culture and the world around them. Initially hoping to learn a little bit about how a professional theater works (no pun intended), I found myself deeply compelled to examine theater as, what Augusto Boal calls, a "weapon for the people." As the end of my internship was approaching, I had secured a number of individuals to come to our opening night performance and talk-back discussion for our show "No Child..." The show examines the contemporary public education system in the inner-city. Guests who had confirmed that they would be coming included, Hartford Mayor Eddie Perez, the Sheff Movement (devoted to equality in public schools), various church leaders, and prominent individuals in the community. The opening night was a huge success, and has since spawned a dialogue in the community about the state of our public schools. As a result of our outreach, I began to research plays that critiqued society in a variety of different ways. The final product is a one-act play, entitled "A Dream..." which examines the various social issues I was confronted with this summer: race, class, and governmental responsibility.

67.

INDIGENOUS VOICES OF CONNECTICUT

Lee Mixashawn Rozie '12

Faculty Sponsor: Eric Galm

To secure indigenous perspectives on the current state of affairs as to who we are, how we see the world and what the future may hold. Though seemingly simple questions, to get honest answers it was clear that traditional ethnological modes of "interrogation" are generally geared to

foreign or academically unsophisticated or “primitive” people, and could be awkward when dealing with Native people from a socially and technologically advanced place like Connecticut. Therefore I chose to let the subjects speak freely about four categories. I chose to interview natives recognized, unrecognized, indigenous and non indigenous from the unemployed to president of the state senate. Using a camcorder and choosing casual settings I strove to create a comfortable atmosphere and pose simple questions allowing space for the subjects to give extended responses. This method was used, as Native people here often do not respond to detailed interrogation. Some questions, like those dealing with “sovereignty” I posed only to subjects with definite experience on sovereignty issues. I also did not ask questions about spirituality, as many people might be offended with such inquiries. While I did manage to interview a wide range of “Indians” there were a number of knowledgeable people who did not want to be interviewed, because they felt that the “mainstream” society already knows too much (and too often misuses what “it” discovers) and the universal response was simply, “fuckum.” As an investigator I was careful to be respectful and inquisitive at the same time walking a fine line between scientist and Native, maintaining my balance. I hope to continue this study as it opened up many question for me personally, and think you will find that there is much about Naïve people here in Connecticut that will surprise and enlighten you.

68.

MY INTERNSHIP WITH THE HARTFORD ADVOCATE: RECONSIDERING THE HARTFORD STIGMA

Megan Schlichtig ‘10

Faculty Sponsor: Irene Papoulis

The city of Hartford carries a stigma in the Trinity College community. A significant portion of the college remains reluctant to leave the campus boundaries due to Hartford’s allegedly extreme levels of crime and poverty. In an effort to explore this stigma and discover whatever truth it might hold, I spent a total of three hundred and fifty hours in the Hartford community interning at *the Hartford Advocate*. My position as an editorial intern allowed me to work in the heart of the city and immerse myself in it on a regular basis. I frequented police stations, interviewed Hartford residents and workers, attended various city events, and familiarized myself with venues in the area. At the end of my project I wrote a total of three full length pieces in which I depicted and analyzed my experience. While ten weeks was hardly enough time for me to fully understand the complicated dynamics of Hartford, it did help me to better understand the city and as such know how to interact with it on a safe level. It is unjust to call Hartford a safe city or an unsafe one. Its true nature lies somewhere in the middle; ultimately it is up to Trinity students to learn how to navigate it with sense and caution. Only then will they discover its treasures.

Also, I had to select my faculty sponsor's area of study in order to submit it; I said "Educational Studies" because that was the closest I could find, but my professor is in fact an English professor. I wasn't sure if you could make "English" an option?

69.

THE IMPACT OF IMMIGRATION ON THE ECONOMY OF HARTFORD PRE AND POST 9/11

Madai Velez '09

Faculty Sponsor: Anne Gebelein

A drastic change on the emphasis placed on immigration after 9/11 lead me to hypothesize that the restrictions placed on immigrants, would lead to a decrease in the number of migrants overall. This lack of immigration would have a negative impact on the economy of Hartford because it would be deficient in cheap labor in the service industry.

The research consisted of interviewing a total of twenty five Hispanic immigrants in Hartford on two aspects: the anecdotal, where the participants told their stories on their migration and their development as a resident of Hartford, and the economical, where they explained how and where they invest their income. The participants ranged from business owners to house wives and the ages from sixteen to forty three.

One direct impact was the strict distribution of drivers' licenses. Most of the immigrant men work in construction and landscaping which require commuting long distances. After 9/11, the requirements to obtain a license became stricter and consequently, many workers could miss up to two months of employment. Another result was how immigrants utilize their savings. Construction and landscaping are both occupations where the period of work is inconsistent. Therefore, the immigrant worker must save enough money for when there is no work available or for a possible deportation. A positive impact on the economy of Hartford is the readiness of business owners to cater to this increasing population by supplying certain products.

In conclusion, it can be said that the number of immigrants that come to the United States is increasing at a decreasing ratio. Therefore, the supply of cheap labor will remain and the overall cost of immigration is less than the benefit. Further education on this issue will be conducted through an exhibition on the Broad Street Gallery.

70.

HOUSE STYLES OF HARTFORD

Yuwei Xie '11

Faculty Sponsors: Kathleen Curran, Laura Knott-Twine, Hartford Preservation Alliance

This summer I worked for Hartford Preservation Alliance, a non-profit organization that is devoted to the preservation of historically significant buildings inside the City of Hartford. My internship is a ten-week long one and my job mainly consists of doing surveys of houses in Hartford, archival work, map coloring, assisting in the event planning and setting up and other office work. To conduct surveys of the houses, we traveled to the streets of Hartford and gave each house a rating and marked its material. Afterwards, we entered them into the database and colored the houses on the map to specify the material it's made of. Archive work required us to read through the materials and then categorize them. Occasionally we went on tours of the city of Hartford and our mentors would give us extensive information on the city. Through interning for

HPA, I acquired a substantial knowledge of house styles in Hartford, familiarized myself with the streets and neighborhoods of Hartford, gained experience in archival work, and also improved my understanding of the history of Hartford.

My final project includes a paper on the house styles of Hartford and a poster of my project.

71.

STORYLINES ACROSS THE GLOBE: THE ROLE OF MODERN STORYTELLING IN CREATING GLOBAL COMMUNITIES

Csenge Zalka '11

Faculty Sponsor: Jane Nadel-Klein

In this research I explored the role of 'international storytellers' in forming communities that expand across political and cultural borders. These communities include the network of storytellers who share stories and experiences, and also audiences all around the World.

In the first part of my research I interviewed several international storytellers and asked them a series of questions, focused on how they would define 'international', where and how they have performed abroad so far, and what differences they see between their local and foreign audiences. I was especially interested in how they create connections with other storytellers and also with the listeners when traveling abroad. This phase brought some interesting results; most importantly the realization that even in the age of technology a significant percent of "networking" still works by simple 'word of mouth' in the storytelling world.

The second part of my research included a 4-week internship at the International Storytelling Center in Jonesborough, TN. By working full time as an intern I learned about how the Center is run and the events are organized, and participated in the everyday life of the town as well. In my research time I sorted through the archives of the history of the National Storytelling Festival (the first and biggest of all such events in the United States), and developed a database of all the storytellers who ever performed on "the Jonesborough stage". I separated all the international storytellers inside this database and analyzed their role in the history of the Festival. I concluded that depending on which definition we choose to decide which tellers fall into the 'international' category it can be said there were much more cultures and countries represented during the 36 years of the Festival than I originally expected.