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NINETEENTH ANNUAL SYMPOSIUM OF TRINITY COLLEGE UNDERGRADUATE RESEARCH

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PSYCHOLOGY

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1.
EFFECTS OF AZOLE ANTIFUNGAL DRUGS ON MYCOBACTERIA
Lydia Ansen-Wilson ‘07
Faculty Sponsor: Lisa-Anne Foster

Using *M. bovis and M. smegmatis* as model organisms for *Mycobacterium tuberculosis*, the effect of azole antifungal drugs, specifically econazole, on growth is being investigated. Multiple dose response experiments were performed for both organisms using concentrations of econazole between 2.5 μM and 25 μM. The growth patterns were then compared to controls with no drugs and two concentrations (0.025 μg/ml and 0.045 μg/ml) of the traditional drug used to treat *M. tuberculosis* infections, isoniazid. Dose response experiments were also performed using combinations of econazole and isoniazid. Since econazole is a very potent inhibitor of growth, no statistically significant synergistic effect between the two drugs has been observed thus far. However, we anticipate that future modifications to our experimental protocol, such as inoculating bacterial cultures with drugs during log phase rather than lag phase, will provide a way to more accurately determine if synergy between econazole and isoniazid exists in regards to growth inhibition. Future dose response studies will also use macrophages harvested from mice to provide a more relevant model of drug action in vivo. Previous research showed the probable protein in mycobacteria targeted by azole antifungal drugs is CYP51, a cytochrome P450. To test this hypothesis, we are currently working to construct an *M. smegmatis* CYP51 deletion mutant by preparing a shuttle phasmid packed in phage heads for delivering the knock out gene to bacteria. Recombinant DNA techniques are being employed to attempt to ligate left and right fragments of the CYP51 gene into endonuclease-digested p0004S plasmid fragments.

2.
DUVANE DITERPENES ACCOUNT FOR THE DEFENSIVE ACTIVITY OF HAIR-BORNE DROPLETS IN TOBACCO BUDWORM (*HELIOTHIS VIRESCENS*) CATERPILLARS
Sarah Arnold ‘06
Faculty Sponsor: Scott Smedley
Frank Schroeder PhD, Department of Chemistry and Chemical Biology, Cornell University

Insects rely on a wide range of physical and chemical defenses against predators. Hairs on the body surface of tobacco budworm (*Heliothis virescens*) larvae bear droplets after the caterpillars feed on their host plant, tobacco (*Nicotiana tabacum*). I provide conclusive evidence that these droplets are obtained through direct contact of the hairs with tobacco trichome secretion rather than through ingestion of the secretion. In bioassays with the predatory ant *Crematogaster lineolata*, I show that the main constituents of the droplets, tobacco-derived duvane diterpenes, account for previous demonstration of the larval droplets’ defensive activity. I also demonstrate in a choice experiment that *H. virescens* larvae tend to prefer wild type tobacco leaves (with trichomes that bear secretion) over dropless mutant tobacco leaves (with trichomes that do not bear secretion). Although ingestive sequestration of host plant defensive chemicals by insect herbivores is common, this appears to be the first example of an herbivore benefiting from external anointment of such substances.

3.

ANALYSIS OF TIRE RUBBER LEACHATE WITH A BACTERIAL MUTAGENESIS ASSAY

Sara Benevento ‘06
Faculty Sponsor: Alison Draper

Rubber particles from automobile tires wear off with use and contribute to water pollution as they leach harmful chemicals into the environment. In an effort to examine the effects of these water-soluble chemicals, *Salmonella typhimurium* was used to assess the mutagenicity of tire rubber leachate. Tire tread particles were leached in hard water for 10 days at room temperature with constant agitation, filtered through a 0.45 µm nylon membrane and stored at 4ºC until use. The leachate was concentrated 10- and 100-fold with a C-18 solid phase extraction column, extracted into hexane, dried under N_2 and reconstituted in DMSO. Bacterial mutagenesis assays using Ames strains TA 1535 and TA 1538 were performed according to Standard Methods. Briefly, bacteria were pre-incubated in nutrient broth for 12 hr at 37°C with shaking. Then, 0.1 ml of test material (in DMSO), 0.5 ml of rat liver S-9 mixture, and 2.5 ml of melted top agar were added. After 20 min additional incubation, the contents were vortexed, poured on minimal agar plates, and incubated at 37°C for 60 hr before being scored. Revertant colonies were counted and scored against negative control plates (DMSO), and diagnostic mutagens analyzed with each experiment served as positive controls. Evidence suggests that tire rubber leachate requires metabolism to induce mutation and may be mutagenic at elevated concentrations. While no mutagenesis was detected with unconcentrated tire rubber leachate, proportional mutagenesis was observed with 10:1 and 100:1 concentration. With a growing number of automobiles on the road there is a marked increase in the amount of tire rubber particles entering the environment: collecting on roadways as dust and eventually being washed into local waterways. Further work will be directed towards identifying the mutagenic chemical(s) in these particles and may suggest the elimination of toxic compounds in future tire production.

4.

GLANDULAR HAIR SECRETIONS IN LARVAE AND PUPAE OF THE BEETLE *DELPHASTUS*: CHEMICAL COMPOSITION AND ECOLOGICAL ROLE

Laura Eckman ‘09
Faculty Sponsor: Scott Smedley
Frank Schroeder PhD, Department of Chemistry and Chemical Biology, Cornell University

Glandular hairs, cuticular structures with droplets at the tip, are present in certain insect species. In some cases, secretions from glandular hairs serve a role in deterring predators. Analyses of several of these secretions from butterfly caterpillars and beetle pupae have led to the discovery of novel chemicals. Whereas previously studied beetle species possess secretory hairs only in the pupal stage, these hairs are found in both the larval and the pupal stages of ladybird beetles in the genus *Delphastus.* The chemical makeup and ecological function of *Delphastus* secretions is unknown. To investigate *Delphastus* glandular hairs, these beetles will be raised in the lab on whiteflies, a common agricultural pest. The whiteflies will be grown on collards, tobacco, and kidney beans. Nuclear Magnetic Resonance (NMR) will allow us to determine the chemical composition of *Delphastus* secretions from both the larval and the pupal stages. It is possible that the secretions have a unique composition in each the larval and the pupal stage; additionally, each could contain novel chemicals. To determine whether these secretions deter predators, bioassays involving beetles with and without droplets will be performed using the predatory ant

Crematogaster lineolata. Further information regarding these secretions may be used to understand topics including the ecology of predator-prey relationships, the use of *Delphastus* as a biological control agent, and insect evolution.

5.

OBSERVING PHAGOCYTIC MEMBRANES WITH THE FLUORESCENT DYE FM4-64

Emily Eisenberg '06
Faculty Sponsor: Kathleen Archer

In *Elysia chlorotica* sea slugs, chloroplasts from the alga *Vaucheria litorea* are retained in the slug's digestive cells and continue to photosynthesize for up to 9 months. Slug digestive cells phagocytose ingested algal material and the phagosomes fuse with lysosomes to be digested, yet this does not occur with chloroplasts. The absence of a phagocytic membrane surrounding the chloroplasts inside the digestive cells may explain why the chloroplasts are not digested with the rest of the algal cell. We tested the red fluorescent dye FM4-64 as a phagocytic membrane indicator. *Tetrahymena*, a protist that is simpler than *E. chlorotica*, was used to establish the FM4-64 staining technique. *Tetrahymena* were starved and stained with FM4-64 and fed 3.5% India ink. *Tetrahymena* ingested ink particles, making it easy to see when phagocytosis had occurred. We took fluorescent photographs to determine whether FM4-64 staining was consistent with phagocytosed ink. FM4-64 staining was found to be consistent with ink vacuoles in *Tetrahymena*, suggesting that FM4-64 is a viable method for detecting phagocytic membranes in *E. chlorotica.*

6.

MODIFICATION OF DROSOPHILA SERRATE- NOTCH INTERACTION BY SPECIFIC INHIBITION OF *O*-FUCOSYLATION

David Frederick '06
Faculty Sponsor: Robert Fleming

The Notch pathway is a signal transduction pathway involved in the regulation of cell fate decisions during the development of many organisms. Activation of the Notch receptor by the ligands Delta and Serrate is known to be regulated by a number of glycosyltransferase enzymes, which add oxygen-linked glycans to repeating EGF-like regions of these proteins. In an effort to determine the significance of specific O-fucosylation sites to Notch activation by Serrate, modifications were made to the *serrate* gene in *Drosophila melanogaster*, eliminating the fucosylation site on EGF 12. The *serrate* cDNA was digested with various restriction endonuclease enzymes in order to isolate the region coding for EGF 12, in which one codon was altered by PCR mutagenesis. Standard techniques were used to clone the plasmids within *Escherichia coli*. The modified gene was then ligated back together and placed in a *Drosophila* transformation vector, which will be injected into embryos and expressed in transformant flies. The larval imaginal wing discs of the transformants will be dissected and assayed for modified Serrate signaling. Results are pending.

7.

CHEMICALLY PROTECTED INSECTS IN THE DIET OF THE NORTHERN CRESTED CARACARA

Isabel Gottlieb ‘09
Faculty Sponsor: Joan Morrison

The Northern crested caracara (*Caracara cheriway*) ranges throughout Central and South America and occurs in an isolated population in south-central Florida. The caracara is an opportunistic forager, feeding on live prey as well as carrion, where they potentially ingest a variety of chemically protected insects that are commonly associated with carrion. Caracaras, like other raptors, regurgitate indigestible prey remains in the form of pellets. We studied the potential relationship between the presence of chemically protected insects and plant material in the pellets of the Northern crested caracara in Florida. We dissected 116 pellets collected at 49 caracara nests between 1994 and 1999, and 200 pellets collected from non-breeding caracaras at a communal roost in 2001. Insects were identified by heads, elytra and pronota, and plant content was recorded using five categories indicating general percent cover. Preliminary data analysis of pellets collected form breeding birds suggests a weak positive relationship between average number of chemically protected insects whose protective chemicals are known and percent plant content. However, when all insects thought to be chemically protected but whose protective chemicals are unknown were included in analysis, a stronger positive relationship was found. These findings suggest a possible role of plants in counteracting the toxins contained within chemically protected insects ingested by caracaras. Further research is suggested to understand how the caracara is able to tolerate these chemical substances and the possible role of plant material.

8.

THE AMPLIFICATION OF CHLOROPLAST DNA IN THE GREEN ALGA *CODIUM FRAGILE* USING CHLOROPHYTA UNIVERSAL PRIMERS

Paula Guzman ‘06
Faculty Sponsor: Kathleen Archer

Sea slugs in the genus *Elysia* feed on algae, digesting everything except the chloroplasts. *Elysia chlorotica* is known to consume the alga *Vaucheria litorea* and maintain the chloroplasts in a symbiotic relationship and use them to harvest energy. This sea slug is found at Menemsha Pond in Martha’s Vineyard and while most of the slugs are found entangled within *Vaucheria* filaments, some are found in a part of the pond where only *Ulva clathrata* is found. In order to assess whether the slugs consume this other alga, we chose to perform a molecular analysis of diagnostic DNA sequences for *Ulva* and *Vaucheria*, using PCR to amplify the regions of interest. Since *Ulva* is a green algae, we used universal primers for Chlorophyta (green algae) developed by Provan. However, before using the primers on chloroplasts extracted from sea slugs, we wanted to verify that our system worked by amplifying DNA from an algal species used by Provan. We also tested 3 separate methods of preparing algal DNA for the PCR reaction and tested a range of annealing temperatures. Experiments are in progress.

9.

EFFECTS OF SUPPLEMENTAL FEEDING ON BEHAVIOR OF FREE-RANGING WHITE-TAILED DEER

Desiree Hernandez ‘06
Faculty Sponsor: Michael O'Donnell

Supplemental feeding of deer creates a concern because it could affect deer behavior in ways that might increase the risk of disease transmission by congregating deer at high densities. To test whether supplemental feeding leads to behaviors that increase disease transmission, we used infrared motion sensor cameras to observe deer at a control site and two experimental feeding sites at the Trinity College Field Station. The two feeding treatments were provision of 7.5 kg loose corn and 30 kg of loose corn, each for a two-week time period. Analysis of preliminary results show that supplemental feeding had no significant effect on whether deer visited the feed sites, or on whether they congregated at higher than normal numbers, however there was a significant increase in visits by other small mammals. The mean number of deer per feeding event did not differ among the three feeding treatments. Preliminary analysis suggests that supplemental feeding does not significantly affect deer feeding behavior. As more data are obtained, further data analysis will be performed and those results will be presented in this poster.

10.

CYTOCHROME P450 MONOOXYGENASES IN *M. TUBERCULOSIS*

Corazón Irizarry ‘09
Faculty Sponsor: Hebe Guardiola-Diaz

Drug-resistant strains of *Mycobacterium tuberculosis* have quickly developed, and are increasingly difficult to treat. It is imperative that research continues into the genome of *M. tuberculosis* to find new targets in order to produce new drug therapies. In an attempt to develop the tools necessary to study CYP140, one of twenty cytochrome P450 proteins in *M. tuberculosis*, DNA samples of *Mycobacterium tuberculosis* genomic DNA were used as template for amplification through a Polymerase Chain Reaction (PCR). Three solutions of 200 μl were prepared for the PCR: one with the two primers necessary to complete the reaction and two controls, each containing only one of the two primers. Aliquots of 16 μl of each solution were set up into three rows of twelve reaction tubes. The PCR was run at temperatures ranging from 60 to 70ºC. The reaction products were resolved in an agarose gel and separated by electrophoresis. Digital photographs of the gels showed no product; none of the four PCRs was successful, despite volume variations for the buffer, $MgCl_2$ and primers. The current focus is on using cosmids, fractions of the genome, of *M. tuberculosis* that encode the CYP140 protein and all other CYPs in the *M. tuberculosis* genome instead of the entire genome to amplify the sequence of DNA that encodes for these proteins. If the amplification succeeds, the product will be inserted into an expression plasmid to be introduced into *Escherichia coli*, where the protein could then be synthesized to study its biochemical properties and function in *Mycobacterium tuberculosis*. A critical role for this protein, or any of the remaining cytochrome P450s, in the pathogen could enable the development of a new tuberculosis treatment.

11.

NOTCH REGULATION BY SERRATE MOLECULE

Rachel Reece ‘09, Rumen Vasilev ‘09
Faculty Sponsor**:** Robert Fleming

The Notch signaling pathway is an evolutionarily conserved cell-to-cell communication system which is involved in the differentiation of tissues in a variety of organisms. In Drosophila, the Serrate molecule, a ligand for the Notch system, has been found to regulate Notch activity. Previous work suggested that a deletion of a hydrophobic region and a part of the 5th and 6th EGF repeats in the Serrate molecule alters the way Serrate regulates Notch. Serrate can either activate Notch on adjacent cells or inhibit Notch when both are expressed on the same cells. However, the mutant form no longer inhibits Notch on the same cells. In order to confirm the actions of the mutant, the mutant construct was moved from the third chromosome to the second chromosome, through a series of genetic crosses. The pure homozygous line showed that the expression of Notch on the second chromosome, with a deletion of the hydrophobic region and the 5th and 6th EGF repeats, caused the same expression of Notch as when it was located on the third chromosome. This suggests that the modified Notch activity is caused by a mutation in the gene and not the location of the insert. Furthermore, another project is underway to test the previous result by using recombinant DNA technology to create a modified Serrate molecule. In this new molecule only the entire 6th EGF repeat, where the hydrophobic region is located, is removed. By discovering more about how the Notch signaling pathway works in segregating every tissue type, drugs and treatments can be targeted for diseases caused by defects in Notch signaling.

12.

USING MOLECULAR SCATOLOGY TO DISCRIMINATE BETWEEN THE SYMPATRIC EASTERN COTTONTAIL (*SYLVILAGUS FLORIDANUS*) AND NEW ENGLAND COTTONTAIL (*S. TRANSITIONALIS*) IN CONNECTICUT

Kevin Scesa ‘06
Faculty Sponsor: Michael O'Donnell

The Eastern cottontail (*Sylvilagus floridanus*) was introduced into the Northeast in the early 20th century. The New England cottontail (*S. transitionalis)* was originally not affected by this introduction due to the abundance of early successional habitat, but in the second half of the century this once abundant native cottontail became displaced by the Eastern. Consequently, the New England cottontail has gained the status of a species of “special concern”. There have been surveys that identified populations of New England cottontails in eastern Connecticut. Consequently, the goal of this experiment was to determine if New England cottontails are present at the Trinity College Field Station (TCFS). Unfortunately, monitoring cottontails proves to be quite difficult, not only because they are elusive, but also because alive, they are morphologically quite similar, and can only truly be differentiated upon postmortem skull analysis. However, the use of cottontail fecal pellets, also morphologically indistinguishable, provides a non-invasive way to obtain the defecator’s DNA to ultimately determine species of origin. Pellets were obtained after snowfalls throughout the winter from either TCFS or the CT-DEP. Additionally, cameras were placed in quadrants at TCFS with known cottontail activity with lettuce/carrot mixture coated with rabbit lure. The pellets were then frozen until DNA extraction was performed with the Qiagen stool mini kit. Following extraction a 565bp fragment of mtDNA was amplified via PCR that utilized primers that annealed to the threonine tRNA gene (L15934) and the conserved sequence block of the D-Loop (H16498). A known restriction site

for *NlaIII* in the PCR product was exploited for differentiation between species. Thus, we present the results of DNA extraction from fecal pellets and the subsequent amplification. The banding pattern resulting from the restriction enzyme digest allows for the differentiation between an Eastern and a New England cottontail fecal pellet.

13.

DIFFERENCES IN THE DIET OF BREEDING AND NON-BREEDING CRESTED CARACARAS IN FLORIDA

Stephen Sullivan ‘09
Faculty Sponsor: Joan Morrison

The Northern Crested Caracara (*Caracara cheriway*) is a raptor that occurs widely in South and Central America and also occurs as a small and isolated population in south-central Florida. Although the caracara’s reproductive biology is generally understood, information on its diet is limited to types of vertebrate prey consumed during the breeding season. We investigated types and abundances of insects in the diet of caracaras in the Florida population during the breeding and non-breeding seasons. Like other raptors, caracaras regurgitate the indigestible parts of prey in the form of pellets. We dissected 200 pellets from non-breeding caracaras collected at a communal roost and 116 pellets collected from 49 nests during the breeding season over 3 years, and insect remains were identified. The insect community in pellets from breeding Caracaras was more diverse, but contained fewer insect families than the insect community in pellets from non-breeding Caracaras. Although more insect families were represented in pellets from non-breeding birds, this community was dominated by high abundances of *Scarabaeidae*, a beetle commonly associated with carrion. This finding suggests that non-breeding birds may be foraging opportunistically in less optimal habitats thus rely more heavily on carrion. The lower abundance of *Scarabaeidae* in pellets of territorial breeding caracaras suggests that they are feeding on more live prey and less carrion because the young require fresher food. Although these results contribute to a better understanding of the Crested Caracara’s diet, more research is needed to better understand these diet differences.

14.

THE EFFECT OF PREDATION RISK ON SMALL MAMMAL ACTIVITY

Elisabeth Treado ‘06
Faculty Sponsor: Michael O'Donnell

Predation risk can affect small mammal community structure, by affecting prey behavior, or prey population dynamics. Small mammals may change their every day behavior with the addition of predation risk. My experiment was testing the effect of perceived predation risk on rodent activity. Predation risk was manipulated by adding predator urine. The goals of my experiment were to assess predation risk on small mammal behavior by using commercially bought predator urine. I also wanted to find out whether track tubes can be used to assess changes in behavior of rodents. I set up three double transects in three areas (grids) of Church Farm, located in Ashford, Connecticut. Each double transect consisted of 10 track tubes, placed approximated 20 meters apart. The four treatments were: control (no urine), bobcat urine, red fox urine and fisher urine. Results showed that the rodents were unaffected by the predator urine. There were many possible explanations for why the experiment showed the results it did. One explanation was that the experiment was not sensitive enough, and that maybe three double transects were not enough. Another possible explanation is that the rodent population is far too high to show changes due to predator urine.

15.

ASSESSING CHLOROPLAST DAMAGE THROUGH USE OF TRYPAN BLUE

Muhammed Umair '09
Faculty Sponsor: Kathleen Archer

A family of sea slugs called *Elysiidae* are able to incorporate chloroplasts from a variety of algae in the sea and become photosynthetic. In order to find how these sea slugs are capable of accomplishing such a task, many researchers have been collecting the slugs and dissecting them in order to see what type of digestive components the slugs have. However, there haven't been any studies done on chloroplast integrity or the ability of plastids to withstand the digestive processes against the sea slug's digestive system. In order to test this, chloroplast will be subjected to harsh treatment which can result in the chloroplast breaking open. Trypan Blue is a dye that can quench the fluorescence of chlorophyll, a protein in chloroplast that usually fluoresces when light hits it. By extracting chloroplast and submerging them in Trypan Blue dye solution, we can apply the treatment then evaluate how many chloroplast survive based on their ability to fluoresce. To examine this effect, chloroplasts from the algae *Bryopsis hypnoides* were extracted in extraction buffer, which contained a 0.4% concentration of Trypan Blue Dye in the solution. Once the chloroplasts were extracted, the entire solution was centrifuged for one minute at 10,000 rpm. The supernatant was discarded and the chloroplasts were resuspended once again into the extraction buffer containing 0.4% Trypan Blue dye. Types of treatments that were carried out include a water treatment and a freeze treatment. Using these treatments, the structural integrity of the chloroplasts was tested by assessing whether or not Trypan Blue was able to quench the fluorescence of chlorophyll, which was accomplished with the use of a fluorescent microscope. The experiment results show that Trypan Blue is an excellent indicator of damaged chloroplast

16.

A TAXONOMIC, CHEMICAL, AND ECOLOGICAL STUDY OF GLANDULAR HAIRS IN CARERPILARS OF TWO COLIADINE BUTTERFLY SPECIES

Laurel Valchuis '07, Francis Sullivan '06
Faculty Sponsor: Scott Smedley
Frank C. Schroeder, Cornell University, Department of Chemistry and Chemical Biology

Caterpillars often defend themselves against predators by means of chemicals. Glandular hairs are one form of delivery for chemical defenses. These hairs are hollow extensions of the insect's cuticle and bear a droplet at the tip. Prior studies in our lab have shown certain species in the lepidopteran family Pieridae posses these glandular hairs that produce novel chemicals. We are currently examining two species of the pierid subfamily Coliadinae, *Phoebis sennae and Eurema nicippe.* For these two species, our goal is to determine the presence or absence of secretory hairs. If present, we will then determine the secretions' chemical composition and biological function. For both species, we photodocumented each instar (developmental stage between molts). We found that *Phoebis sennae* had glandular hairs from the second through the fifth instar, while *Eurema nicippe* possessed them in all five instars. To determine the respective secretion's chemical composition, we collected 4 whole body samples (totaling 230 larvae) for *P. sennae* and 6 samples (totaling 646 larvae) for *E. niccipe*. The molecular structure of components will be determined by NMR. To determine if these droplets provide a means of chemical protection we will conduct bioassays of the caterpillars with the predatory ant *Crematogaster lineolata*. Our results will be compared to those for other species in the family Pieridae.

CHEMISTRY

17.

ANALYSIS OF FLUORIDE AND CHLORIDE CONTENT IN HARTFORD COUNTY DRINKING WATER

Nicole Benjamin ‘08, Julianne Boccuzzi ‘08, Emmy Handy ‘08
Faculty Sponsor: David Henderson

Water purification plants add chemicals in varying concentrations to drinking water for health and safety reasons. Two inorganic anions commonly found in drinking water are chloride and fluoride. While maximum contaminant levels are set by law, the concentration of these anions varies depending on location (i.e. what treatment facility the water comes from). To determine the varying concentrations of fluoride and chloride in cities and towns throughout Hartford County, water samples were collected from the following 20 towns or cities: Hartford, Manchester, East Hartford, West Hartford, Farmington, Newington, Avon, Wethersfield, Glastonbury, Bloomfield, Windsor, South Windsor, East Windsor, Windsor Locks, Enfield, Simsbury, and New Britain. The water samples collected were filtered and analyzed by ion chromatography and compared to the calibration curve to determine the fluoride and chloride anion concentration.

18.

NEW SYNTHETIC ROUTE TO (S)-5,5'-D-TERT-BUTYL-N-(9-FLUORENYLMETHYLOXYCARBONYL)-4-CARBOXYGLUTAMATE

Nick Callahan ‘06, Frank Mieles ‘07
Faculty Sponsor: Richard Prigodich

Solid-phase peptide synthesis is an important source of biologically active peptides. Peptides that include unusual amino acids are expensive to produce due to the high cost of purchasing N-terminal- and side-chain-protected rare amino acids. 4-Carboxyglutamic acid (gla) is such a rare amino acid. There are two published synthetic approaches to synthesizing 4-carboxyglutamic acid in the appropriately protected form for use in solid-phase synthesis. One method activates the hydroxyl side chain of L-serine rendering it as a suitable leaving group for attack of the 3-position with a malonate anion. The other method starts with D-serine. The 1-carboxylate is reduced to an aldehyde then attacked with malonate anion. The hydroxyl group at the 3-position is oxidized to a carboxylic acid. These two methods were studied and a comparison of the mechanisms and relative utility of the two approaches was made. Based on the shortcomings of these approaches a new synthetic route was devised. This new route uses a reaction of protected malonic acid with 2-bromomethyl-1,3-dioxolane to create the backbone gla structure. The 2-carbon of the dioxolane becomes the gla-carbon. This carbon is converted in turn into an aldehyde, imide, cyanoamine and finally the protected gla amino acid, (S)-5,5'-D-tert-butyl-N-(9-fluorenylmethyloxycarbonyl)-4-carboxyglutamate

19.

DEVELOPMENT OF THE SUPERCRITICAL FLUID EXTRACTION AND QUANTIFICATION OF ROTENONE IN HAIR TO ASSESS OCCUPATIONAL EXPOSURE

Joseph Cavar ‘06
Faculty Sponsor: Janet Morrison

Rotenone is a naturally occurring compound extracted from the roots of leguminous plants which is incorporated into various botanical pesticide formulations for use in gardens and on food crops. Recent animal studies have suggested a link between long-term exposure to rotenone and the development of symptoms consistent with Parkinson's Disease. The aim of the present study is the development of an analytical method to assess rotenone exposure through hair analysis. Hair provides a non-invasive testing medium for evaluating chronic exposure to toxins, and has been used as a toxicological specimen to detect chronic illicit drug use due to its wide detection window and the ease and safety associated with sample collection, storage, and transport. A supercritical fluid extraction (SFE) method was developed and optimized for isolation of rotenone. Analyte quantification was performed by reverse phase HPLC and LC-MS with external standard calibration. SFE recovery data is presented for (1) initial spike-recovery experiments designed to optimize SFE conditions of temperature, pressure, fluid composition, and extractant volume and maximize rotenone solubility from an inert matrix; (2) spike-recovery experiments from negative human hair designed to evaluate matrix effects and identify potentially interfering hair coextractables; (3) application of optimized extraction conditions to drug-fortified hair; and, finally (4) analysis of hair obtained from rats subjected to chronic rotenone exposure. Future work will focus on reducing detection limits through the use of LC-MS, with the ultimate goal of assessing exposure in humans who are at especially high risk of environmental contamination through occupational contact.

20.

SYNTHESIS OF TRIPEPTIDE BOC-LYS(CBZ)-ALA-LYS(CBZ)-NHCH3

Neena Chakrabarti ‘09
Faculty Sponsor: Timothy Curran

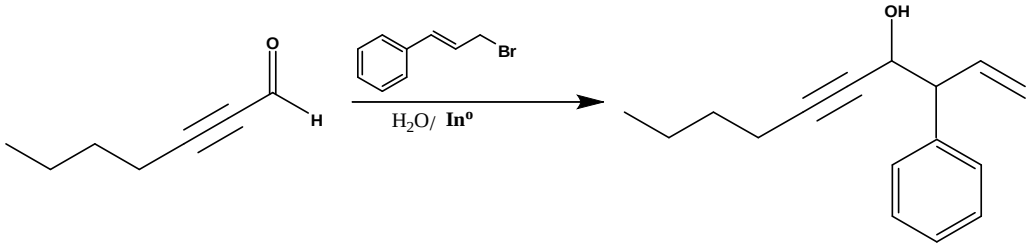
The coupling of transition metals with peptides can result in the formation of secondary structures. The ability to predict the formation of these secondary structures and define the shapes of the peptides may aid in the creation of proteins which might bind to DNA and fight terminal illnesses, such as cancer. The goal of this step in research is to successfully couple tungsten to a tripeptide and analyze the resulting structure of the peptide. In order to begin this secondary structure analysis, a tripeptide was synthesized using Boc-Lys(Cbz)-OSu, a lysine derivative, as the starting material. A series of reactions were run in which the amino acid derivatives Boc-Ala-OSu and Boc-Lys(Cbz)-OSu were used to create the Boc-Lys(Cbz)-Ala-Lys(Cbz)NHCH3 tripeptide. Subsequently, the tripeptide was hydrogenated for 48 hours with the catalyst palladium on carbon, in order to remove the two Cbz groups. The most recent reaction involved the replacement of the Cbz groups with Poc groups. Although it is predicted that the coupling of this tripeptide with tungsten will result in a gamma turn, this part of the procedure has not been carried out yet. Future work will be directed toward improving the synthesis of the tripeptide and completing the metal coupling procedure in order to analyze the resulting secondary structure of the peptide.

21.

INDIUM-PROMOTED COUPLING OF HEPT-2-YNAL ALDEHYDE WITH CINNAMYL BROMIDE

Kwame Frimpong ‘08
Faculty Sponsor: Thomas Mitzel

Knowledge of flow of electrons during synthetic reactions is crucial in chemistry as it helps construct models that predict product formation. This study involved indium-promoted coupling of hept-2-ynal aldehyde with cinnamyl bromide using a variety of solvents and reaction conditions. In addition, the kinetics (rates) of the reaction is being studied to determine when the reaction goes to completion. The general reaction is shown below:



This poster will describe the methods used, products obtained and the electronic models derived from the data collected.

22.

***IN VITRO* DEGREDATION OF COCAINE, MORPHINE, METHAMPETHAMINE, AND PCP BY TYPICAL PUTREFACTIVE BACTERIA**

Katharine Harte ‘08, Kathryn McColl ‘08, Jordan Fisher ‘08
Faculty Sponsor: Janet Morrison
Robert Powers PhD, Connecticut Department of Public Safety

The postmortem fate of drugs-of–abuse in decomposing bodies is not clearly understood. During autopsy, the investigator screens for the typical parent drugs and known metabolites. Many of the typical bacterial species which are present during the putrefactive interval of decomposition are capable of catabolizing a variety of organic species; consequently, it is hypothesized that drugs-of-abuse which may be present at the time of death may be similarly degraded by these bacterial species. Such post-mortem bacterial drug metabolism could significantly alter the expected profile of human drug metabolites that are routinely screened for during toxicological analysis of autopsy specimens. The fundamental goal of the present project is to investigate the *in vitro* degradation of cocaine, methamphetamine, morphine, and PCP by typical putrefactive bacteria. Specific underlying goals include the quantitation of drug loss as a function of time and the identification of non-typical (non-human) metabolic products which could serve as marker compounds for the target drugs-of-abuse.

23.

ANALYSIS OF ARCHAEOLOGICAL CERAMICS VIA SCANNING ELECTRON MICROSCOPY

Adam Hill, ‘08
Faculty Sponsors: Ann Lehman, Maria Parr

Archaeometry is the science of history. It is the application of the physical sciences to the study of artifacts. While some understanding of an object comes from how people used it, or its significance to a culture as a whole, much of this knowledge is lost with the march of time. The amount that can be learned from a careful examination of the physical properties and structure of an artifact is astounding, be it the methods of construction, the conditions of the local soil, or the skills of the artisans of the period.

In this project, a number of archaeological pottery fragments were examined using a scanning electron microscope (SEM) equipped with an X-ray energy dispersive spectrometer (EDS). The SEM/EDS analysis served two purposes: the samples were imaged in great detail and their elemental compositions were obtained. The data showed differences between ancient and relatively modern ceramics, both in the composition of the aluminosilicate matrix and the size and type of temper material employed (e.g. SiO_2 or $CaCO_3$) in the construction of each piece. In addition, analysis of the surface pigment of one fragment showed the presence of lead, which is most likely indicative of “lead white,” $2Pb(CO_3)_2$ $Ph(OH)_2$, a pigment common in ancient times.

24.

TEMPERATURE AND SOLVENT EFFECTS UPON THE REGIOCHEMISTRY AND RATE OF INDIUM PROMOTED COUPLING REACTIONS BETWEEN PROPARGYL ALDEHYDES AND CROTYL BROMIDE

Kristin Kremer ‘07
Faculty Sponsor: Thomas Mitzel

The stereoselectivity and reaction pathway of the indium promoted coupling reaction involving crotyl bromide and propargyl aldehyde were studied using different temperatures and solvents. The reaction yielded a high amount of the diastereomer product. Based upon the solvent and temperature conditions used, the reaction may have proceeded as a 1,2 or a 1,4 Michael Addition. Water and NMF were the solvents used. At room temperature the reaction rate in both solvents was the same, but when run at 0°C in NMF, the rate of the reaction increased. When the reaction was run at 50°C the rate of the reaction also increased slightly. Data acquired from the GC-MS was used to follow the progress of the reaction.

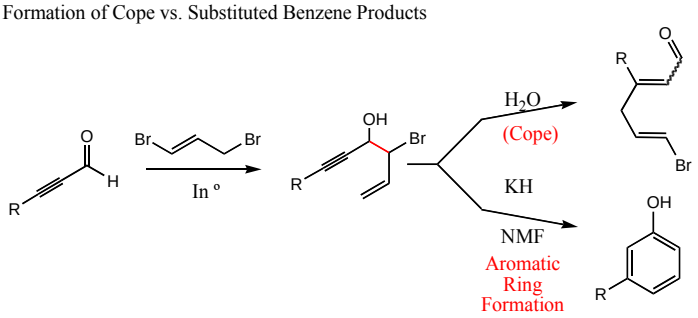
25.

CASCADE REACTIONS ENROUTE TO META-SUBSTITUTED BENZENE RINGS

Claire Lawlor ‘06
Faculty Sponsor: Thomas Mitzel

Previous studies in our laboratory have shown that allyl-indium metal organometallic complexes add 1,2- to propargyl aldehydes. Studies have also shown that these systems may rearrange via a Cope pathway to give an alpha, beta-unsaturated aldehyde as shown in Scheme 1. In an effort to increase the efficiency of the Cope rearrangement, 1,3-dihalopropene moieties were utilized as nucleophilic species in the system. Introduction of the dihalo species resulted in the formation of a substituted benzene structure when NMF was chosen as the solvent. These reactions, along with the mechanistic pathways of their formation, will be discussed.

Scheme 1: Formation of Cope vs. Substituted Benzene Products



26.

INDIUM MEDIATED PETERSON OLEFINATION

Jacqueline McKenna ‘06
Faculty Sponsor: Thomas Mitzel

The Peterson olefination is an important organic reaction, which transforms carbonyl groups into alkenes by taking advantage of the strength of silicon-oxygen bonds. Furthermore, the stereochemistry of the resulting alkene can be easily controlled by treatment with either acid or base. However, this reaction requires fairly harsh conditions since a Grignard reaction is used to form the alpha-silyl carbanion. In this study, the use of indium in replacement of magnesium for the formation of the alpha-silyl carbanion was studied. Anhydrous conditions may be unnecessary for the completion of this reaction, since indium can react under aqueous conditions.

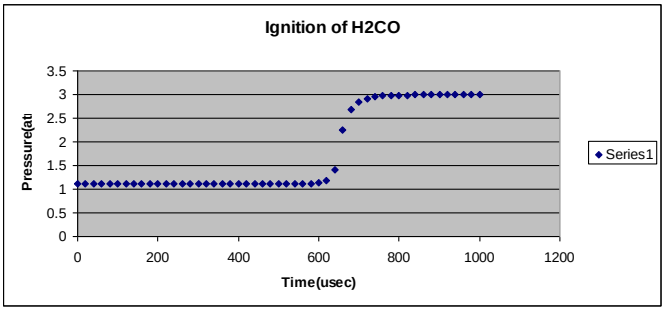
27.

CURRENT RESEARCH ON THE SHOCK TUBE

Scott Mussmann ‘09
Faculty Sponsor: John Mertens

Intro: This research project focuses on two objectives: learning about how shock tubes work and doing computational work involving gas chemistry. A shock tube is a device that heats gases up nearly instantaneously to a controlled temperature using supersonic shockwaves.
Methods: Given test gas initial temperatures, pressures, and shock wave velocities, final temperatures and pressures were calculated using conservation of mass, momentum, and energy equations for a compressible fluid. In other computational work, the computer program Chemkin – a differential equation solver– was used to model shock tube reactions involving combustion of hydrocarbons. Graphs were then plotted to determine which species demonstrated growth or decay over time. The reaction pathways of carbon and hydrogen forming carbon dioxide and water were also examined. The time of ignition of a reaction – the time at which the pressure increases dramatically – was also calculated with Chemkin.

Sample Results: Argon at an initial pressure of 0.02 atm and temperature of 300K shock-heated by a wave velocity of 1100 m/s produces a final pressure and temperature of 1.32 atm and 2759K respectively. The figure below shows a typical ignition calculation for Syngas, a mixture of H_2 and CO produced from coal. The calculated time of ignition below is 630 μsec.



Discussion and broader implications: Syngas can be a clean and domestically available source of energy in the future. Design of detailed models of its combustion process will aid future design of Syngas power plants.

28.

INDIUM-MEDIATED COUPLING ALDEHYDE REACTIONS

Jonathan Nyce ‘09
Faculty Sponsor: Thomas Mitzel

Indium metal is becoming very popular for use as a catalyst in Barbier reactions because of its utility in stereo- and regio-selectivity under mild conditions. Past research using n-methylformamide has shown that polar solvents tend to yield high stereoselectivity in product formation. Dimethylsulfoxide is also a very polar solvent and has the potential to promote stereoselectivity. This poster will describe the use of dimethylsulfoxide as a solvent in the indium promoted coupling reactions of propargyl aldehydes and allyl bromide. Regio- and stereoselectivity in product formation as a consequence of the solvent use will be discussed. The use of lewis Acid catalysts and their effects on product formation will also be shown.

29.

ASSESSING THE PURITY OF TUNGSTEN-ALKYNYLPEPTIDE COMPLEXES

Sarah Pitts ‘07
Faculty Sponsor: Timothy Curran

In many experiments synthesis of a new molecule is only half of the battle. After synthesis the new compound must be purified, and the structure of the compound must be determined. Both thin layer chromatography and high performance liquid chromatography can be used to asses the purity of a product. If a product is determined to be impure, the various components can sometimes be separated using flash chromatography. After separation the structure of the individual components can be analyzed using NMR, and it is possible to determine if the product of a synthesis is the desired product. In this series of experiments the purity of tungsten-alkynlypeptide complexes previously synthesized was determined.

30.

NITRATE-NITRITE LEVELS IN CONNECTICUT WELL WATER

Sarah Pitts ‘07, Jon Weiss ‘07
Faculty Sponsor: David Henderson

Nitrate and nitrite molecules can cause severe health problems in infant children. They are commonly found in many agricultural products including fertilizer. The chemicals can migrate from lawns and crops to well water. Samples from wells of Connecticut residences were analyzed in order to determine the levels of nitrate and nitrite present using ion chromatography. These results were compared to the EPA regulations to ensure they meet the national safety standards. Our findings will be presented.

31.

ANALYTICAL EXAMINATION OF THE FAT CONTENT IN MAYONNAISE

Kelly Rice ‘06, Sarah Sweatt ‘07
Faculty Sponsor: David Henderson

Saturated fats are known to increase blood cholesterol levels. Increased blood cholesterol levels are the root or coronary heart disease caused by athlersclerosis. In addition, the excessive intake of saturated fats is linked to many chronic health conditions such as obesity, and certain types of cancer. This research sought to analyze and compare the fats in mayonnaise and what are advertised as healthier mayonnaise substitutes. Extraction of fats from samples was accomplished by supercritical fluid extraction (SFE) with CO2 solvent. The extracted fats were then methylated and run through gas chromatography (GC). The GC analysis will determine how much saturated, unsaturated, and polyunsaturated fat is present in the samples. In addition to analyzing the fat components of mayonnaise samples this study attempted to compare the SFE method to simple solvent extraction. The anticipated results for this experiment include fat contents correlating to the advertised nutrition facts for each sample. We further hope to support previous studies suggesting SFE is an accurate and efficient method for fat analysis in food products such a mayonnaise.

32.

SYNTHESIS OF BETA-TURNS USING 1,1’-FERROCENEDICARBOXYLIC ACID

Andrew Rosenau ‘07
Faculty Sponsor: Timothy Curran

Beta-turns are believed to nucleate the formation of beta-sheets which make up large portions of proteins. Being able to control and predict beta-turns has many applications in protein chemistry including advancements in dug development. In order to form a beta-turn on small amino acid chains we had to hold the structure rigid; 1,1’-ferrocenedicarboxylic acid was used. We sought to determine if this template would potentially lead to formation of a beta-turn.

33.

DETERMINATION OF ETHANOL CONTENT IN VARYING BRANDS AND STYLES OF BEER BY GAS CHROMATOGRAPHY

Andrew Rosenau ‘07, Adrian Estepa ‘07
Faculty Sponsor: David Henderson

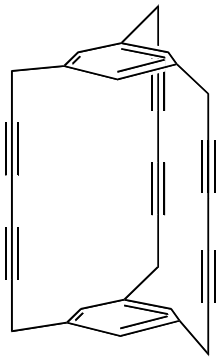
The objective of this experiment is to determine the ethanol content in various brands of beer (i.e Keystone, Sam Adams, Coors) as well as various styles of beer (i.e light, lager, ale). By creating a dilute solution of decarbonated beer (done by filtering several times) with deionized water and a n-propanol standard, the beer was analyzed by gas chromatography to determine the relative amount of ethanol. Once all beers have been analyzed, a comparison can be made between the amount of ethanol that was discovered in the various beers, the reported amount of ethanol on the packages of the beers, and the most popular consumed beers studied. It is expected that the lagers and heavier beers will contain more ethanol than the light beers.

34.

TOWARD THE SYNTHESIS OF THE HOMOCONJUGATED CAGE $C_{30}H_{18}$: MODEL STUDIES FORMING UNSYMMETRICAL DIYNES

Daniel Shepherd ‘06
Faculty Sponsor: Thomas Mitzel

Figure 1. $C_{30}H_{18}$



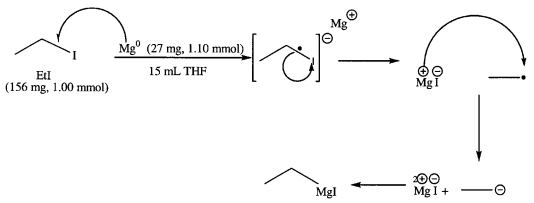
The cyclophane $C_{30}H_{18}$ (Figure 1) exhibits homoconjugation in three dimensions. This electron delocalization, coupled with the ability of the molecule to trap electrophilic guest atoms, may impart interesting properties such as superconductivity, making this an interesting synthetic target. This poster will describe our studies towards the synthesis of $C_{30}H_{18}$ using unsymmetrical diynes.

35.

DETERMINATION OF LOCATION AND EFFECTS OF METAL ION INTERACTIONS ON DNA THROUGH ANALYSIS OF CHEMICAL SHIFTS IN ^{31}P NMR SPECTROSCOPY

David Slatkin ‘08
Faculty Sponsor: Richard Prigodich

At present there has been an influx of interest into antisense oligonucleotides as a theoretical form of treatment for genetic disorders, but very little research has been conducted into the interactions betwixt oligonucleotides and metal ions. In this experiment twelvemer oligonucleotides will be synthesized with a 3’-methylene-modified oligonucleotide as a marker for determination of location and effect of magnesium metal interactions with the twelvemer oligonucleotide. Through this it is possible that we can gain better insight into oligionucleotide and metal interactions resulting in a better model for antisense oligonucleotide drug synthesis. This study has thus far focused on refining the experimental protocol in relation to the final synthetic step of creation of 3’-methylene-modified oligonucleotide using the simplified system of grignard formation between ethyl iodide and magnesium metal. The general mechanism is illustrated below. This poster will focus on the design and background of this project from research conducted up to this point.



36.

SYNTHESIS OF SYMMETRIC ALKYNYLPEPTIDES AND COORDINATION TO TUNGSTEN COMPLEXES

Whitney Smith ‘07
Faculty Sponsor: Timothy Curran

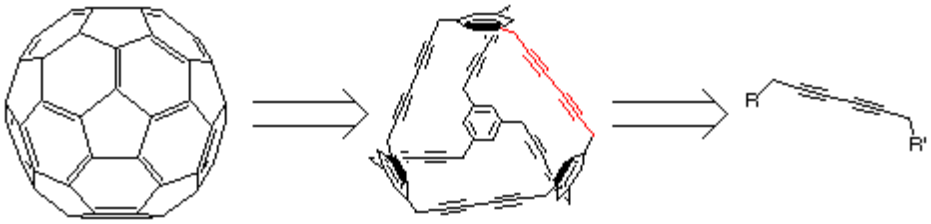
Previous research done in our lab has proven that alkynylpeptides react with the tungsten complex (W(CO)3(dmtc)2, dmtc = dimethylthiocarbamate). The product of this reaction is a tungsten bis-alkynylpeptide complex. This year I prepared the corresponding mono-alkynylpeptide complexes using symmetrical alkynylpeptides. The results of this work will be presented.

37.

SYNTHESIS OF HYDROCARBON CAGES AS PRECURSORS TO FULLERENE FORMATION

Katharine Spencer ‘08
Faculty Sponsor: Thomas Mitzel

Fullerenes have the desirable ability to form endohedral complexes with the inclusion of a “guest” molecule. The size of this guest atom is limited by the size of the individual rings of the fullerene, and requires a significant amount of energy to enter. The synthesis of a hydrocarbon cage as a precursor to Buckminsterfullerene allows for a guest molecule to be incorporated into the cage as it forms, and thus eliminates much of the size and energy requirements needed for traditional methods of forming such complexes. The goal of this research was to continue perfecting the method by which a diyene precursor to the hydrocarbon cage was made. Fullerenes have a largely untapped potential in many fields such as industry and medicine and further research in the rational synthesis of fullerenes with or without a guest molecule will lead to breakthroughs and progress in both fields.



38.

HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY DETERMINATION OF CAFFEINE LEVELS IN POPULAR COFFEES

Jeffrey Sullivan ‘07, Jessica Leandre ‘07
Faculty Sponsor: David Henderson

Seven different types of coffee readily available on campus were characterized for their caffeine content by a quick and efficient HPLC protocol using a 90:10 deionized water/acetonitrile mobile phase. Minimal preparation was performed so as to limit the number of outside factors that could influence the caffeine concentration of the samples. For purposes of ensuring accuracy and reliability of results, quantitation was carried out using both the calibration curve and standard addition methods, with the calibration samples each being submitted for HPLC analysis three times. Weighted to a mean 8 oz. serving size, the coffees were found to have a very broad range of caffeine levels.

39.

THE SYNTHESIS OF PROPARGYL BENZENE AND OTHER ALKYNES TOWARDS THE FORMATION OF FULLERENE HYDROCARBON CAGES

Zuleyka Torres-Morales ‘06
Faculty Sponsor: Thomas Mitzel

In the past, hydrocarbon cages have been formed as precursors to the formation of Buckminsterfullerene, a molecule resembling the structure of a soccer ball. Although the formation of hydrocarbon cages has been successful, it has been performed at high costs. Simpler model systems have been developed to form hydrocarbon cages utilizing less expensive and more simplistic reactions. This poster will describe synthetic methods utilized towards the synthesis of these hydrocarbon cages and Buckminsterfullerene.

40.

STUDY OF CHRONIC PESTICIDE EXPOSURE BY HAIR

Bennett Walker ‘06
Faculty Sponsor: Janet Morrison

Research suggests that pesticides such as 2,4-dicholorophenoxyacetic acid (2,4-D) can result in Parkinsonian like symptoms. However, the research chronically exposed laboratory rats to the pesticides. If humans could be exposed similarly to rats, then they too could develop the same symptoms. In collaboration with Imperial Nurseries in Granby, CT, it was decided that seasonal workers would be tested for chronic exposure to 2,4-D. Testing hair samples for chronic exposure was determined to be the most effective method mainly due to the hair’s long detection window and simplicity. In an effort to examine the effects of 2,4-D with the seasonal workers, an experimental procedure had to be developed and optimized for the most accurate and efficient results. The methods needed for development were collection, extraction and analysis of hair. To collect the hair samples, a preparation hair cutting kit was assembled. Once the hair was collected, the most efficient method of extraction was determined to be supercritical fluid extraction (SFE). The extraction method was chosen because of the superior efficiency possible with SFE. However, in order to obtain the best results, optimization of temperature, pressure, fluid composition and volume was required. Once extracted, an analysis technique needed to be developed. GC-MS proved to be the best method for analysis due to its accurate qualitative ability. Because of 2,4-D’s polarity, pentafluorobenzyl bromide was used as a derivatizing agent, allowing the 2,4-D derivative to run through the column. After completing the development and optimization techniques, the seasonal farm hands from Imperial Nurseries will be tested for chronic exposure to the pesticide 2,4-D. Final analysis will give definitive results to the hazards of long term exposure of 2,4-D.

41.

CROSSLINKING PEPTIDE SIDE CHAINS USING A FERROCENE LINKER

David Webster ‘06
Faculty Sponsor: Timothy Curran

Peptide chemists have long sought workable models for β-sheets that would facilitate an understanding of how sheets are formed and stabilized. Most β-sheet models that have been explored rely on a β-turn element for enforcing the close proximity of the two peptide strands in a β-sheet. A possible alternative approach for generating β-sheet models is to covalently

crosslink an amino acid on one strand with another amino acid on the second strand; this approach does not require the use of a β-turn element. In our laboratory we have been exploring the use of 1,1'-ferrocenedicarboxylic acid as the crosslinking agent. In this presentation, first, the synthesis of peptides that are crosslinked by reaction of 1,1'-ferrocenedicarboxylic acid chloride with amino acid residues possessing side chain amines will be given. Second, the conformational behavior of the ferrocene-crosslinked peptides will be delineated.

42.

CREATING BETA-TURNS USING 1,1' FERROCENEDICARBOXYLIC ACID AS A TEMPLATE

Jonathan Weiss '07
Faculty Sponsor: Timothy Curran

Secondary structure is very important to protein behavior. Proteins are made of polypeptide chains, which can form beta-sheets from hydrogen bonding. Based on previous research in our lab, 1,1' ferrocenedcarboxylic acid was used to create a beta-turn in a dipeptide molecule by cross-linking the side chains of two consecutive aminoalanines. The conformation of the resulting cyclicpeptide will be analyzed using 1H NMR with DMSO titrations. Once the cyclicpeptide incorporating the ferrocene is synthesized additional amino acids can be attached to create a beta-sheet. Progress towards the synthesis of this molecule will be presented.

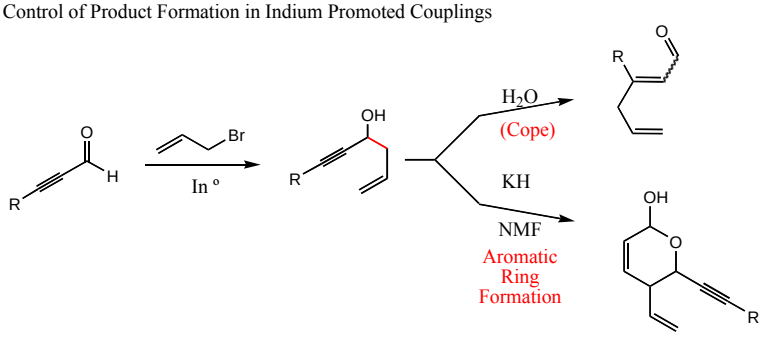
43.

COPE REARRANGEMENTS AND LACTOL FORMATIONS: INDIUM METAL PROMOTED COUPLINGS WITH VERSATILITY

Joe Wzorek '06
Faculty Sponsor: Thomas Mitzel

Formation and control of carbon-carbon bonds are an essential part of organic synthesis. The ability to also dictate regioselectivity during these formations is an important step in controlling the structure of natural products and synthetic templates. Indium metal has historically shown to add preferentially to unsaturated carbonyl moieties with 1,2- preference over a 1,4-addition pathway. This poster will address studies in our laboratory revealing that indium promoted couplings to propargyl aldehydes may be controlled to give the 1,2-, or 1,4-addition product. Slight modifications to these conditions also allow formation of the 6-membered ring lactol as shown in Scheme 1.

Scheme 1: Control of Product Formation in Indium Promoted Couplings



44.

SIDE-CHAIN TO SIDE-CHAIN METALLACYCLICPEPTIDES USING TUNGSTEN-ALKYNE COORDINATION

Craig Yennie ‘06
Faculty Sponsor: Timothy Curran

Peptide chemists have sought to limit the conformational freedom of peptides by covalently linking two sites on a polypeptide. An alternate approach for introducing conformational constraints in a polypeptide is to coordinate two or more ligands on the peptide to a transition metal, forming a metallacyclicpeptide. In our laboratory we have been exploring the use of tungsten-alkyne coordination as a simple means for introduction of an organometallic constraint. In this presentation the synthesis of peptides having an alkynes appended to the side chain amines of two lysine residues will be given. Further, the synthesis and characterization of the metallacyclicpeptides derived from reaction of the dialkynylpeptides with the tungsten precursor will be given. Finally, the conformational behavior of the metallacyclicpeptides will be delineated.

COMPUTER SCIENCE

45.
AN ANALYSIS OF RANDOM NUMBER GENERATOR ALGORITHMS
Matthew Coraccio ‘06
Faculty Sponsor: Ralph Morelli

A random number generator is an algorithm that generates pseudo-random numbers. They are important in many different applications, from statistical sampling and games to cryptography and computer simulation. Most programming languages include functions that act as random number generators, which usually return a floating point value between zero and one, but because these functions are deterministic, they are not truly random. After a number of iterations, these functions will eventually return to a previous state where it will repeat indefinitely. Using Pearson’s Chi-Square Test for uniform distribution and the Wilcoxon Signed-Rank Test for interdependency of successive values, a number of different algorithms for generating “random” numbers are tested. These algorithms include Linear Congruential generators, Lagged Fibonacci generators, Linear Feedback Shift registers, the Mersenne Twister, Blum Blum Shub, and the RANDU algorithm.

46.
FLASHDANCE
Emily Foster ‘06
Faculty Sponsor: Madalene Spezialetti

My project is an interactive webpage aimed at teaching beginner dancers how to dance basic combinations in Salsa. The user by selecting various options will be able to see visual directions for each dance tailored to what is most useful for them. Each basic step can be shown as directions, animated foot placements, animated cartoons or real time video. Each is shown at a different angle depending on the user’s gender. There will also be an option to select combinations of moves in order to create a dance routine. All of this is done using Flash and coding with ActionScript in addition to video and various editing programs.

47.
COMPARISON OF DISTANCE-BASED PHYLOGENETIC TREE CREATION
Alicia Morelli ‘06
Faculty Sponsor: Ralph Morelli

A phylogenetic tree depicts the relationships between different species or classes of organisms. In a phylogenetic tree species are represented by leaves, common ancestors between species are represented by nodes, and relationships between species are represented by branches. With the advent of bioinformatics, phylogenetic tree creation is done using algorithms that analyze biological data to find relationships between organisms. Distance based tree creation algorithms use distance data between pairs of species to determine tree topology. In this study three different distance-based tree-building algorithms were implemented: UPGMA, Neighbor’s Relation, and Neighbor Joining. Algorithms were tested and compared on simulated data. Comparisons were made based on how often the algorithms produced trees of the same topology from identical data.

48.

INVESTIGATING ARTIFICIAL INTELLIGENCE TECHNIQUES FOR FINANCIAL PREDICTION

Alec Schmid ‘06
Faculty Sponsor: Ralph Morelli

Financial Market analysis is a field that uses a variety of techniques over large amounts of data to try and determine the best course of action given the current status of the market. This project looks at two different methods of analysis that can be automated to return analysis on a current situation given the historical data of the market. A Naïve Bayes classifier was used as the primary method of comparison, where prior data is used in a probabilistic fashion to determine the most likely next occurrence of the data. The secondary method used is a neural network, which takes a series of inputs, modifies them using weights for each input, and then uses a sigmoid function, also called an activation function to set the output of the network. The data is approximately two years of financial data, selected at random by the classifier to create different environments for the training and testing of both of the techniques. The Bayesian Classifier is the easier of the two to implement, since it forms its own biases on the importance of each data attribute on the resulting classification. While design of the classifier must best try and describe the situation, the design of the neural network requires much more knowledge of the given data. The results of the study will compare which classifier more accurately represents the data, and outcome.

49.

A COMPARISON OF A NEURAL NETWORK ENGLISH-GERMAN VERB TRANSLATOR AND A KNOWLEDGE-BASED WEB TRANSLATOR

William Servos ‘06
Faculty Sponsor: Ralph Morelli

This research into the application of a Neural Network to natural language seeks to establish a new method of accurate dictionary free translation for verbs. Specifically in this case the translation of English regular verbs to German. The Neural Network has been tested against a knowledge based system, SYSTRAN, which is used commonly for everyday translation services. The focus of the project is to try and develop a Neural Network to translate exclusively from one language to another, without the use of dictionaries. Neural Networks represent the closest artificial duplication of brain function to date, and natural language, being a construct of the brain, seems a good test of their limitations. The strength of Neural Networks lies in their ability to learn based on usage data, formulating a solution based only on the input, without any dictionaries and are used primarily in pattern recognition problems. Utilizing the Java Object Oriented Neural Engine (JOONE) as the basis for the Network, has simplified much of the process by allowing spreadsheet file input and a graphical representation of the networks. The SYSTRAN 5.0 translation engine, serves as the alternative to the NN form of translation. Acting as a control to both of these systems is the WordChamp website, which provides an academically verified natural translation of the test verbs. Testing has shown expected high success rates for the SYSTRAN system, though synonyms and double meanings seem to prevent full accuracy in all instances. The Neural Networks have proven less effective than anticipated, encountering difficulties at a variety of sizes and depths. The number of artificial neurons within each layer, and the number of layers within the network alter the number of connections and calculations, allowing for more complexity in larger volumes.

50.

THE STAR FILE RETRIEVAL SYSTEM (SFRS), A STAR TREK WEB-DATABASE

Michael Sollami ‘06
Faculty Sponsor: Peter Yoon, Ralph Morelli

The Star File Retrieval System (SFRS) is a web-accessible database that manages information related to Star Trek history and facts. Such information includes episode, ship, planetary, and character data. SFRS is implemented with the Apache supported scripting language PHP, and uses the MySQL database system to store the data. The website was constructed with HTML and javascript and was designed to satisfy the guidelines and standards of Library Computer Access and Retrieval System (LCARS), the 24th century computer system of the Star Trek Universe. The MySQL database provides different query and result support, including a fulltext indexing, to access and retrieve desired data from the tables. The implementation of this system was an opportunity to develop a fun working application but it was also an opportunity to master coding in PHP, XHTML, and MySQL.

51.

USING BAYES' THEOREM AND ANALYSTS' OPINIONS TO PREDICT THE STOCK MARKET

Shon Urbas ‘06
Faculty Sponsor: Ralph Morelli

Bayes’ Theorem is a powerful tool for classifying information. It provides an ability to quantify a belief in something. In this project Bayes’ Theorem is used to predict the stock market. The expert opinions of analysts from various brokerage firms were used and the performance of the stock to form a single, more informed opinion about whether a stock will go up, down, or remain the same. Bayes’ Theorem is a way of relating past evidence of a hypotheses being true to the chances of it being true now, given some new evidence. In this study the Naive Bayesian classifier and the Full Bayesian classifier were used. The difference in the two is in the former conditional independence of the evidence is assumed, while in the latter it is not. An object-oriented program was created that calculates all the necessary probabilities from data about the stocks fed into it. It then outputs a prediction about the next movement of the stock based on each classifier. These predictions are compared to one another and against the actual movements of the stock.

52.
IMPLEMENTATION OF A PUBLIC-KEY CRYPTOSYSTEM
William Zeller ‘06
Faculty Sponsor: Takunari Miyazaki

Public-key cryptography is widely used today to protect sensitive information transferred over the Internet from those able to intercept these communications. RSA is a type of public-key cryptosystem and is based on the assumption that the product of two primes is computationally very difficult to factor. The project implemented an RSA cryptosystem using an object oriented big number library. The project included multiple methods of performing various mathematical operations, an efficient algorithm to test whether or not a given integer is prime, and factoring algorithms. The source code of this library was published online and a website was created with instructions and tutorials on how to use the library with the hope that it will be used in real-world applications. Documentation and usability was improved with the goal of creating a simple user experience.

53.
PITCH-BASED TUNE IDENTIFICATION
William Zeller ‘06
Faculty Sponsor: Takunari Miyazaki

A program allowing a user to hum a tune and identify that tune would be useful for times when one can only remember the melody of a song and not the title or lyrics. This program will allow a user to enter pitch information (in both a phone and web-based interface) and will search a database of melodies for tunes with similar pitch. This program has a variety of elements to it, such as pitch extraction from a database of melodies, storing pitch information, searching pitch information, pitch detection (from user input) and user interface issues. Pitch will be extracted from RTTTL files and encoded using Parson's code, a simple system where only the relative pitches are stored, not the pitches themselves. Monophonic pitch detection will be used to extract pitch information from the user. This pitch information will be converted to Parson's code and used to search the database of melodies. Using the web interface, the user will be able to enter a Parson's code directly, be able to hum a tune into a microphone and be able to play a tune on a virtual piano keyboard. The user will also be able to use a phone to hum a tune. The phone interface will be created using VoiceXML (an XML extension created specifically for voice applications). The web interface will use the PHP scripting language and MySQL as the backend server.

ENGINEERING

54.
REAL-TIME HUMAN PERFORMANCE MEASUREMENT
Anthony Angelo ‘06
Faculty Sponsor: Joseph Palladino
Kevin Ball PhD, Physical Therapy, University of Hartford

This study uses a new motion capture laboratory at the University of Hartford to measure how humans lose and regain their balance. It is a normative study using elementary school children and college-aged adults. Subjects will be asked to maintain balance while performing a cognitive task. It is hypothesized that the younger children will have more difficulty maintaining balance while performing the cognitive task compared to the older adults. This study will eventually be performed on the elderly to better identify the balance characteristics of falling. In order to perform this study, a support frame for the motion capture camera and two electrical components specifically for the study had to be constructed. The support frame is capable of lifting an 80 lbs camera using a hand winch and can be transported between the two laboratories where the camera would be used. An electrical biofeedback system resembling a traffic light and a custom touch sensor were built to interact with the performance measurement program written by Dr. Ball. The biofeedback system is used to notify the subject that 1) he/she is out of position, 2) he/she is in position, or 3) they may start the study. These lights turn on and off depending on whether or not the subject is within study parameters specified by the researcher. The custom touch sensor was made to simulate natural destabilization of balance. The sensor is placed outside the subject’s reach, requiring them to destabilize their own balance to depress it and then regain their balance afterwards.

55.
AUTONOMOUS ROBOT NAVIGATION USING VISION AND SENSORS BASED ALGORITHM
Susmita Bhandari ‘07, Sam Lin ‘07, Allison Mathis ‘07, Kashif Mohiuddin ‘08,
David Pietrocola ‘08, Maria Restrepo ‘06
Faculty Sponsor: David Ahlgren

ALVIN-VII is an autonomous vehicle designed to compete in the Intelligent Ground Vehicle Competition. The competition consists of Autonomous and Navigation challenges. Using tri-processor control architecture the information from various components such as sonar sensors, cameras, GPS and compass is effectively integrated to map out the path of the robot. In Autonomous challenge, the real time data from two IEEE Pyro cameras and an array of four sonar sensors is plotted on a custom defined polar grid to identify the position of the robot with respect to the obstacles in its path. Depending on the position of the obstacles in the grid, a state number is determined and a command of action is retrieved from the state table. The image processing algorithm comprises of a series of steps involving plane extraction, morphological analysis, edge extraction and interpolation, all of which are statistically based allowing optimum operation at varying ambient conditions. In the Navigation challenge, data from GPS and sonar sensors is integrated on a polar grid with flexible distance thresholds and a state table approach is used to drive the robot to the waypoint while avoiding obstacles. Both algorithms are developed and implemented using National Instrument’s (NI) LabView platform. The task of collecting and processing information in real time can be time consuming and hence not reactive enough for

moving robots. Using three controllers, the image processing is done separately for each camera while a third controller integrates the data received through Ethernet connection. Currently, research and testing is underway to implement fuzzy logic controller for integration of processed data.

56.
MULTI-COMPONENT FORCE BALANCE FOR AERODYNAMIC TESTING
Stephen Doherty ‘06, Edward Wellington ‘06
Faculty Sponsor: Joseph Palladino

A force balance is an instrument used to measure various aerodynamic forces on a model in a wind or water tunnel. Forces experienced by the model are precisely quantified into useful engineering data. Typical applications of this data include designing airfoils to produce maximum lift or designing a vehicle to minimize drag. The force balance for Trinity College's Aerolab wind tunnel is not currently producing reliable data. In order to remedy this problem, a new force balance was developed utilizing the resistive properties of strain gages. Strain gages are silicon resistors which, when affixed to a flexing metal beam, can be used to produce a voltage proportional to the strain on the surface of the beam. In this case, a hydrodynamic force on a model causes a beam to bend, producing a voltage proportional to that force. LabVIEW software converts the voltage reading to an accurate force measurement using equations developed from calibrating the transducer.

57.
DESIGN OF A JAUS COMPLIANT REMOTELY CONTROLED ROBOT ARCHITECHURE
Kevin Harder ‘06
Faculty Sponsor: David Ahlgren

The purpose of this project is to develop the software architecture for a remotely controlled robot as well as the accompanying user interface which comply with the Department of Defense’s Joint Architecture for Unmanned Systems (JAUS) standard. JAUS is a component based messaging protocol created as a common interface for all types of unmanned systems: ground, air and under water. A JAUS compliant architecture allows for complete vehicle interoperability and compatibility independent of platform or specific system hardware. National Instruments LabVIEW graphical programming language was used to create both the JAUS robot architecture as well as the user interface. A LabVIEW written JAUS architecture is directly compatible with the Trinity College Robot Study Team’s autonomous robot ALVIN and will allow for JAUS compliance in future competitive autonomous robots.

58.

TRINTIY COLLEGE PARKING STRUCTURE

Walter Hartnett ‘06
Faculty Sponsor: John Mertens
David Woodard

Trinity College is in the process of constructing a new large sports facility off New Britain Avenue on the edge of the campus. Although there are currently enough parking spaces available for the level of traffic on campus, it is expected that once completed, this new facility will generate increased congestion because of its size and location; so, there will be a need for more parking. This project addresses the perceived need for more parking with a theoretical design and analysis of an on-campus parking structure. It will highlight structural system selection, factors affecting design, and associated design elements.

59.

DESIGN OF A VOCAL TUNER

Emily Hubert ‘06
Faculty Sponsor: David Ahlgren

A vocal tuner is a device which singers use to find the correct pitch of the note they are singing. The tuner informs the user how far away the frequency they are singing is from the closest musical note frequency. The vocal tuner can be used in vocal training, pitch recognition, and to find the starting note of a piece. The vocal tuner needs to be portable and accurate over the range of the human voice. The vocal tuner consists of a microphone, amplifier circuit, microcontroller, and LCD display. The input signal of the vocal tuner comes in through a microphone. Since the signal from the microphone is not large enough it is sent through an amplifier circuit. The signal then goes into the A/D converter of the microcontroller. The microcontroller does calculations, including Fourier transform, to find the frequency of the sung note. The microcontroller then compares this frequency to a table of known musical note frequencies. The microcontroller selects the closest musical note frequency and finds the difference between the sung and musical note frequencies. This information is then sent to the LCD display. The display shows the user the frequency they sang, the closest musical note letter and its frequency, and if they need to adjust their pitch higher or lower.

60.
IMPEDANCE DEFINED FLOW IN ARTERIAL SYSTEMS
Casper Livie ‘06
Faculty Sponsor: Joseph Palladino

A fluid-filled loop of two dissimilar tubes yields one-way steady flow in the absence of valves, termed impedance defined flow (IDF). IDF is possibly an important perfusion mechanism in the cardiovascular system and may explain how the mechanism in the human fetal circulation system prior to valve formation functions. Further, IDF may also be the underlying principle of cardiopulmonary resuscitation. The principle of impedance is defined as the resistance of a medium to the transmission of a wave, and depends on the frequency components of the transmitted wave. In addition, when two mediums connect that have different impedances, a wave passing through that intersection will partially reflect in an amount based on the relative values of these impedances. In the context of a senior project Michelle S. Bovard conducted a study titled “Quantifying Impedance Defined Flow” in 2004. The goal of this undertaking was to quantify this phenomenon. Bovard constructed the circular loop using PMMA acrylic tubing for the rigid half and Tygon vinyl for the elastic section. To ensure reproducibility, Bovard utilized an AC electro mechanical solenoid powered by an optical relay to compress the elastic section of the tube. The flow was measured via image capture using a digital camera and National Instruments LabVIEW software. Flow markers were used to detect net flow. The experiment conducted this semester elaborated on this previously completed study. A DC motor compressing the tube through translational motion replaced the previously used solenoid. This measure ensured that the behavior of IDF under a sinusoidal compression condition could be investigated. Further, this project combined all components of the experiment into an integrated control system. Thus, impulse and behavior of the system were controlled
and monitored by a single computer system using LabVIEW.

61.
DESIGN OF AN AUTONOMOUS WALKING ROBOT
Allison Mathis ‘07, Peter Dacey ‘07, Nabil Imam ‘06, Kumud Nepal ‘08, Sagar Bhandari ‘08, Michael Teesdale ‘08
Faculty Sponsor: David Ahlgren

In the field of robotics and automated motion in general, the primary mode of movement is wheels, as they are fairly simple to control in most applications. Nonetheless, legged, or walking robots, have a definite future as they must function in human society, the majority of which is not set up to accommodate the unconstrained wheel-based motion.
When live organisms, such as quadrupeds turn a corner, they are able to bend their body into the turn, and move in an arc, rather than making an axis turn. However, this sort of motion is extremely difficult to attain with any sort of reasonable speed in robotics. The frame of the body is static, and must remain so to handle the forces being applied during motion. The robot, Walker, Texas Ranger, was designed to change the axis of its motion not by a slow shift in the direction of its front, but by changing the location of its legs, to make a 90 degree turn without ever changing the position of the body in relation to the path. The theoretical design suggests that this would be a practical method to change the direction of motion of a robot; however, the physical limitations of the system meant that there were considerable setbacks in developing the artificial intelligence algorithms. Future work will be directed towards constructing the mechanical frame to support intelligence systems.

62.

DESIGN OF A DYNAMIC EXHAUST SYSTEM AND INERTIAL DYNAMOMETER

Thomas Menke ‘06, Sebastian Rubbo ‘06
Faculty Sponsor: John Mertens

The standard form of an exhaust system for an internal combustion engine is essentially a rigid pipe. Performance of an engine can be optimized by being able to optimize its performance throughout its entire operating range, however this standard form does not allow for this complete optimization. A dynamic system, on the other hand, has the potential to change its characteristics during operation in order to maximize the engine’s performance throughout its operating range (RPM range, warmup phase, varying ambient conditions, etc.). Due to the scale and accessibility of the engine, a motorcycle was chosen as the base of the project. The dynamic exhaust was tested on the motorcycle during several operation conditions.
In order to observe the gain in performance such a system creates, a method of measuring the engine’s performance is necessary. A dynamometer was also designed and built in order to measure the torque and horsepower that the engine outputs. Due to the constraints surrounding the project (particularly the budget of $400), the design was chosen to be that of an inertial dynamometer. Since the testing with the dynamometer needs to simulate real road conditions, the motorcycle needs to accelerate the roller of the dynamometer at the same rate that it would accelerate on the road. By plotting the angular velocity of the roller against time, one can derive angular acceleration, torque, and horsepower. The testing then allows for the effects of the dynamic exhaust system to be observed, and thus the performance of the engine can be optimized.

63.

MATHEMATICAL MODELING OF AN ACTIVE NEURAL NETWORK USING MATLAB AND SIMULINK

Kristin Nassar ‘06, Katrina Voorhees ‘06
Faculty Sponsor: Harry Blaise

This project utilized Matlab in conjunction with SIMULINK to design an active mathematical model for a neural network with synaptic channels. A current stimulus within the soma of the first neuron triggers the flow of Na+ and K+ creating a visible change in voltage within the membrane which can be viewed traveling along the axon into the axonal boutons. This change in voltage takes the characteristic shape of an action potential. Innovations within this model allow for the visualization of potassium and sodium flow resulting in the action potential as well as the controlled release of neurotransmitters within the synaptic boutons. Three neuron models were combined in series creating a network. The stimulus current within the soma of the first neuron travels down the first neuron and into the second and third neurons modeling signal propagation. The propagation of this signal was compared to signal propagation in hippocampal neurons of freely moving rats.

64.
DESIGN OF A COLORIMETER
Maria Restrepo ‘06
Faculty Sponsor: David Ahlgren

A digital colorimeter was designed to capture a color in the real environment and return its Red Green Blue (RGB) values. The device is portable, inexpensive and it is ideal for designers, photographers, art directors or any user interested color reproduction. The main components of the design are: an image sensor from Omnivision Company (OV6620), and a Microchip’s PICmicro® microcontroller. The image sensor captures the color and returns the RGB values of every pixel in the picture. The microcontroller configures the image sensor and records the captured color’s pixel information. An algorithm was implemented to sort, calculate and calibrate the RGB values of the color. The colorimeter was designed to communicate with a computer using a serial port and the system includes an interface to allow the user to download the image files to their computer. The reproducibility of the color depends highly on color management and color calibration. These techniques make the color displayed on the computer monitor an accurate representation of the previously recorded color.

65.
DESIGN AND PRELIMINARY VIBRATION ANALYSIS OF A SMALL SCALE STATIONARY SERVO-FLAP DUAL BLADE ROTOR
Cal Sargent ‘06
Faculty Sponsor: Taikang Ning
Jon Wei PhD , Kaman Aerospace

Since their conception, helicopters have become among the most capable and useful aircraft available to both civilians and military personnel. Their unique ability to take off and land vertically, to hover above ground, and to perform a variety of different maneuvers is what sets them apart from fixed wing aircraft. Unfortunately, along with these unique flying capabilities come a variety of complex aerodynamic problems: a high decibel level, high power requirements and a significant vibration problem. These vibrations are directly linked to the quick deterioration and short life-span of many of a helicopters numerous pieces. One very promising aid in the reduction of vibrations is the use of a servo-actuated flaps placed at approximately ¾ the full length of the blade. The problems associated with the delineation of the mechanisms involved in the generation of helicopter vibrations have existed for decades. A better understanding of these mechanisms will expedite and improve the design of, and flight tests performed by helicopters. In this research project, a small scale, stationary, servo-flap dual blade rotor system is to be built to examine the lateral and vertical vibrations experienced at a helicopter’s center gravity using an array of uni-axial accelerometers. Though this is the primary goal of this project, the system will also be adaptable to configurations that facilitate any number of other helicopter blade related experiments and tests.
The linear relationship between multiple harmonics of 1/rev will be studied using a National Instruments data acquisition system, LabView and MATLAB. Vibrations measured at various points on the base structure will provide useful information pertinent to both the specific mechanical structure of the servo rotor as well as the scale model itself. The validity of such information derived can be used to assist helicopter design and repair for better performance.

66.

RF COMMUNICATION SYSTEM FOR A HEART RATE MONITOR

Reg Schonborn ‘06
Faculty Sponsor: David Ahlgren

In order to wirelessly transmit an athlete’s heart rate to a remote computer, a communication system will be designed and built using a Radio Frequency (RF) transmitter and receiver.
A direct relationship exists between the heart rate and exertion levels of an athlete during physical exercise. Available heart rate monitors are designed mainly for athletes and personal training purposes. These heart rate monitors consist of a chest belt transmitter and a wrist watch receiver. The chest belt transmitter generates an electromagnetic pulse every time the heart beats. The wrist watch receives the pulse and displays the heart rate in beats per minute. Since available heart rate monitors are mainly for personal use, the maximum transmission range between the chest belt transmitter and the wrist watch is approximately 3 ft.
This design project will increase the transmission range to a minimum of 40 ft using an RF transceiver system. The objective of increasing the operating range is to display an athlete’s heart rate in real time on a remote computer during a match situation. The specific range of 40 ft was selected based on the fact that the final goal of this project will be to study a squash player’s heart rate during a match. Since all the heart rate information will be recorded and analyzed on a remote computer in this system, one will be able to inform spectators of the exact physical condition of athletes during matches. This heart rate monitor device will be ideal for real time off-court/off-field analysis of the physical condition of athletes during sport events and matches.

67.

DEVELOPMENT OF A FAMILY OF FITTINGS FOR A MULTI USE AEROSPACE INSTRUMENTATION SEALING METHOD

Christopher Sherman ‘06
Faculty Sponsor: John Mertens
Vernon Goodrich, Pratt & Whitney, Systems Engineering & Validation

In the process of developing a new or upgraded aircraft engine, many engines undergo testing to assure requirements are met. In many cases, this is done using instrumentation to measure pressure, temperature, stress, strain, thrust, fuel consumption, etc. Such data is used to validate engineering models. Instrumentation also poses many challenges, among them assuring the instrumentation does not create situations that will interrupt a test. One of the situations that can and does interrupt testing is oil leakage due to inadequate or faulty sealing of instrumentation as it passes from an oil-wetted area into a non-oil-wetted area. Hot gas path flow into a bearing compartment is another issue; depending on the delta pressure, one or the other may occur with a potential for fire. There is a need for an improved method of sealing instrumentation as it passes from an oil-wetted area into a non-oil-wetted area. While the majority of these issues are found inside the engine, the same principles and methods can be applied to components on the outside such as external oil tubes. Through this design project, the development of a family of fittings for a multi use aerospace instrumentation sealing method, a preferred solution was to be derived, tested, analyzed, and implemented to address this important issue. Several design constraints and requirements had to be met such as the sealing method needed to be inexpensive, easily installed, as well as dependable. After exploring several different sealing options, an optimal configuration was found by using a specially designed metal gasket seal with a Swagelok brazed to a specially designed clamp. Thus far, this design has met all of the design constraints and

requirements. Testing of this design under the given pressure, temperature, and vibration conditions is the next step in validating this design.

68.
RESEARCH ABSTRACT FOR ROBOTICS
Michael Teesdale ‘09, Kumud Nepal ‘09
Faculty Sponsor: David Ahlgren

In order to make a walking robot, a good leg design was needed, as well as computer code and sensors. The robot design chosen for research used a combination of motors, gears and servos that were all attached to metal dowels which essentially were the legs. When set in motion the motors and gears moved the dowels in such a way that the robot was propelled forwards, while the servos functioned as a mechanism for turning the legs sideways to navigate corners. The robot was programmed using Interactive C. In addition, the robot used several sensors such as the sharp sensor (a sensor that determines distance from an object using reflected light), touch sensors, and an infrared light sensor. Another type of sensor that can be used in future projects is the CMUcam (Carnegie Mellon University camera). Currently research is being conducted on how to integrate the CMU camera into such a design. The outlook of the CMUcam looks promising since the camera is extremely flexible in its function. For example, it can be used to track motion, track different colors, and other useful functions. The goals of this project were to create a walking robot that could compete in Trinity's annual fire fighting competition. The outcome of the competition show there are problems with the mechanical leg design of the robot, and the coding. The leg design problem was due to the motors being extremely difficult to attach to the gears, the motor shafts were made of plastic and could not be soldered onto the metal gear shafts, thus when the motors turned the glue would fall off. The programming problem was due to servo motors that were incorrectly configured. Overall the project was a success because despite the mechanical shortcomings the robot succeeded in walking.

69.
TORQUE AND HORSEPOWER
O’Rayan Velarde ‘09
Faculty Sponsor: Joseph Palladino

Automobiles change speed via acceleration arising from torque generated by their internal combustion engines. Radio-controlled model cars are driven by electrical forces that can also be measured in terms of torque. Combining torque and velocity gives power, typically measured in horsepower. The goal of this project was to build an inertial dynamometer to measure horsepower produced at the wheels of a radio-controlled model car. A 2 ½ inch diameter aluminum cylinder, with steel axles at each end, was mounted on a 24’’ x 153/4’’ rectangular base to serve as the inertial dynamometer. The latter was coupled to a rotary variable differential transformer which gives a voltage output proportional to rotational position. Differentiation of this signal gives angular velocity and acceleration. The model car’s rear wheels are placed on the roller, and the vehicle is accelerated over a set period of time. Torque of the engine is calculated through the equation $T=I*\alpha$ where I is the known moment of inertia of the dynamometer and α is the angular acceleration of the cylinder. Power is torque multiplied by angular velocity. A computer program provides an interface to the equipment and gives power produced in horsepower units. This research project is a mean for measuring the horsepower of a radio-controlled model car in a cost-efficient manner.

ENVIRONMENTAL SCIENCE

70.
LOSS ON IGNITION ANALYSIS OF A CORE SAMPLE FROM MUDGE POND IN SHARON, CT
Paul Baumgartner ‘06, Emil Crystal-Ornelas ‘07
Faculty Sponsors: Jonathan Gourley, Christoph Geiss

A loss on ignition analysis was performed on a core sample (MUD 04) from Mudge Pond in Litchfield County, Connecticut. This analysis was performed to determine the cores composition of water, organics, and inorganic carbonates which can give evidence to past environmental conditions of the pond. First, a stratigraphic column was constructed of the 833 cm long core to determine major sediment boundaries and major sediment types present. The dominant sediment present in this sample was clay with areas of silt (422 and 609.5 cm) sand (669, 675, 694cm) and shells (298, 348, and 422cm). From this column the areas from which 20 samples for LOI were determined. Loss of ignition analysis was then performed as described in Deane (1974). The percentage of lost components during each bake was then calculated as a percentage of the original sample. Percent water composition showed a decreasing trend with core depth. This was likely due to the fact that sediment at the top of the core was closer to a water source (the pond) and was therefore more saturated. As depth increased organic matter fluctuated representing natural changes in biological productivity of the pond over time. At a depth of 609.5 cm there is a spike (0.11%) of organics. This spike also occurred at the depth at which the sediment was observed to be dark-yellowish-brown silt. Inorganic carbonates had an overall increasing trend with depth with major increases observed in the samples taken between 200 and 500 cm. The samples taken from this depth all had a percentage of inorganic carbonates over 0.08% in contrast to the other 14 samples which had a percentage of inorganic carbonates of less than 0.07%. This observed trend of increased inorganic carbonates in the range of depths between 200 and 500cm was likely the result of the large amounts of invertebrate shells (inorganic carbonates) that were physically observable in three of the sample areas, (298, 348, 422cm).

71.
TIRE RUBBER LEACHATE INHIBITS SNAIL (*PHYSA HETEROSTROPHA SAY*) GROWTH AND REPRODUCTION
Mosammat Fatema ‘06
Faculty Sponsor: Alison Draper

Tires deteriorate over time from exposure to physical and chemical stresses and the particles that are released leach toxic chemicals into the environment. These chemicals leach into surface water and aquatic organisms are thus exposed. This project was undertaken to explore the effects of tire rubber leachate on snail (*Physa heterostropha Say*) growth and reproduction. Ten snails per concentration, 4-4.5 months of age, matched for length were exposed to tire rubber leachate: 0%, 15%, 30%, 50%, 75%, and 100%. The experiment was performed at room temperature (~20°C) for seventy three days, and media was changed weekly. The length, weight, number of egg packets and the number of eggs were counted weekly. The results show less growth in snails exposed to higher leachate concentrations. Additionally, snails produced more egg packets per snail in the lower leachate concentrations and fewer egg packets as concentration increased.

Finally, egg production was higher in the lower leachate concentrations compared to the higher concentrations. Interestingly, when snails were allowed to re-equilibrate in hard water, egg production in the high leachate-exposed snails resumed. Generally snails have a high pollution tolerance and the results of this study reflect that snails grew and reproduced better in slightly polluted water. However, the results showed that high concentrations of tire rubber leachate suppressed snail growth and reproduction.

72.

INVESTIGATION OF PINGO SCARS IN WETHERSFIELD, CT

Courtney Hugo ‘08
Faculty Sponsor: Christoph Geiss

This study intends to observe the geological and geophysical features of surface depressions in the Wethersfield Woods in order to determine their origin, specifically the possibility that they are pingos and may be relevant to regional paleoclimate reconstructions. Pingos are mounds of sediment-covered ice that form during extremely cold climates, which might have occurred in Connecticut as late as 12,000 years ago. At the end of the last glaciation the ice in these mounds melted and caused the thawed layer to sink and be surrounded by elevated berms of sediment. The depressions were mapped using GPS and ArcGIS. Our map shows 43 depressions of varying sizes and with rounded features. No specific placement pattern is visible implying that they were not created by men and may be pingos. Comparisons to other pingo fields, analyses of the elevations of the berms surrounding the depressions and their depths, as well as core samples of sediment will be used to further clarify the possibility that they are true pingos.

73.

X-RAY DIFFRACTION ANALYSIS OF MUD-04-F FROM MUDGE POND, SHARON, CT

Courtney Hugo ‘08, Zachary Spielman ‘08
Faculty Sponsor: Jonathan Gourley

The purpose of this study was to identify the mineral sediments in the core MUD 04 from Mudge Pond in Sharon, CT. The mineralogy and deposition of sediments can help to make inferences about local and global climate changes. The placement of sediments can give clues as to the past physical and biochemical processes within the lake. We used XRD to identify trends in the mineralogy of the sediments. The core was 835.5 cm long and was composed of mainly clay with some thin layers of silt, sand, and shells. The XRD results showed that the most notable trace minerals in the clay were predominantly quartz and calcite through out the entire core, with traces of bornite and hematite in the top three hundred centimeters. The x-ray analysis showed that in the layers that contained shells calcite was the mineral with the highest concentration. These trends can help to reconstruct the environmental history of the lake during the time period of deposition.

74.

TOXICITY OF HISTAMINE ANTAGONISTS ON AQUATIC ORGANISMS

Nikki LaBella ‘06
Faculty Sponsor: Alison Draper

Pharmaceutical contamination of surface water has become an increasing concern due to the potential negative implications for aquatic organisms and human health. The design of once-a-day pharmaceuticals to enhance compliance has resulted in drugs that resist breakdown in wastewater treatment systems and thus, release pharmaceuticals into surface water. Because some of the most commonly prescribed pharmaceuticals are the histamine antagonists, the following drugs were used in toxicity tests: cimetidine, famotidine, nizatidine, ranitidine, astemizole, rompheniramine, diphenhydramine, fexofenadine, hydroxyzine, loratadine, promethazine, and pyrilamine. The toxicity of these drugs was examined on *Selenastrum capricornutum*, *Lemna minor*, *Ceriodaphnia dubia*, *Daphnia magna*, and *Pimephales promelas*, all cultured according to Standard Methods. Exposures were performed using 10 ppb of each drug in the appropriate medium. A two week static assay was performed on *S. capricornutum* and growth was no different in exposed cultures than in control cultures. In a 96 hr static assay, *L. minor* also exhibited little difference in growth when exposed to drugs compared with the control. A 48 hr static assay was conducted on *C. dubia* and *D. magna* and there was no difference in the mortality rate in treated organisms compared to controls. *P. promelas* underwent a 96 hr static renewal assay in which the drugs also had little effect on the mortality rate. Based on this research, detrimental effects from histamine antagonists at these low, environmentally relevant concentrations are improbable, but environmental effects may be observed with higher concentrations or more susceptible organisms.

75.

LOSS OF OPEN SPACE IN WETHERSFIELD, CT

James Gary Moffat ‘08
Faculty Sponsor: Christoph Geiss

The loss of urban green space over the last 30 years is a significant environmental issue that continues to occur to this day. Urban sprawl carries severe environmental consequences. Land that was once dedicated solely to farming or remained an untouched forest is now being used for mega mansions and neighborhood developments. The local watersheds, wetlands, and ecosystems are being significantly altered in order to build another neighborhood in a once uninhabited land. The goal of this project is to illustrate how much land was lost in Wethersfield, Connecticut over the period of its heaviest development. Using ArcMap, a geographic analysis program, we put together aerial photos of the region roughly every decade and determined whether each land parcel in the town was open space. Through the use of ArcMap we were able to create several working maps that sufficiently illustrated the loss of urban green spaces in Wethersfield. The loss of open spaces in Wethersfield was large as illustrated by our final maps. We conclude that it is vital for the Wethersfield town council to continue to fight for open spaces in their town. The development of the few remaining open spaces would significantly stress the surrounding ecosystem and watershed.

76.

ARM SAMPLING DETERMINES THE HISTORIC MAGNETIC LEVELS IN SOIL AT A POND IN NORTHWESTERN CT

Michael Ottariano ‘07, William Strong ‘06
Faculty Sponsors: Jonathan Gourley, Christoph Geiss

We tested the magnetic properties of a sediment core from Mudge Pond, Sharon, CT, in 2004. Using data from a previous study on magnetic susceptibility, combined with our data, we tested levels of magnetic remanence (ARM), finding small magnetite, maghemite, and hematite minerals within the core. It was clear from visual analysis of the core sample that variations of sedimentary composition were present. Near the surface of the pond the sediment contained small black particles, which suggested the presence of rich organic matter. Also near the surface, there was very little magnetism, which could be an indication that organic materials hold little or no magnetic properties. Close to five meters down there was a significant increase in the magnetic properties of the core sample where high levels of iron minerals were detected using the magnetic susceptibility test. It was clear that towards the bottom of the core magnetism increased and must be a result of a change in geologic conditions of the area.

77.

INVESTIGATION INTO THE DYNAMICS OF FINFISH FISHERY IN SOUTH CAICOS

Kelly Rice ‘06
Faculty Sponsor: William Church
Aaron Henderson, School for Field Studies

Although commercial pressure on the finfish fishery in South Caicos is currently minimal, increases in demand and economical favorability are making it important to further understand the complexities and intensity of the finfish fishery. A total of 49 fishermen surveys were standardized and conducted at the two main fish docks in Cockburn Harbor, South Caicos. The baseline data collected with these surveys includes engine sizes and locations fished. Furthermore, it was found that only 19% of fishermen surveyed included finfish as part of their targeted species with only 4% targeting finfish alone. It was also found that 100% of the finfish catch remains within the Turks and Caicos Islands with more than 50% never leaving South Caicos. Less than one quarter of fishermen surveyed reported their fishing efforts as intentional with 16% reporting their catch as bycatch in lobster traps. Of those surveyed with finfish catches 66% used the Hawaiian sling as gear for harvest. This study suggests that the finfish industry is dominated by subsistence and opportunistic efforts, however, there remains a large potential for growth. It is recommended that the information collected in this research be used as baseline data and continued researched be conducted to monitor the growth and health of the finfish fishery in South Caicos.

78.

PETROGRAPHIC ANALYSIS OF LAKE CORE FROM MUDGE POND, SHARON CT

Michelle Smith ‘08, Lorenzo Bellard ‘07
Faculty Sponsors: Christoph Geiss, Jonathan Gourley

In an effort to understand greater the prior climate of Connecticut twenty samples from one sediment core (Core MUD 04-F), taken from Mudge Pond, Sharon, CT in 2004. The percentages of four key components: organic matter, organisms (diatoms), carbonates, and quartz and feldspar were estimated. A petrographic microscope was used to examine the prepared slides. Each slide was prepared by selecting specific samples from the core at varied depths mixing it with one drop of distilled water on a microscope slide and dried out on a hot plate. A correlation between the composition of the samples and the depth from which the sample were taken was found. The shallow depths contained a greater composition of organics and organisms (diatoms) and at the deeper positions there was a greater composition of carbonates, quartz and feldspar.

79.

A PALEOMAGNETIC ANALYSIS OF FIDDLER LAKE, WIND RIVER RANGE, WYOMING

Jacques Swanepoel ‘07
Faculty Sponsor: Christoph Geiss

A paleomagnetic study was conducted on a sediment core taken from Fiddler Lake, Wind River range, Wyoming. A total of 106 samples spanning approximately 6000 years of continuous sedimentation were analyzed for changes in the direction of the earth’s magnetic field. Since the sediment cores were unoriented with respect to geographic North, this study is limited to the reconstruction of variations in inclination. The results from Fiddler Lake were compared to a similar paleomagnetic study done on nearby Louis Lake in order to establish the reliability of the paleomagnetic records from both sites. In an attempt to date our magnetic record comparisons were made with studies performed on Fish Lake (Oregon) and Lake St. Croix (Minnesota) but our record is too short to obtain a high-quality estimation of where Fiddler Lake fits in. Samples from the top of the core were to weakly magnetized to obtain accurate measurements with our magnetometer. Further measurements will be required to make an accurate comparison from lake to lake and to ultimately determine the age of Fiddler Lake.

HEALTH FELLOWS

80.

THE GEOGRAPHIC DISTRIBUTION OF MILD-SEVERE PERSISTENT PEDIATRIC ASTHMA IN HARTFORD PATIENTS OF THE CONNECTICUT CHILDREN'S MEDICAL CENTER

Scott Dale '07
Faculty Sponsor: Laurel Baldwin-Ragaven
Karen Daigle MD, Pulmonary Medicine, Connecticut Children's Medical Center

High rates of asthma within the city of Hartford have been correlated with low household income and being of Hispanic descent. The goals of this study were to further understand the distribution of asthma within Hartford, and to assess whether the Connecticut Children's Medical Center (CCMC) Pulmonary Clinic sees a representative sample of patients from the local community. The geographic distribution of children with mild-severe, persistent asthma who live in Hartford and visit CCMC was analyzed for possible patterns. Distribution was based on the child's primary residence and location of school. Analysis was conducted using ArcGIS mapping software. The study involved two parts. The first was a retrospective chart review of cases with the inclusion criteria: < age 18 years; office visit to the Pediatric Pulmonology Clinic in 2005; mild-severe, persistent asthma as defined by the National Asthma Education and Prevention Program; primary residence in the city of Hartford. The sample size was 200 patients. The following demographic and clinical data were extracted: date of birth, gender, race/ethnicity, asthma severity, duration of symptoms, health insurance plan, census tract of primary residence. In the second part of the study, information about school location and attendance was obtained via a written questionnaire. The questionnaire was offered to a subset of the cases identified by chart review who meet the following inclusion criteria: school-aged (5-18 years); attend the Pediatric Pulmonary clinic in spring of 2006. This part of the study is ongoing due to a lack of significant numbers of responses. The distribution of asthma cases per school will be analyzed for possible patterns, hopefully reflecting the distribution of cases across different areas of the city.

81.

THE CORRELATION OF BLOOD PRESSURE ELEVATION TO SEVERITY OF ILLNESS IN CHILDREN WITH GUILLAIN-BARRÉ SYNDROME

Carrie Edwards '08
Faculty Sponsor: Sarah Raskin
Francis DiMario MD, Director, Department of Neurology, Connecticut Children's Medical Center

Acute inflammatory demyelinating polyneuropathy, more commonly known as Guillain-Barré syndrome (GBS), is a neurologic disease that affects the peripheral nervous system through demyelination of both motor and sensory nerves. It presents most often due to previous infectious illness, such as Epstein-Barr virus, febrile gastrointestinal illness, or upper respiratory illness. GBS is suspected to be an acquired, immune-mediated disease with an incidence in adults of 0.4 to 1.7 per 100,000 and in children (<18) of approximately 0.5 to 1.5 per 100,000. The clinical presentation of GBS is symmetric weakness and decreased reflexes (hyporeflexia or areflexia) as well as sensory disturbances. During the course of the illness there can be many

complications, due to both paralysis and autonomic nervous system dysfunction. Hypertension, or elevated blood pressure, has been found to be a prevalent complication in adults with GBS; 22% to 61% of adult patients with GBS had an occurrence of hypertension. One study on a group of 30 children with GBS found that 66.7% experienced hypertension. A preliminary positive correlation of hypertension to severity of Guillain-Barré in children has been suggested. In this study, we are determining whether there is a correlation between blood pressure and severity of Guillain-Barré syndrome in children. We postulated that blood pressure can serve as a prognostic indicator for the severity of the course of the illness. Knowing what the prognosis of the child will be ahead of time, allows patients, parents, and doctors to anticipate such drastic symptoms of GBS. Methods: We performed a retrospective chart review of 24 children who were hospitalized at Connecticut Children's Medical Center for Guillain-Barré syndrome. We recorded daily blood pressure as well as other relevant clinical data, such as autonomic nervous system dysfunctions and length of hospital.

82.

QUALITY OF LIFE IN THE FIRST YEAR FOLLOWING DIAGNOSIS OF PEDIATRIC INFLAMMATORY BOWEL DISEASE: EFFECT OF A POSITIVE FAMILY HISTORY

Abigail Garrity '07
Faculty Sponsor: Laurel Baldwin-Ragaven
Jeffrey Hyams MD, Department of Gastroenterology, Connecticut Children's Medical Center

Background and Aims: There are little data on health related quality of life (HRQOL) in children with inflammatory bowel disease (IBD). The aim of this study is to evaluate changes in HRQOL in a cohort of newly diagnosed children over the year following diagnosis and to determine whether a family history of IBD has an influence on outcome. Methods: Data from a prospective, multi-center observational registry recording clinical, laboratory, and humanistic outcomes in newly diagnosed children between the ages of nine and 16 with IBD were examined to identify study subjects. IMPACT-35, a previously validated health related quality of life (HRQOL) measurement, was used to record HRQOL at diagnosis and at one year. Notation was made of the presence or absence of IBD in a parent or sibling of the proband. Results: 206 subjects met inclusion criteria (mean age 12.65, 46.4% female). 13.6% had a parent or sibling with IBD. Total IMPACT-35 scores and individual domain scores did not differ at diagnosis and one year after diagnosis between groups. At diagnosis, children with a family history of IBD were more worried about flare ups and felt worse than children without a family history of IBD. Children with a family history were also less bothered by taking medicines. Most notably, children with a family history of IBD did not improve on the worry score one year after diagnosis. Discussion: Although there were few differences between children with a family history of IBD and those without, children with a positive family history were more worried. These findings have may important implications for treatment and intervention strategies in children with a family history of IBD. Further investigation of the influence of a family history of IBD on quality of life in children with IBD should be done using a larger sample size.

83.

AMYGDALA ACTIVATION DURING UNCERTAINTY IN FEAR CONDITIONING

Becket Greten-Harrison ‘07, Seth Shipman, Institute of Living
Faculty Sponsor: Sarah Raskin
Robert Astur Ph.D., Principal investigator, Institute of Living

Amygdala activation in the limbic system is critical for the development of fearful behavior. The amygdala is first activated to induce fearful behavior and is then deactivated once anxious behavior has been learned (Buchel, 2000). Amygdala activation has been observed in brain imaging studies and by examining skin conductance response (SCR) to threat conditions using electrical shock. It was of interest to examine whether a stimulus that did not always predict a shock would illicit a greater fear response than one that would predict a shock 100% of the time. In this fear conditioning protocol, subjects are shown a series of three different shapes in three phases, a baseline phase, acquisition phase, and extinction phase. In all three phases, SCR and electrocardiogram are recorded. Shocks are administered during the acquisition phase, (one shape shocks 100% of the time, one 50% of the time, and one 0% of the time), and it is determined if the subject has conditioned to the shock if SCR response increases when a shock shape is presented during the extinction phase. Functional magnetic resonance imaging (fMRI) data are also collected to determine whether significant activation occurs in the amygdala when the shapes predicting shock are displayed. Preliminary results indicate that subjects show a significant SCR response following the shocks as well as the shapes predicting the shock 100% of the time. Additional analyses are underway to determine whether the amygdala is activating during these conditions, and whether the shape predicting shocks 50% of the time results in greater or less SCR than the other shapes. It is hypothesized that the shape that shocks half the time will illicit the greatest fear response from the subject because of the uncertainty of whether the shock will come followed by the 100% shape and then the 0% shape.

84.

MOTIVATING FACTORS BEHIND THE DECISION TO MOVE INTO ASSISTED LIVING: A SURVEY OF CONNECTICUT ASSISTED LIVING RESIDENTS

Jacquelyn Harvey ‘06
Faculty Sponsor: Sarah Raskin
Patrick Coll MD, University of Connecticut Medical Center

Reports by the Assisted Living Federation of America (ALFA) and the State of Connecticut housing authority indicate that the purpose of Assisted Living facilities (ALF) is residential. The American Geriatrics Society reported that ALFs must focus on the medical model of housing as opposed to purely residential. In an effort to gauge the consumer’s perspective on the conflicting reports of the primary goals of ALFs, a comprehensive survey including questions focusing on the motivating factors behind the decision to move into an ALF using a five-point Likert scale was distributed. The surveys were distributed to 250 ALF residents in Connecticut along with prepaid return envelopes after an initial pilot survey of 5 ALF residents. With the permission of each ALF, the surveys were delivered directly to the mailboxes of individual residents. Return responses were addressed to the University of Connecticut’s Center on Aging for collection. The data was analyzed using the Statistical Package for Social Sciences (SPSS). T-tests were run to compare the opinions of several groups of residents, including male v. female, under 85 v. over 85 years of age, and previous experience v. no previous experience in with ALFs. Results of this study are currently pending.

85.

FACTORS CONTRIBUTING TO POST-PARTUM HYPOTHERMIA IN VERY LOW BIRTH WEIGHT (VLBW) INFANTS

Todd Morrison ‘07
Faculty Sponsor: Laurel Baldwin-Ragaven
James Hagadorn MD MS, Department of Neonatology, Connecticut Children's Medical Center

Background: Hypothermia is a common and potentially serious problem in newborn VLBW (<1500 g) infants admitted to the Neonatal Intensive Care Unit (NICU). These infants are at a higher risk for developing hypothermia due to their physical and metabolic limitations. Other factors may also potentially contribute to rapid heat loss during the initial moments of life.
Objective: The purpose of this study is to identify clinical factors predisposing VLBW infants to hypothermia on Connecticut Children’s Medical Center (CCMC) NICU admission.
Methods: In this retrospective study, the medical records of a two-year cohort of VLBW infants admitted to the CCMC NICU were reviewed. It was hypothesized that post-partum hypothermia in VLBW infants was a non-random outcome of delivery associated with identifiable and potentially modifiable clinical factors. The data collected included clinical factors immediately pertinent to temperature control (i.e., infant demographics, resuscitation measures used, and the duration of time between delivery and admission to NICU). The data was described by means of univariate and multivariate regression analyses using commercial statistical software. Clinical factors independently associated with admission hypothermia were identified, adjusting for the effects of biological confounders such as birthweight and gestational age.
Results: The results of this study outline the degree to which admission hypothermia in VLBW infants is a problem in the CCMC NICU, suggest modifications to the immediate post-partum care of VLBW infants that may reduce admission hypothermia and provide baseline information regarding the incidence of post-partum hypothermia that will allow subsequent documentation of improvement.

86.

RELATIONSHIP BETWEEN OBSESSIVE BELIEFS IN OCD AND TREATMENT OUTCOME

Karen E. Mulak ‘06
Faculty Sponsor: Sarah Raskin
David Tolin PhD, Anxiety Disorders Center, Institute of Living/Hartford Hospital

The cognitive-behavioral model of obsessive-compulsive disorder (OCD) posits that maladaptive beliefs elicit anxiety and compulsive behaviors. The model further suggests that cognitive behavioral therapy (CBT), incorporating exposure and response prevention, acts by reducing the strength of obsessional beliefs. Therefore, a reduction in the strength of obsessive beliefs should correlate with a reduction in compulsive behavior, and thus OCD severity.
The present study will consist of an archival review of adult OCD outpatients (N=44) who received CBT for OCD at an outpatient anxiety clinic. Analyses will test the relationship between obsessions and compulsions by looking at whether changes from pre- to post-treatment in strength of obsessional beliefs as measured by the Obsessional Beliefs Questionnaire (OBQ; OCCWG, 2001, 2003) relate to changes in OCD symptom severity and other measures of illness, as measured by the Yale-Brown Obsessive-Compulsive Scale, Clinician’s Global Impression, and Sheehan Disability Scale. We predict that reductions in OBQ scores will correlate positively with reduction in the severity measures, consistent with the cognitive-behavioral model of OCD. Additionally, the study will look at whether obsessional belief type, determined by the OBQ

subscales, predicts CBT treatment outcome, measured by pre- and post-treatment changes in YBOCS score, controlling for pre-treatment severity. We hypothesize that patients who endorse exaggerated beliefs about threat will show a greater decrease in YBOCS scores, whereas patients endorsing perfectionist beliefs will show an attenuated treatment response.
Obsessive Compulsive Cognitions Working Group* (2001). Development and initial validation of the Obsessive Beliefs Questionnaire (OBQ) and the Interpretation of Intrusions Inventory (III). Behaviour Research & Therapy. 39, 987-1006* co-coordinator.
Obsessive Compulsive Cognitions Working Group (2003). Psychometric Validation of the Obsessive Beliefs Questionnaire and the Interpretation of Intrusions Inventory: PartI.Behaviour Research and Therapy, 41, 863-878.

87.

CHILDHOOD COUNSELING OF VITAMINS AND MINERALS: HOW WELL DO CONNECTICUT'S PEDIATRICIANS, FAMILY PRACTITIONERS AND NURSE PRACTITIONERS FOLLOW CURRENT RECOMMENDATIONS?

Sara Thiede ‘06
Faculty Sponsor: Laurel Baldwin-Ragaven
Hugh Silk MD, UConn School of Medicine

Vitamins and minerals are essential to the health of an growing children. Most family physicians (FM’s), pediatricians (ped’s), and nurse practitioners (NP’s) are knowledgeable about recommending fluoride and calcium for their pediatric patients. Calcium is vital for bone strength and linear growth, as well as the proper functioning of nerves and muscles. Fluoride is important for dental health. Inadequacy of vitamin D prevents proper calcium absorbed in the intestine, and bones development in children. The American Academy of Pediatrics (AAP) has recently recommended Vitamin D supplementation. The current level of Vitamin D counseling by family physicians, pediatricians and nurse practitioners in Connecticut is not well known. In this study, I worked with two physicians from the University of Connecticut, Dr. Hugh Silk and Dr. Thomas Trojian. We hypothesize that that there is a difference in the rate of counseling of Vitamin D supplementation between FM’s and ped’s, as well as a difference between NP’s and MD’s. A self-reporting survey was sent to pediatric primary care providers in the state of Connecticut to evaluate the frequency of assessment of vitamin and mineral consumption, as well as the accuracy of counseling regarding supplementation. Our analysis specifically examines the frequency and accuracy of Vitamin D counseling by pediatricians, family practitioners and nurse practitioners in Connecticut. To date, 284 completed surveys have been returned. Of those who responded, 134 are FM'S, 112 are ped’s, and 38 are NP’s. Initial analysis indicates statistically significant correlations between the type of practice and the frequency of counseling on Vitamin D. The initial results of the means of the self-reported survey indicate that FM’s self report the lowest rating of importance of Vitamin D. A full analysis of the results is being completed.

MATHEMATICS

88.
THREE COUNTRY ARMS RACE
Douglas Goodman ‘06, Jacob Becker ‘06
Faculty Sponsor: Philip Brown

This is a mathematical model for three countries in an arms race, derived from the Richardson arms race model for two countries. It will specifically explore the different possible combinations of fear, restraint, goodwill and grievances between all three countries simultaneously. Each case will result in multiple 3-D trajectories, contingent upon differing initial conditions, which will be plotted and solved numerically.

89.
LOCATION MODEL: AN ANALYSIS OF STRATEGIC PLACEMENT OF DAIRY QUEENS IN CANCUN, MEXICO
Jennifer Kern ‘07
Faculty Sponsor: Philip Brown

Dairy Queen would like to extend its operations to several resorts in Cancun, Mexico. Ideally, Dairy Queen would build miniature ice-cream shops in resort lobbies. This would make for easy access from both the street and the beach. The resorts are located along a beach that is 1 kilometer long with 5,500 evenly distributed vacationers. The sun is terribly hot (a scorching 98 degrees!) and every person would like to buy an ice-cream cone as long is as it does not cost more than 44 pesos (US $4). The transportation cost (buying flip-flops to get across the hot sand) will amount to 55 pesos (US $5) for every one kilometer the vacationer has to walk. It costs Dairy Queen 8 pesos (US $.75) to make an ice-cream cone and 3,863 pesos (US $350) per day to operate each shop regardless of the number of ice-cream cones sold.
A location model will be used in determining how many Dairy Queens should be opened along a boardwalk in Cancun, Mexico. It will determine their specific location, most efficient price and the profits earned.

90.
MONTE CARLO SIMULATION OF THE NBA LOTTERY DRAFT
Jaclyn Kupper ‘06, Matthew Anderson ‘08
Faculty Sponsor: Philip Brown

Using Monte Carlo Simulation, this project will replicate the NBA draft lottery. The lottery is currently set up so of the fourteen non-playoff teams, the worst team has the best chance (25%) of getting the first pick and the best team has the least chance (0.5%) of receiving the first pick. Using one thousand numbers, intervals will be established with lengths consistent with the ability of each team. When a number, produced by a random number generator, falls in a particular team’s interval, they get next pick. This is continued until all the players are chosen.
The poster will explain the draft procedure and include a flow chart for the computer program and model a typical simulation.

91.
EASTER ISLAND PREDATOR-PREY MODEL
Yang Liu ‘08
Faculty Sponsor: Philip Brown

We are making a poster project presenting a predator-prey model of Easter Island like the Lotka-Volterra predator-prey model. In this model, people are the predator and the resources that they use are the prey. The growth of humans depends on the prey and humans cannot survive without the prey thus leading to cycles of famine. The population boom and destruction of resources led to the eventual demise of the people on Easter Island. Our model will show this cycle.

92.
AREA FIRE MODEL
Matthew Miller ‘09
Faculty Sponsor: Philip Brown

Mathematical models have proved an effective tool in analyzing, and in some cases predicting, the outcome of an arms conflict. A model for conventional warfare typically involves the assumption that the loss of one country’s soldiers is proportional to the number of soldiers in its enemy’s army, such that, for countries x and y:

$$\frac{dx}{dt} = -ay \qquad \frac{dy}{dt} = -bx$$

This system of differential equations can be solved to determine the outcome of such a conflict. This model, known as the direct fire model, follows an assumption of conventional warfare, meaning that each enemy knows the other’s position. Modern combat has dramatically changed, and direct fighting between soldiers in contemporary warfare has adopted a particular pattern. Recent conflicts have been characterized by guerilla warfare, where the weaker enemy resorts to unorthodox methods of fighting in order to contend with a superior enemy. For purposes of this model, in guerilla warfare, one enemy is unaware of the position of the other, consequently decreasing the probability (with each shot) that they will kill the opposing force. Therefore, the equation for loss of soldiers over time for one country (x) remains the same, while the other (y) is affected by the interactions of soldiers, such that:

$$\frac{dx}{dt} = -ay \qquad \frac{dy}{dt} = -bxy$$

The resulting analysis of this system of differential equations will indicate that guerilla war tactics are effective until the opposing (conventional) force x has ten times the force of y. When many guerilla soldiers are fighting there is a higher chance that they will be killed. This model was used to understand the difficulty America had in the Vietnam War, and will be used to analyze the present conflict in Iraq.

NEUROSCIENCE

93.
EFFECTS OF NEONATAL ISOLATION ON BIDIRECTIONAL PLASTICITY IN THE BASOLATERAL AMYGDALA - DENTATE GYRUS SYNAPSE OF FREELY MOVING RATS

Urey Chow ‘09, Kaitlin Haines ‘09
Faculty Sponsor: Harry Blaise

Neonatal isolation, a known emotional stressor, has been shown to impact memory processes by altering levels of synaptic plasticity in the hippocampus. Synaptic plasticity, which is measured by the changes in neuronal activity, is defined as bidirectional, incurring long term potentiation (LTP) in the positive direction and long term depression (LTD) in the negative direction. LTP can be defined as an increase in neuronal activity and synaptic strength, whereas LTD can be referred to as a decrease in synaptic strength. The basolateral amygdala (BLA) and dentate gyrus (DG) are two structures in the brain that have been linked to both emotion and learning and memory. Their interactions are thought to represent the neural mechanisms linking emotion to memory. In order to assess the effects of neonatal isolation on bidirectional synaptic plasticity in the BLA, neonates, ages 2 through 9 days, were isolated from their mothers in white noise chambers for one hour each day and then permitted to mature under standard conditions. Between 70-120 days of ages, animals underwent surgery to implant stimulating, recording, and ground electrodes in the BLA, dentate gyrus, and contralateral parietal cortex, respectively. After a one-week recovery period, the animals were stimulated with either a 100-pulse, 5-Hz burst stimulation to induce LTP, or a 900-pulse, 1-Hz sustained stimulation to induce LTD. Preliminary results indicate that there is an increase in synaptic strength of isolated compared to non-isolated animals, suggesting that neonatal isolation increases LTP in the BLA and DG. Conclusive results regarding LTD have not yet been obtained.

94.
VISION, HEARING, AND TOUCH BASED ON SIGNAL & TACTILE TRANSDUCTION PATHWAYS ACTIVATED BY AUDITORY & VISUAL SIGNALS FROM THE ENVIRONMENT

Vashon Donique ‘06
Faculty Sponsor: Sarah Raskin

These sensory systems function similarly to the signal-transduction pathways for many hormones. For vision, perhaps the best understood of the senses, two classes of photoreceptor cells exist: cones, which respond to bright lights and colors, and rods, which respond only to dim light. The photoreceptor in rods is rhodopsin, a 7TM receptor that is a complex of the protein opsin and the chromophore 11-cis-retinal. Absorption of light by 11-cis-retinal changes its structure into that of all-trans-retinal, setting in motion a signal-transduction pathway that leads to the breakdown of cGMP, to membrane hyperpolarization, and to a nerve impulse. Color vision is mediated by three discrete 7TM photoreceptors that utilize 11-cis-retinal as a chromophore and absorb light in the blue, green, and red parts of the spectrum. The instantaneous receptors for hearing are found in the hair cells of the cochleae, which contain bundles of stereocilia. When the stereocilia move in response to sound waves, cation channels will open or close, depending on the direction of movement. The mechanical motion of the cilia is converted into current flow

and then into a nerve impulse. Touch, detected by the skin, senses pressure, temperature, and pain. Specialized nerve cells called nociceptors transmit signals that are interpreted in the brain as pain. A receptor responsible for the perception of pain has been isolated on the basis of its ability to bind capsaicin, the molecule responsible for the hot taste of spicy food. The capsaicin receptor, also called VR1, functions as a cation channel that initiates a nerve impulse.

95.

THE EFFECTS OF NEONATAL ISOLATION ON BIDIRECTIONAL PLASTICITY OF THE BASOLATERAL AMYGDALA-DENTATE GYRUS PATHWAY IN FREELY BEHAVING RATS

Emily Dorward ‘06
Faculty Sponsor: Harry Blaise

Previous studies have shown synaptic plasticity in the basolateral amygdala-dentate gyrus pathway, whereby electrical stimulation of the basolateral amygdala (BLA) induced field potentials in the dentate gyrus (DG) in freely behaving animals. The BLA is known to be involved in emotion and the DG, as a part of the hippocampus, to be responsible for learning and memory. Together, this pathway is thought to link emotion with memory. To examine the effect of neonatal isolation of the BLA-DG pathway on bidirectional synaptic plasticity, the changes in long-term potentiation (LTP) and long-term depression (LTD) will be measured between a control group of non-handled animals and an isolated group which will undergo neonatal isolation. Neonatal isolation, a known stressor, is thought to increase the ability of neurons to receive and respond to synaptic inputs. The isolated rats will be separated from their mother and siblings from postnatal days 2 through 9 for an hour each day and then allowed to grow to adulthood. The control group will not be subjected to any isolation protocol. After implantation of electrodes in the BLA and DG in animals between 70 and 90 days of age, LTP will be induced in the DG by application of a 100-pulse, 5-Hz stimulation (theta burst stimulation) and LTD will be induced by application of a sustained 900-pulse, 1-Hz stimulation to the basolateral amygdala in freely behaving animals. As stress is known to increase plasticity in the amygdala, it is expected that bidirectional plasticity in both LTP and LTD in the BLA and DG will increase. This comparison between the induction of LTP and LTP in the BLA-DG pathway in isolation and control groups will help to explain the neural mechanisms connecting emotion (in the amygdala) and memory formation (in the hippocampus) and the effects that stress has on this system.

96.

BRAIN MAP ANALYSIS OF THE RELATIONSHIP BETWEEN POST-TRAUMATIC STRESS DISORDER, ALCOHOLISM, AND SCHIZOPHRENIA

Emily Dorward ‘06
Faculty Sponsor: Dan Lloyd

Previous studies have demonstrated that post-traumatic stress disorder and alcoholism often are found concurrently in patients. Furthermore, schizophrenia has been linked to both of these disorders through stress, as schizophrenia is thought to contain both a genetic and environmental component brought out through early childhood stressors. Currently, though only behavioral and clinical studies have yet confirmed these similarities, it is thought that particular brain areas such as the amygdala may play similar roles in these diseases. The amygdala is involved in emotion,

and more specifically emotion retention and memory tagging, and has demonstrated significant plasticity as a result of stress. This study will, using an online Brain Map database (www.brainmap.org) and other archives of brain data, compare and contrast the differences in brain activity of patients with these disorders as compared to controls in the performance of working memory tasks. We hope to demonstrate the relationship between post-traumatic stress disorder, alcoholism, and schizophrenia based on the brain images resulting from the working memory task studies.

97.
ERRORS, ALCOHOL, AND TEMPORALITY
Alexander Fredell '07
Faculty Sponsor: Dan Lloyd

The nature of this research will center on the examination of error recognition and its evolution and development through adaptive human responses. Past research has called the specific response the error-related negativity (ERN) which has been defined as: "occurring between 50 and 100 ms after the commission of a speeded motor response that the subject immediately realizes to be in error[1]."
Data for experimentation was from a research experiment at Olin Neuropsychiatric Research Center (Hartford, Connecticut). The Olin research was a driving study that examined the affect on the brain under conditions of alcohol intoxication (all participants performed the driving simulation inside of an FMRI scanner).
Data for analysis involved three sober sessions and three drunken sessions. Each session had three one minute and thirty second driving subsections (9 sessions of driving per condition). During each driving session participants were to follow all road laws, including speed and traffic laws. Participant's willingness to follow traffic laws was output into a behavioral file, which was used to find specific occurrences during which the ERN might be apparent. The specific response, which has become called the over-compensation response (OCS), occurred whenever a participant crossed a passenger side line, then over-corrected and hit the driver side line. The OCS, in this case, is the exact motor response needed for the ERN to take place. The ERN was then traced to physical structures of the brain and examined in relation to behavior to give a time course of the ERN. The ERN was then examined with relation to retention (memory of past) and protention (predictive of future outcomes) within the Husserlian framework of temporality.
[1] Luu, P; Tucker D.M.; Makeig S.; Clinical Neurophysiology 115 (2004) 1821–1835

98.
ANALYSIS OF PRACTICE ON BRAIN ACTIVITY AND PERFOMANCE IN SIMULATED DRIVING TASK
Josh Gaston '09
Faculty Sponsor: Dan Lloyd

The old adage says that practice makes perfect, and as William James noted, "if practice did not make perfect, nor habit economize the expense of nervous and muscular energy, (man) would therefore be in a sorry plight." Everyday experience demonstrates that the more times that tasks are practiced and performed, it undoubtedly results in the easier performance of these tasks, and also in increased performance of them. Yet, James's statement that practice economizes nervous

energy implies that the better and easier performance of a task that result from practice are themselves a result of decreased activity in the brain. Given the counterintuitive notion that decreased brain activity results in better and easier performance of a task, an effort was put forth to determine the precise effects of practice on the performance of a task as well as on the capacity to which different brain areas are used in practiced tasks compared to new ones.
Subjects were placed within an fMRI brain scanner with a steering apparatus in reach. At first they were instructed to do nothing other than focus on a fixation cross. Next, they were told to watch a computer simulated roadway from the perspective a car traveling down it. Finally, they were instructed to drive the simulated car, obeying normal traffic laws. This cycle was then repeated two more times. The fMRI brain scans taken during the performance of the driving task were then compared along the basis of the first, second and third run. Work was then done analyzing the different areas of the brain, searching for increased or decreased brain activity that had a high correlation with whether a task was being performed for the first, second or third time.

99.
ANALYSIS OF BRAIN ACTIVITY IN DRUNK & SOBER DRIVING
Elijah Heckstall ‘08, Owen Cahill ‘08
Faculty Sponsor: Dan Lloyd

Problems can occur when an individual drinks and gets behind the wheel. Alcohol affects your judgment and motor skills so in an fMRI study, our particular subject was put into a driving simulator in which he drove the course in a sober condition and a drunk one (individual was brought to a blood alcohol level of 0.10). To complete the analysis we constructed a few images of the brain during the driving phases of the tasks from each condition. Intensity of blood flow shows which areas of the brain are more active. We’ll form a comparison between the two phases by using a subtraction method of an average image during the driving phase while sober, taken away from the average image of the drunk phase. This will answer the question this study is aimed at: what is the difference in the areas of the brain used during driving when sober and intoxicated. Alcohol inhibits and slows many functions and we predicted that different areas of the brain compensate for the drunkenness. Further analysis could determine why certain areas are likely to contribute to the process of driving while drunk and the level of mistakes/ breaking of certain road rules could be compared to function of certain brain regions.

100.
DRIVING TO DISTRACTION: THE NEUROLOGICAL EFFECT OF A BLINKING LIGHT ON DRIVING MISTAKES IN fMRI
Alexandra Hoffmann ‘08
Faculty Sponsor: Dan Lloyd

Driving is a task that requires a great deal of attention, and recently much awareness has been raised to the importance of focusing on the road and not on distractions such as cell phones. In order to determine the instance of mistakes caused by distractions while driving, a subject performed a driving simulation task in a functional magnetic resonance image scanner. During the driving task, the subject was also instructed to press a button on the steering wheel when a light on the dashboard came on. This light served as a distraction to the driver, requiring attention to be paid to the dashboard as well as to the road. The number of mistakes made over a

series of four driving runs while the dashboard light was on was compared to the number of mistakes made while the light was off. Mistakes were defined as movement over the white line on the right side of the road, the yellow center line, and the white line on the far left side of the road. The images taken by the fMRI scanner during the light-on mistakes and the images taken during the light-off mistakes were separately compared to the scans taken during the driving task when no mistakes were being made. Both the comparison of the mistakes and the comparison of the fMRI scans were used to determine a correlation between distraction and driving mistakes.

101.
THE EFFECTS OF DEPRESSION ON NEUROCOGNTION IN PATIENTS WITH SCHIZOPHRENIA

Elizabeth Jones ‘06
Faculty Sponsors: Susan Masino, Sarah Raskin
Matthew Kurtz PhD, Institute of Living

Schizophrenia has a profound impact on neurocognition and community functioning. It is estimated that 70% of patients with schizophrenia have neurocognitive deficits (Palmer et al., 1997) and 70-80% of patients with schizophrenia are unemployed at any one time (Rupp & Keith, 1999). It has also been estimated that about 25% of patients with schizophrenia also meet criteria of the Diagonstic and Statistic Manual of Mental Disorders (DSM-IV) for depression (Siris, 1994). However it remains unclear the degree to which observed neurocognitive in this disorder can be linked to co-occurring depression. At the Institute of Living in Hartford, CT over 70 patients were administered the Beck Depression Inventory to assess level of depression. Based on these results, these patients were divided into low/high categories of depression and a battery of neurocognitive tests, including tests of verbal and visual memory, attention, problem solving, language and motor ability, were administered. Patients with low levels of depression were compared to those with a high level of depression. Preliminary data analysis does not support that our original hypothesis that patients with schizophrenia with co-occurring depression will show more profound deficits in neurocognitive compared to those without depression. In fact patients with co-occurring depression performed better on tests of memory and attention. There was no data that suggested any correlation between depression and executive function or motor ability. An alternate hypothesis is that patients who perform better on neuropsychological tests are more aware of the gravity of their situation causing self-reported depression.

102.
DECONSTRUCTING SPATIAL NAVIGATION IN AN EVENT-RELATED fMRI VIRTUAL MORRIS WATER MAZE TASK

Juli Martha ‘06
Faculty Sponsor: Sarah Raskin
Robert Astur PhD, Olin Neuropsychiatry Research Center, Institute of Living

The involvement of the hippocampus (HPC) in spatial memory has been well documented. Deteriorated performance in spatial memory tasks results from hippocampal insult (Astur RS, 2002). However, measures of spatial memory can vary greatly. Rodent tasks tend to require allocentric memory whereas human tasks tend to require egocentric memory (Astur RS, 2001). The Morris water task (MWT), which is a spatial navigation task, is known as one of the most

reliable and specific measures of spatial memory ability in rodents, requiring the usage of visual cues to navigate though an opaque pool of water to a hidden platform. Robert Astur, Ph.D. (Olin Neuropsychiatry Research Center) developed a joystick-operated virtual reality Morris water task (vMWT) in order to make comparable spatial memory observations in human subjects and to further elucidate the neuroanatomical involvement in spatial memory through fMRI analysis.
It is unclear whether the entire vMWT is equally sensitive and specific in assessing spatial memory and HPC involvement. Spatial navigation is a complex behavior, where the HPC is one of a network of brain areas involved (McGuire EA *et al.,* 1998). In this experiment, the vMWT was divided into two time-controlled segments: PAN, where subjects used pre-learned visual cues to orient themselves towards the "platform" goal and NAVIGATE, where subjects propelled themselves along a known path towards the already identified platform goal.
Twenty healthy controls (10 male) completed the task. Subjects received pre-scanner training in the vMWT and performed with 92.65% accuracy while in the Siemens Allegra 3 Tesla scanner, indicating efficient spatial processing. SPM software was used to examine brain activation in each of the two segments, revealing significantly greater bilateral HPC activation in the first PAN segment. These data suggest that visual cue orientation to a goal preferentially activates the HPC, rather than the subsequent goal-directed movement.

103.
NEUROSCIENTIFIC INVESTIGATION OF PHENOMENOLOGICAL TEMPORALITY
John Meyer '07
Faculty Sponsor: Dan Lloyd

Both neuroscience and philosophy are involved in the investigation of human consciousness, though often pursuing it in very different ways. In this experiment the two are joined, and philosophy, namely phenomenology, is used as a guide for the neuroscientific investigation of consciousness. Phenomenology states that as time passes the "now" continually sinks into the past and is replaced with a new "now" and with it comes new sensation and experience. Though there is only one instant's worth of sensation presented at a time, human consciousness is experienced as a continual flow; like the passing of individual frames of a film is experienced as a moving picture. According to phenomenology, the perception of the now is interpreted in context of what has already past, and in anticipation of what is coming. This retention and protention is a requirement for a continuous experience. If this philosophical theory is true, than the "now" brain must include a record of the past and a prediction the future. Neuroscientific tools can be used to examine such a phenomenon. Using fMRI data analyzed with Independent Component Analysis and a trained neural network it is possible to extract this record from each brain scan and to determine which past and future brainstates are most represented in the "now" brain. This study will investigate the temporal structure of experience using fMRI data collected during a driving paradigm.

104.

THE NEUROPROTECTIVE EFFECTS OF CHRONIC ADENOSINE A1 ANTAGONISM

Reid Offringa ‘06
Faculty Sponsor: William Church

It has been shown that the chances of developing Parkinson’s disease decrease in individuals who drink coffee. In addition, this correlation is known to be dependent on the average, daily dose of coffee. What could be the mechanism of neuroprotection which results from a lifetime of coffee use? Caffeine is an antagonist at both the adenosine A1 and A2a receptors, but few studies have examined the neuroprotection involved in A1 antagonism. The prevailing neuroprotective paradigm is that acute antagonism at the adenosine A2a receptor is what saves the brain from Parkinson’s disease. This study examines the up regulation of the adenosine A1 receptor, and examines its neuroprotection. SH-SY5Y cells were grown in DMEM:F12 media with 10% fetal bovine serum, and seeded into 24-well plates at a ratio of 1:24. The cells were allowed to come to confluence and treated DPCPX or caffeine for ten days. After coming to confluence, we exposed the cells to MPP+ and cell viability was assessed using the MTT assay. We expect to see neuroprotective effects from antagonist induced A1 receptor upregulation.

105.

RECONCILING MITOSIS AND NEURITE GROWTH: A STUDY INTO SH-SY5Y DEVELOPMENTAL PATTERNS

Reid Offringa ‘06
Faculty Sponsor: William Church

SH-SY5Y cells are cloned human hybridoma cells which possess peculiar growing patterns. Typically, neurite growth is induced using a combination of retinoic acid and brain derived neurotrophic factor, which traps the cell line in the G1 phase of development. Without this anti-mitotic cocktail, the blastoma cells are limited in the way that they can develop their processes. We visually examined the SH-SY5Y cells without any G1 trapping treatment to find how a connected, neuritic cell divides. Our findings show that the cells grow in a form resembling a fried egg, with differentiated cells surrounding a blob of cells without visually distinguishable boundaries. Cells were seen budding off of the central blob and extending neurites onto the floor of the plate. Connected cells were photographed dividing along the axis of their neuritic extensions, and the processes were grown perpendicular to the newly formed cell membrane. It is not known if neurites which grew parallel to the new boundary membrane were lost or never present. This visual examination has implications for how neuronal stem cells may grow, and how a neuron with brain connections may divide.

106.

BI-DIRECTIONAL SYNAPTIC PLASTICITY IN FREELY BEHAVING ADENOSINE A1 RECEPTOR- DEFICIENT MICE

Natalie Phouyaphone ‘06
Faculty Sponsors: Harry Blaise, Susan Masino

Adenosine is a nucleoside known for modulating neuronal activity. Activation of adenosine receptors by adenosine generally leads to inhibitory effects on glutamatergic pathways. This inhibition is mediated by A1 receptors (A1R) which are found abundantly in the hippocampus, an area associated with learning and memory. There are two types of processes that may offer neuronal understanding of the mechanisms underlying learning and memory, and these are known as long-term potentiation (LTP) and long-term depression (LTD). LTP and LTD are phenomena that relate to a long term increase or decrease in synaptic efficacy, respectively. It has been found that there is a bi-directional transition from LTD to LTP and that is dependent on the stimulation frequency of the glutamatergic pathway.
The goals of this study are to investigate whether this same bi-directional transition profile exist in A1R-deficient mice, and thus to assess the potential role of adenosine in learning and memory. Microelectrodes were chronically implanted, and after recovery, different stimulation frequencies of electrical impulses were applied to perforant pathway in the hippocampus and the resulting change in synaptic efficacy was quantified. We examined three genetically altered groups of mice: KO (absence of A1R gene), heterozygotes (half of A1R gene) and wildtype (presence of full A1R gene). Due to the inhibitory nature of A1R, the KO group exhibited a transition in synaptic plasticity at a lower frequency than the heterozygote and wildtype group, while the heterozygote group wild demonstrated the transition at a lower frequency than the wildtype group.

107.

THE ROLES PLAYED BY ADENOSINE A_1 AND A_{2A} RECEPTORS IN THE EFFECT OF TEMPERATURE ON ADENOSINE-MEDIATED SYNAPTIC TRANSMISSION

Laura Pomeroy ‘09
Faculty Sponsor: Susan Masino

Adenosine regulates synaptic transmission and excitability in the brain. The dominant adenosine response in the hippocampus as well as many regions of the brain is inhibitory, which is due to the dominant effect of the adenosine A_1 receptor. However, temperature affects the influence of endogenous adenosine and corresponding synaptic responses in the brain. Previous studies suggest that the influence of adenosine is a U-shaped function across the temperature range where hippocampal slice recordings typically occur, with the smallest influence at 33ºC, a significantly larger influence at 25ºC and 37ºC, and the greatest magnitude of adenosine influence at 25ºC. The shape of this function suggests that there is some other factor affecting adenosine influence besides temperature. In this study, 400 μm transverse hippocampal slices were obtained from 4-to-6-week-old male Sprague-Dawley rats. Extracellular electrophysiological recordings, with both stimulating and recording electrodes in the CA1 region of the hippocampus along the Schaffer Collateral pathway, were performed on the slices at the specific temperatures of 25ºC, 29ºC, 33ºC, and 37ºC. The slices were baselined and superfused with antagonists specific to the A_1 and A_{2A} receptors. These studies were performed with the intention of discovering the specific influence of each receptor subtype on synaptic transmission at different temperatures. These data suggest that the adenosine A_1 receptor has the most impact at the higher temperatures tested. The inhibitory influence of this receptor at higher

temperatures may explain why fever or a hot environment can promote sleep. This information is pertinent in understanding how the temperature at which experiments are conducted affects influence of adenosine and how this may impact results. It will provide more information upon which scientists can base their choice of recording techniques, and help relate them to behavioral phenomena.

108.

TEMPERATURE DEPENDANT MODULATION OF SYNAPTIC TRANSMISSION: THE ROLE OF ADENOSINE A_1 AND A_{2A} RECEPTOR POTENTIATION

Charles Psoinos '06
Faculty Sponsor: Susan Masino

Adenosine is present throughout the human body, both as part of cellular energy cycles and as a signaling molecule. It plays an important role in regulating the excitability of the brain and is known to be as a sleep-promoter, pain-reliever, and seizure reducer. Because of these properties, understanding the regulation and actions of adenosine may hold important clinical implications. Adenosine exerts its influence on the central nervous system through several receptor subtypes. We will be looking directly into the relationship between two of these subtypes, the adenosine A1 and adenosine A2a receptors, which have opposing effects on neuronal excitability (inhibitory and excitatory, respectively). Preliminary trials have shown that adenosine is regulated by temperature. The aim of this study is to further understand the relationship between temperature of adenosine and the regulation of adenosine receptor activity in the nervous system. Using extracellular electrophysiological recordings from hippocampal slices (Schaffer Collateral pathway) from 4-5 week old Sprague-Dawley rats we looked further into this phenomenon taking recordings at the specific temperatures of 25ºC, 33ºC, and 37ºC and applying adenosine receptor antagonists. These results show that the effect of the adenosine A1 receptor is dominant at 33ºC, whereas the A2a receptor subtype is activated at other temperatures above and below 33ºC. Understanding the relationship between adenosine and its receptors, both in vivo and in hippocampal slice preparations, may help design further strategies to regulate brain excitability through these specific receptor subtypes.

109.

QUANTITATION OF URIC ACID IN ALLOPURINOL-TREATED CELL CULTURES VIA HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY

Jeffrey Sullivan '07
Faculty Sponsor: William Church

It is thought that allopurinol prevents the formation of uric acid by acting as a competitive inhibitor of xanthine oxidase. In order to test this hypothesis in a simplified cell culture system, ventral mesencephalon cells of mice were treated with allopurinol and analyzed for uric acid content by HPLC. Quantitation was carried out with the use of a calibration curve. Results suggested a 2-6% inhibition of uric acid over a span of 1-7 days of treatment. Going forward, the experiment will be repeated using a stronger allopurinol treatment to determine the degree of proportionality between allopurinol exposure and uric acid inhibition.

110.

ANALYSIS OF HOW A FIXATION PERIOD EFFECTS TEMPORALITY

Tyler Triggs ‘09
Faculty Sponsor: Dan Lloyd

Temporality is the concept of the mind’s retention and protention of passing time. Events occur in the ‘now’ moment, and drift into short term memory retention. Also through experience and anticipation one can anticipate future events or outcomes, which is called protention. My analysis focuses on a study that monitored brain activity while a subject performed three different activities: driving a virtual car, watching from the passenger’s seat, and staring at a white ‘+’ on a black background (which is called ‘fixation’). It is my hypothesis that one of the effects of the fixation period is to disrupt the mental temporality of the subject. The experiment runs the three activities back to back in a pattern for about ten minutes. In one scanning session three ten minute cycles are recorded for averaging. The fixation period comes right before the drive section and right after the observe section of the scan, and serves to clear the mind in order to get more consistent results each time through.

The resulting image of measuring temporality is a graph that measures the protention and retention at the specific selected period. In order to judge if the fixation period does dampen the protention of the next drive period, I will scan three sections of the fixation period. The first section will consist of a portion of the tail end of the previous observe section, and will continue into the beginning of the fixation section. The second section will cover the middle of the fixation period, and lastly the third will run from the middle of the fixation into the beginning of the drive sequence. The results show a dampened protention in the middle section of the fixation period; which show that the fixation period did interrupt the protention of the coming driving sequence.

111.

TEMPORAL PROTENTION DURING DRIVING STUDY

Cristina Wheeler Castillo ‘08
Faculty Sponsor: Dan Lloyd

This experiment investigates the neurophenomenology of mental engagement and learning during a driving test simulation. Utilizing preprocessed fMRI data, the protention and retention structure of each brain image is determinable. During the driving portion of the tests, the first few seconds of each trial should depict comparable levels of brain activity which subsequently diminish in proceeding trials. In an effort to determine change in activity levels, the first five seconds of each of the three driving trials pertaining to a single run were compared using temporal analysis and spm contrast methods. These were also compared to two proceeding runs. Results suggest a decrease in protention as the trials occur, and also a decrease in activity levels in certain brain areas. Two possible explanations include that the subject engages less in the driving task as time goes on, resulting in temporally lower brain activity. The second explanation concludes that the while driving, a technique is learned throughout the separate runs and therefore, the protention decreases over time because the subject is more familiar with the course and the simulation.

112.
MEASUREMENT OF PROSPECTIVE MEMORY
Miriam Zichlin ‘06
Faculty Sponsors: Sarah Raskin, Dan Lloyd

The majority of individuals who suffer from brain injury experience a deficiency in a type of memory called prospective memory. Prospective memory can be defined as the ability to remember what we must do in the future, such as pick up a gallon of milk on the way home from work. Patients with prospective memory deficits can incur problems relating to planning, memory, attention or concentration. These problems can cause patients to seem forgetful and unable to complete daily tasks, such as remembering to lock their doors or even eat! Prospective memory is currently evaluated through many different kinds of tests such as the Memory for Intentions Screening Test (MIST) and a target recognition task. These two, seemingly different tests, both claim to measure prospective memory. In order to determine whether they do both measure the same construct, both tests will be administered to 20 patients over a 10 week period. The results of these tests will be compared to see which correlates most strongly with a measure of prospective memory in daily life whether or not a discrepancy is found. If neuropsycologists use the results of these tests as a basis for their work, it is necessary that all tests claiming to measure prospective memory correlate to one another. It is hypothesized that the MIST test and the target recognition task do not have correlating results. It is further hypothesized that the MIST test results vary more substantially with injury, while the target recognition task will not. Both test results will be compared to the degree of brain injury measured by psychological histories. The hope of this study is to be able to create a more even playing field to enable scientists to have a clearer view of what prospective memory is, and what tests truly measure it.

PHYSICS

113.
SEISMIC REFRACTION STUDY OF THE TRINITY COLLEGE CAMPUS
Emily Allen ‘08, Bryan Crabtree ‘06, Margaux Morrison ‘06
Faculty Sponsor: Christoph Geiss

Seismic refraction studies are conducted on a regular basis to investigate the makeup of the Earth. By measuring the velocities of seismic waves through the ground we can determine the depth, density and angle of the underlying layers, which can be interpreted in terms of composition and rock type. By comparing these three characteristics of the underlying layers, it can be determined what type of elements these layers are composed of. Basalt rocks have been found both on Zion Street and Summit Street on the Trinity College campus, despite their elevation difference. The presence of these rocks indicates that the denser underlying layer of the crust is angled downward from the west to the east side of campus. Seismic refraction studies have been conducted on both the upper and lower levels of the Trinity Campus in order to track the depth of this underlying layer. The seismic refraction studies were done using a series of geophones which tracked the vertical movement of both the primary and secondary seismic waves. Initial seismic wave velocity readings of these two portions of campus, the rugby field and the main quad, indicate that because there is a difference in their wave arrival time, there must be a difference in depth between the west and east ends of each study. By determining the makeup and layout of the layers of the Earth’s crust, a better understanding of the topography of specific location is possible.

114.
CHARACTERIZATION OF PACVD DIAMOND FILMS
Matthew Bermudez ‘09
Faculty Sponsors: Barbara Walden, Ann Lehman

The unique properties of diamond have long been known, and significant study has been done to investigate these properties in diamond films. Diamond film coating is applicable in countless fields because of the hardness, thermal conductivity, and inertness of the crystal. In order to fully take advantage of these properties, diamond growth will have to be more versatile than it is now. When growing films of greater than a few microns in thickness, intrinsic stresses develop, reducing the strength and integrity of the film. These features are closely related to the manner in which the crystals are grown, and onto what type of surface. In the nineteen-eighties, a method called chemical vapor deposition was applied to the manufacture of thin diamond films. Plasma-assisted Chemical Vapor Deposition (PACVD) has been used recently to grow thin films of the crystal with structure on the order of nanometers. Different growth conditions yield different film structures, and thus different levels of stress. Films have been prepared under different plasma temperatures, pressures, and from different mixtures of gasses.
Scanning electron microscope images of the films have shown a variety of surface features that indicate the different conditions under which they are formed. This study will link the different film features to their original deposition conditions. The next step in our research will be Raman spectroscopy on the films. It provides a characteristic signature for carbon materials, and thus is used to evaluate the micro and nanostructural properties of CVD diamond films. Shifts and changes in size and shape of the peaks in the spectrum generated by the diamond indicate flaws

and stresses. These spectrums, along with the visual data from the microscopy, will help to further characterize films based on their deposition conditions.

115.
OPTICAL PUMPING
Bryan Crabtree ‘06
Faculty Sponsors: Barbara Walden, Wayne Strange

Optical Pumping is a method used to push atoms away from thermodynamic equilibrium in order to see the different energy levels of an atom. This produces the phenomenon of Zeeman splitting, which is called the Zeeman effect. Zeeman splitting occurs when a group of atoms are placed in a very low magnetic field. The Zeeman effect is when the S1/2 and P1/2 get subdivided into 8 different sublevels. These sublevels are differentiated by the angular momentum of the atom. The Zeeman effect was observed by shooting circularly polarized light through a cell containing two different rubidium isotopes with a detector on the other side. At the two different resonance frequencies where the Zeeman effect occurs the atoms absorb the light instead of it passing through to the detector. The Zeeman effect was examined both linearly and quadratically. The transient effect was also examined when the radio frequency was no longer stable. From the data obtained a conclusion about how the nuclear spin and angular momentum characterize the different energy levels of an atom.

116.
QUANTIFICATION OF ULTRA-FINE MAGNETIC GRAINS IN SOILS
Tamara Machac ‘06
Faculty Sponsor: Christoph Geiss

Our research investigates an alternative inexpensive, fast and sensitive method initially developed by Horst Worm (1999) to quantify the abundance of very small magnetic grains (diameter smaller that 20 nm) near the SP-SSD boundary in natural soil samples and relates these abundances to modern climate in the Midwestern US.
The amount of these ultrafine magnetic grains in soils is thought to vary with changes in climate, especially precipitation. By comparing the physical properties of modern soils and older, buried soils we intend to shed light on past climatic changes. We designed a small field coil that can produce a magnetic field between approximately 100 to 6000 A/m. Using this simple device, we expose samples to a magnetic field for about 0.02s, by dropping the sample through the vertically oriented coil. Exposure to the same magnetic field for longer time periods is possible by placing the sample in the pipe for the specified amount of time. We measure the magnetic remanence of the samples after we expose the samples to the coil’s magnetic field for first 0.02, and then two seconds, using a JR6 Spinner Magnetometer. Then, we calculated the normalized difference ((IRM2s-IRMpulse)/IRM2s) of the two remanence measurements to estimate the abundance of ultrafine magnetic particles.
We have found that in general, the abundance of ultrafine magnetic (SP) particles increases dramatically for soils in the upper soil horizons, and then decreases with depth. Also, their abundance is generally greater in soils that formed under humid climatic conditions. However, the correlation between SP particles and climate is not particularly strong. SP-abundance is unlikely to yield a useful climatic proxy.

117.
THE FRAGMENTATION OF RUPERT'S TEARS
Margaux Morrison ‘06
Faculty Sponsor: Mark Silverman

Many rigid structures in nature can be described by a fractal distribution. As icebergs crash into one another the pieces created by this collision are not random, but can be classified into groups of different sizes. The number of pieces in each size bin increase by a power of ten as the bin goes up, thus creating a fractal distribution. Rupert’s Tears are glass tear drops under high stress due to the tension in the interior of the drop. By breaking the tail off the drop, it will explode immediately. Because Rupert’s Tears are a mode of glass, the distribution of their fragments may not be the same for crystalline materials. In order to characterize their distribution, samples of Rupert’s Tears were made by dropping molten glass into cold water. The tails of the tears were then broken off and the fragments were collected. By sifting the resulting pieces, they were put into different categories according to size. With the use of a microscope, the tiny pieces were counted and a log plot of frequency versus size was made. From this plot one can study the nature of the fragmentation process and, in particular, whether it is scale invariant (i.e. behaves like a fractal).

118.
SELF-ORGANIZED CRITICALITY IN CELLULAR AUTOMATON AS A POSSIBLE MODEL FOR EVOLUTION
Bao Pham ‘06
Faculty Sponsor: Mark Silverman

The Theory of Self-Organized Criticality (SOC) describes nature as a complex dynamic system, perched at a poised critical state. This state is characterized by scale free behaviors in which small disturbances can cause responses, call avalanches, of all sizes. A complex system becomes critical without forcing from any outside agents. The critical state comes into existence as a consequence of interactions among individual elements of the system. In other word, the critical state is self-organized. The key mathematical characteristic of SOC is the power laws relation, which is characterized by the line on the double logarithmic plot. SOC appears in a range of biological, earth and human systems. One interesting model that was observed to be critical is the ‘Game of Life’ developed by John Conway. This computer game is a cellular automaton, made up of a square lattice system with a specific set of rules that govern the state of each square. Earlier studies found that realizations of the game organize into the critical state from which scale-free structure emerged. The power law was applicable for both the distribution of ‘clusters’ of size s and the distribution of durations of perturbations. In this study we looked at previous research carried out on the Game of Life. We found that the rules established in this game were critical within a large length scale. We extended the study by creating our own cellular automaton on a hexagonal lattice governed by a unique set of rules. We hope that by studying the dynamics of cellular automata we will gain some insight into the dynamics of a society of living organisms and how these systems evolve.

119.

DETERMINING THE MAGNETIC MINERALOGY OF BASALT SAMPLES FROM SUMMIT STREET

Ryo Saotome ‘08, Russell Adler ‘08
Faculty Sponsor: Christoph Geiss

The aim of this project is to determine the main magnetic mineral present in the basalt flow located under Summit Street. In order to do this we subjected a rock sample from this basalt flow to a series of ARM and isothermal remnant magnetization measurements under different conditions and temperatures. The acquisition curve we acquired from these measurements indicated that our sample was mostly a low-coercivity ferromagnetic mineral. In order to figure out which one, we measured its Curie temperature. We found it to be 580C which is near the known value for magnetite. Furthermore, we performed a series of low-temperature demagnetization experiments. These experiments indicated that our sample loses its magnetic remanence when cycled through the Verwey transition, another characteristic property of magnetite. Based on these results, we can say with high confidence that the main magnetic mineral present in the basalt flow under Summit Street is magnetite. Further tests are necessary on a heated sample to see if the magnetic properties of rocks from the basalt flow changes when heat is applied to it. The culmination of this project should lead to a better understanding of the geological makeup of the Trinity Campus on a firsthand basis.

120.

ANALYSIS OF MCCOOK GROUND TEMPERATURE

Valentina Zhelyazkova ‘08, Tamara Machac ‘06
Faculty Sponsor: Christoph Geiss

In this research we examine how the daily surface temperature changes affect the temperature at various depths in the soil.

We obtained data using temperature sensors to record the temperature in fifteen minute intervals at three different depths in the soil near the McCook building for a total period of eight weeks. We generated several mathematical models that describe changes in temperature with depth and time and determined which one correlates best with the empirical results. One of possible models is the heat conduction equation, which predicts the penetration of external heat into the Earth for a sinusoidal surface temperature variation. However, we think that the use of the complementary error function model will present a better approximation to the actual temperature distributions at various depths. In this model, we divided the total depth into small increments. Then, we calculated the expected temperature for the following day at a certain depth using as input, the current day’s temperature of the soil cells lying directly above and below. In our final model, we obtain the temperature at a certain depth for the next day, by averaging the temperature of the soil cells lying directly below and above. We expect this simple model to resemble the complementary error function model.

In our analysis, we found that in a total probe depth of 0.4 m, fluctuations of daily surface temperature greatly affected the upper horizons in a short period of time. However, it takes several days for surface temperature variations to penetrate to the lowermost layers of a soil profile.

PSYCHOLOGY

121.

EFFECTS OF PARENT ACADEMIC VALUES AND BELIEFS ON THE RACIAL ACADEMIC ACHIEVEMENT GAP IN MIDDLE AND HIGH SCHOOL STUDENTS

Katherine Berkenbush '06
Faculty Sponsor: David Reuman

Past research has focused on many family and school factors which account for the academic achievement gap between White, Black, Hispanic, and Asian students. Of primary importance to this study are the effects parents have on their children through parent efficacy beliefs and family academic values, which include aspirations and beliefs of the importance of education for the future. Parent values both directly and indirectly affect their children's values, which in turn impact effort and achievement in classes and on standardized tests. I predict that racial differences in academic values can account for some aspects of the racial academic achievement gap. Middle school and high school students, along with a subset of their parents from a suburban school district, were administered surveys, measuring academic values, and the responses were linked to state-administered standardized test scores and class grades. Implications of the results for reducing the racial achievement gap will be discussed.

122.

THE INTERRELATIONSHIPS AMONG PERFECTIONISM, DEPRESSION, AND SOCIAL ANXIETY: A LONGITUDINAL STUDY

Alexander Bruce '06
Faculty Sponsor: David Reuman

The present study investigated possible longitudinal relationships among perfectionism, depression, and social anxiety. Based on previous research, it was predicted that self-oriented perfectionism would significantly predict depression over time, and that socially prescribed perfectionism would contribute to subsequent social anxiety (Hewitt, Flett, & Ediger, 1996; Schlenker & Leary, 1982). A sample (N = 118) of Trinity College students, the majority of whom were freshmen and sophomores, completed the Multidimensional Perfectionism Scale (MPS; Hewitt, Flett, Turnbull-Donovan, & Mikail, 1991), the short version of the Center for Epidemiologic Studies Depression Scale (CES-D; Cole, Rabin, Smith, & Kaufman, 2004), and the Social Phobia and Anxiety Inventory (SPAI; Turner, Beidel, Dancu, & Stanley, 1989) at two separate times with an average interval of 35 days. Multiple regression analyses indicated that self-oriented perfectionism and depression at Wave 1 significantly predicted increases in social anxiety at Wave 2, whereas socially prescribed perfectionism at Wave 1 did not predict subsequent social anxiety. No significant predictors of Wave 2 depression were identified, net of initial levels of depression. The findings raise the possibilities that self-oriented perfectionism and depression may each have a stronger effect on subsequent anxiety than socially prescribed perfectionism, and that self-oriented perfectionism may not play as strong a role in depression as previously thought.

123.

TRINITY COLLEGE STUDENTS AND THEIR VIEWS ON HOMOSEXUALITY: SOCIAL CONSTRUCTIONISM VS. ESSENTIALISM

Joanna Confalone '06, Alexandra Miller '07, Christine Grant '08
Faculty Sponsor: Dina Anselmi

Individual disposition and behavior are established by two influences: biology and culture. Two theories have been proposed to describe the factors that determine an individual's characteristics. Social constructionism proposes that an individual's characteristics are shaped by society's cultural norms and values. Essentialism, on the other hand, suggests that genetics and innate characteristics are responsible for the differences among individuals. We predict that college students tend to take a social constructionist view when assigning responsibility to individual characteristics. They tend to believe that culture is the primary force that drives behavior and determines characteristics. However, we feel that college students will not have this social constructionist viewpoint in regards to homosexuality. We hypothesize that Trinity college students, regardless of their demographics, will maintain an essentialist view of homosexuality. Also, more masculine students will have a social constructionist view of this topic. In order to illustrate our hypothesis, we designed a study surveying 50 Trinity College students on their views towards homosexuality and the issues pertaining to it.

124.

SENSORY INTEGRATION DYSFUNCTION IN CHILDREN WITH AND WITHOUT AUTISM

Kwame Dance '06
Faculty Sponsors: Dina Anselmi, Randy Lee

Although most children with Sensory Integration Disorder (SID) are classified as either having Autism, Obsessive Compulsive Disorder (OCD), or Attention Deficit Hyperactive Disorder (ADHD), some children do not possess other defining characteristics of any other disorder. This study investigated the relationship between Sensory Integration Disorder and Autism in children ages 4 to 16. The study examined both the sensory similarities and differences, and early environmental differences between children with Autism and children classified as having SID. This comparison was measured using the Sensory Integration Questionnaire, a 52-item scale that measures parents' reports of their children's sensory difficulties. To supplement this questionnaire and provide qualitative details about the child's early environment, parents were administered eight interview questions aimed at gaining information about their children's sensory history. Based on previous research, and my own observation of children with sensory integration problems with and without autism, I hypothesized children with autism would experience more tactile (touch), attention/behavioral, muscle tone, and coordination difficulties; while SID children would exhibit more difficulty with, motor, vision, audition, and olfaction. I also hypothesized there would be a correlation between problems in early environment and SID. A two-factor ANOVA was conducted on the eight sensory categories measured in the Sensory-motor History Questionnaire. Contrary to my hypothesis results indicated a significantly higher level of attention and behavior problems in SID children. The relationship between early environmental problems and SID children was measured using a Chi-squared analysis to determine if there was a correlation between type of early environmental problem and the disorder the child developed. No significant correlation was found.

125.

EFFECTS OF PARENTAL INVOLVEMENT ON THE ACHIEVEMENT GAP

Katherine DellaSelva ‘06
Faculty Sponsor: David Reuman

It has been well documented that many school and home factors have influenced and contributed to the racial achievement gap in the United States. Parental involvement is one of these factors that has been shown to have a large impact on a students’ educational achievement. This study looked at the influence of parental involvement on the achievement gap in a suburban Connecticut town. Both students and parents were surveyed with questions referring to the parent’s involvement in homework, course selection, and extracurricular involvement, among other activities. It’s hypothesized that there would be less parental involvement for students of color than their peers, and that they will subsequently have achieved less academically. The implications of this study can be used to guide and create policies or programs to help target and lessen the achievement gap.

126.

EFFECT OF SEX ON CLASS PARTICIPATION IN COLLEGE STUDENTS

Lesya Gaynor ‘08, Stephanie Gonzalez ‘08, Alexandra Puleo ‘08, Elena Wetmore ‘06
Faculty Sponsor: Dina Anselmi

In a study of the connection between sex and participation in the classroom, Crombie, Pyke, Silverthorn, Jones and Piccinin (2003), found that males were more likely than females to participate in class discussions. Their research also revealed that students’ perceptions of their own activity levels were generally consistent with the observed participation. In a study of discussion-based courses at Trinity College, we sought to determine whether males or females were more likely to participate voluntarily in discussions. Classes were audio recorded for a total of two and a half hours each, and the sex of speakers and length of comments were recorded. Questionnaires were handed out to the students in the recorded classes to determine self perception of participation levels. We hypothesized that males would participate more frequently and speak for longer periods of time than females, because they are more confident in the classroom. We also predicted that both sexes of students would evaluate themselves as having higher levels of participation than actually observed.

127.

GENDER ROLE BEHAVIOR IN TELEVISION SERIES

Jonathan Grabowski ‘07, Tyler Simmons ‘07, Jessica Piervicenti ‘07, Jane Shiverick ‘08
Faculty Sponsor: Dina Anselmi

Popular television can be seen as a reflection of a society’s contemporary views and values. Given that gender role norms have been progressively changing in recent decades, it seems logical that the scripts for television series’ would reflect this progression; contrary to this reasoning, male and female characters in TV shows still seem to embody outdated gender stereotypes. Attempting to identify a trend of gender inequality in popular television series, a content analysis of primetime commercial network television series across three decades was conducted. The Bales’ Interaction Process Analysis was used to identify the behaviors and interactions of male and female characters. We hypothesized that female characters would exhibit more emotional behavior than males. Conversely, we expected that males would exhibit more task-orienting behavior than females.

128.

RACE, PERCEPTIONS OF RACIAL CLIMATE, AND THE ACHIEVEMENT GAP

Elizabeth Gutterson ‘06
Faculty Sponsor: David Reuman

Increasing diversity of the student population in today’s school systems has brought to attention an important problem: Some children are noticeably lagging behind their classmates in a variety of disciplines and, to the dismay of educators and school administrators, are not catching up as they progress through the grades. The achievement gap is found regardless of socioeconomic status and exists mainly between majority (mainly White) and minority (mainly African-American and Hispanic) students. While many reasons for this achievement gap have been presented, it is likely that both family and school factors are involved. The present study seeks to further examine one of these factors: namely, the inter-racial climate at school, to see if and how it affects different races and contributes to the achievement gap. In order to measure the inter-racial climate of a classroom, Green, Adams and Turner (1988) developed a scale based on Allport’s contact theory and conditions. It is widely acknowledged that the presence or absence of these specific conditions affects the inter-racial climate in the classroom. A random sample of 7th and 11th graders in the Twainville public school system were given a questionnaire in which they responded to questions regarding the inter-racial climate at school. Results will be used to gain a better understanding of the race gap in achievement and what can be done to help close the gap.

129.

MARRIAGE AND CAREER ASPIRATIONS OF TRINITY COLLEGE STUDENTS

Katharine Hancock ‘06, Sarah Purvis ‘06, Tina MacDonald ‘06, Max Weisz ‘07
Faculty Sponsor: Dina Anselmi

Gender differences in career and marriage aspirations of current undergraduate students were examined, specifically whether men or women would be more likely to choose to stay at home and raise children instead of pursuing a professional career. An online survey was distributed to 58 Trinity College non-IDP undergraduates, consisting of 16 males and 42 females. Attitudes were measured using a 38-item scale modified from a previous study conducted by Smith at Trinity College in 1983. Based on Smith’s (1983) research, we hypothesized that women would be more likely to report marriage as more important vs. career, while men would be more likely to report career vs. marriage. We also predicted that in the future, women would be more likely than men to see themselves doing housework, volunteering, or part-time work outside the home. It was also hypothesized that women with a spouse and/or children would be more likely to make certain sacrifices (e.g.: taking time off of work to care for children, entertaining clients/associates) and less willing to make other sacrifices (e.g.: relocate, work weekends, stay at work overtime, bring unfinished work home, attend further school for work, and travel for job) to their own career vs. men. Women would also be more willing than men to make these sacrifices to help their spouses’ career. Regarding type of marriage or long-term relationship, we predicted women would prefer equal decision-making between spouses, while men would show greater preference for a husband/male dominant relationship. We predicted that participants would be more likely to choose preference for roles similar to those of their parents. Finally, these results were compared to Smith’s (1983) findings to determine whether there are generational changes for Trinity College students in career and marriage aspirations.

130.

EFFECT OF PESTICIDE EXPOSURE ON NEUROPSYCHOLOGICAL FUNCTIONING OF FOREIGN-BORN FARMWORKERS

Jesse Hansen ‘06, Lauren Farrer ‘08
Faculty Sponsor: Sarah Raskin

Many farm workers are exposed to chronically high levels of pesticide exposure. Often, both nationally and internationally, migrant farm worker’s exposure to harmful pesticides is underreported, and high percentages of these workers experience negative symptoms and illness as a result. Among these illnesses, pesticide exposure has been demonstrated to result in a variety of neuropsychological defects in agricultural workers. With the incidence of chronic low-level pesticide-related intoxication in the agriculture workers worldwide as high as 25 million per year, it is necessary to research and understand the neuropsychological effects of pesticide exposure in this underserved population. This purpose of this study was to examine the occurrence of and relationship between low-level exposure to organophosphate pesticides and neuropsychological dysfunction in agricultural workers in the absence of any previous history of acute chemical exposure. It was hypothesized that farm workers with a higher lifetime exposure to organophosphates would perform significantly worse on measures of neuropsychological functioning than minimally exposed control subjects. A group of foreign-born farm workers at Imperial Nurseries, a local ornamental plant nursery in Granby, CT, were recruited to participate in the study. Trinity College B&G staff was also recruited as control subjects. Each subject was tested in two sessions: an interview-based questionnaire (The Farmworker’s Health Study Questionnaire) was administered to determine exposure, followed by a computer-based neurobehavioral test that included measures of attention and memory (Behavioral Assessment and Research System). Results are pending.

131.

FAMILY COMMUNICATION AND HAPPINESS

Paul Jarboe ‘07, Kate McEachern ‘07, Erin Michelson ‘06, Christine Myksin ‘07
Faculty Sponsor: Dina Anselmi

This study investigated whether students’ happiness levels change throughouttheir years at Trinity College in relationship to family contact and quality of home life. In this study, happiness was measured using the Oxford Happiness Questionnaire (Hills & Argyle, 2002). The frequency of family contact and quality of parental relationships were measured using a modified version of the Parent Adolescent Communication Scale (Barns & Olsen, 1985). The survey was sent to 200 Trinity College students via email. We investigated happiness levels in relation to family contact concerning variables such as race, class year standing and gender. It was predicted that students with better relationships with family members would have higher levels of happiness at school than those with lower levels. It also was predicted that there would be no gender differences in relation to happiness or quality of familial relationships, but that females would communicate with family members more often than males. It was expected that the happiness levels of students would be higher for upperclassmen than it would be for underclassmen, and that class year would have no influence on the quality of familial relationships. Finally, it was predicted that communication with family members would be higher for underclassmen than it would be for upperclassmen.

132.
BODY PERCEPTION IN ANIMISTIC AND SCIENTIFIC CULTURES
Lindsey Jordan ‘06
Faculty Sponsor: Randy Lee

People in different societies perceive their bodies in unique ways due to differences in cultural norms, values and the surrounding environment. Past research indicates that body perception develops through internalization of societal ideals involving how one should experience the self (Miller, 2005). The purpose of this study was to examine body perception through scientific and animistic worldviews in order to understand the motivations and implications of placing significant cultural value in body image. This discussion is constructed through the lens of the ecological psychology model, or ecopsychology. Ecopsychology develops on the relationship between organism and environment. Developed by Kurt Lewin in 1936, it studies the relationship between humans and nature and operates under the premise that the mental health of earth’s inhabitants has a direct relationship with the environment’s health. It was predicted that cultures that value body image would have a higher prevalence of negative self reflection and disordered eating than cultures that perceive the body on a vitalistic level. Body perception was further explored by examining bodily relation to spirit as well as the impulse to control, compartmentalize, and objectify the body and the environment.

133.
GENDER ROLES AND RELATIONSHIPS: A CROSS-CULTURAL COMPARISON
Lindsey Jordan ‘06, Lilia Vazova ‘06, Matthew Krant ‘06, Kelly Mearns ‘08
Faculty Sponsor: Dina Anselmi

Research suggests that boys and girls are socialized into their respective gender roles and moreover that they learn styles of relating to one another through the process of imitation. (Firestone, Firestone, Catlett, 2006). Consequently, family and societal values play an important role in determining the gender role values that children develop. These values play out in their own relationships in childhood and as they approach adolescence and adulthood. Concepts of masculinity and femininity vary from culture to culture and may have different meanings depending on societal values. This study investigated the role between gender roles, culture and relationships in Trinity College students. We predicted that students would model their gender roles in relationships after the values of their family and local society. Further, we predicted that Bulgarian students would have a significantly more conservative view of gender roles than American students.

134.
ASSESSING THE RELATIONSHIP BETWEEN SEXUAL RECIDIVISM, HARE PSYCHOPATHY CHECKLIST-REVISED, AND STATIC-99
Hoa Lam ‘06
Faculty Sponsor: Barbara Chapman

Assessing factors involved in sexual recidivism is extremely important due to the danger sexual offenders present to the community. Several actuarial risk scales are available to predict recidivism rates of sexual offenders. This study analyzed two widely used assessment scales, the Hare Psychopathy Checklist-Revised (PCL-R) and Static-99. This study examined the relationships between these assessment scales, sexual recidivism, number of sentencing dates,

and age at first sexual offense. Information was gathered from 200 male sexual offenders who were interviewed and evaluated for Sexual Violent Predator status, out-patient status, or prison entry in the California Bay Area. The onset ages for the men ranged from 11-62 years old (M = 27.79, SD = 10.44). Statistical analyses indicated that non-recidivists had lower PCL-R scores than recidivists. Results also showed that individuals with higher PCL-R scores and recidivists were more disposed to start offending at a younger age. Child molesters were found to be less selfish, more remorseless, and less egocentric than rapists/mixed offenders. Finally, there was a positive correlation between PCL-R and Static-99 scores. These findings may help to develop new policies and interventions to reduce sexual recidivism.

135.

HOW DEEP IS YOUR TAN? THE ROLE OF HEALTH AND APPEARANCE BELIEFS, RISK-TAKING PROPENSITY, AND SELF-ESTEEM IN ARTIFICIAL TANNING BEHAVIOR AMONG COLLEGE STUDENTS

Tina MacDonald '06
Faculty Sponsor: Randolph Lee

Skin cancer has become an undeclared epidemic, as medical reports have indicated a startling increase in cases of basal, squamous, and malignant melanoma in recent years. This increase can be attributed to high-risk behaviors such as sunbathing and tanning salon use. Despite the recognized harmful consequences of tanning, however, people continue to sunbathe and use tanning salons. Why do individuals partake in such self-harming behavior? This study investigates this question by examining the roles of health- and appearance-related beliefs, risk-taking behavior, and self-esteem in college students in relation to tanning salon frequency (TSF). Tanning affects physical appearance, and past research has established a strong relationship between low self-esteem and negative body image (Goldenberg & Shackelford, 2005). A negative correlation between self-esteem and tanning behavior was therefore predicted. Excessive exposure to UV rays is considered a high-risk behavior, and it was hypothesized that high-risk propensity would be positively correlated with tanning. Zuckerman's Sensation Seeking Scale was administered to measure risk-taking behavior and the Rosenberg Self-Esteem Test to measure self-esteem level. Subjects were also asked to indicate their agreement with various health- or appearance-related beliefs associated with tanning. There was no significant correlation between TSF and both self-esteem and risk-taking behavior. There was a significant gender difference in TSF, as females tanned more than males. Overall, the two statements that were the greatest predictors of TSF were a health-related belief ("I see harm in going to tanning salons") and an appearance-related belief ("When I am tan, I feel more attractive"). This suggests that high TSF is found primarily in females and is motivated by appearance-enhancing motivations, but can be deterred by health concerns. The results and their implications in forming an effective intervention to decrease TSF are discussed.

136.
SEXUAL ATTITUDES ACROSS GENERATIONS
Elizabeth Maynard ‘07, Melanie Levy ‘07, Stacy Hills ‘07
Faculty Sponsor: Dina Anselmi

The use of contraceptives is a controversial practice that has been debated in our society for decades. The debate is further fueled by the issue of sexual education in schools. Contraceptives have developed and advanced in recent decades and there are more options available then ever before; abortion, condoms, and the morning after pill all fall in this category. These forms of birth control are becoming more readily accessible to each successive generation. With these changes, however, controversy arises due to conflicting views between generations. Our study investigates whether there are generational differences in views on sexual behavior, education, and contraceptives in American culture. To look at attitudes across generations, 110 Trinity Students and 100 Trinity Faculty were chosen at random to participate. They were asked to complete an anonymous online survey that measured their attitudes about of sex education and the use of contraceptives. We expect to find that the older generation composed of faculty members have a more conservative attitude on the use of contraceptives and sexual education. We also anticipate the younger generation composed of students to have a more liberal attitude towards these issues, and that they will be less likely to view educating adolescents about contraceptives as inappropriate.

137.
ASSESSING THE RACE ACHIEVEMENT GAP: THE RELATIONSHIP BETWEEN PARENTS’ EDUCATIONAL ASPIRATIONS, CHILDREN’S EDUCATIONAL ASPIRATIONS, AND PRO-ACADEMIC PEER NORMS
Molly McGuinness ‘06
Faculty Sponsor: Dina Anselmi

The race achievement gap in schools is an unresolved crisis in need of further examination. Past research suggests that both home and school factors play important roles in racial differences in academic success. This study assessed the significance that parents’ educational aspirations and values, adolescents’ educational aspirations, and the relative influence of peers’ educational attitudes had on racial disparities in academic achievement. Previous studies suggest that parents’ beliefs on educational attainment were strong predictors of their children’s beliefs of their future educational outcomes. A stratified random sample of local White, Asian, African-American, and Hispanic high school adolescents and a subset of their parents were given a survey assessing these domains. The implications for the effects these measures have on the race achievement gap will be discussed.

138.

MUSICAL RHYTHM, EMOTION, AND HEART RATE VARIABILITY: COHERENT HEART RATE VARIABILITY (HRV) PATTERNS INDICATE POSITIVE EMOTIONAL STATES AFTER EXPOSURE TO REGGAE

Jennifer Mingrino '07
Faculty Sponsor: Randolph Lee

Rhythm is an essential part of the beating of our hearts, the growth of a plant, or the tapping of a drum. For centuries, people have used music as a healing tool, but only recently began empirically exploring the potential role that music has in our autonomic physiology and the organizing effect it has on human brain activity and emotional states. Western musical genres rooted in traditional African music aesthetic, Reggae, in particular, are heavily steeped in rhythm. The current study hypothesized that exposure to the consistent stimulus that rhythm (most notably in the drumbeats) provides will generate a coherent HRV pattern, thus a positive emotional effect will result. Additionally, it is the prediction of the present study that those individuals with a positive response to the music correlate with certain personality characteristics on preliminary tests of personality and emotional reactivity. Participants (N=7) took a 12-question music survey, the 16 Personality Factor Questionnaire, and Gough & Helibrun's Adjective Checklist. Each subject listened to two selections of music (Mendiani Rhythm & Roots Reggae) and one non-musical selection (ocean waves crashing on shore). Using raw ECG data and a time-domain analysis of heart rates researchers calculated the HRV of each participant. R-R intervals calculated and graphed over time were determined "coherent" or "incoherent" in their general paths. Literature has shown that a coherent HRV pattern is indicative of alpha brain wave activity, which denotes a relaxed and positive emotional state. Results are predicted to show that HRV coherence results from exposure to Reggae, thus causing synchronization in ANS and a positive emotional state. This evidence has implications for music therapy especially for those suffering from depression, stress, anxiety, Parkinson's, and Alzheimer's.

139.

ADOLESCENTS AND THEIR PARENTS VIEWS ON CHILDREN'S RIGHTS, ADOLESCENT DECISION-MAKING AND PARENTING STYLE

Elizabeth Reichert '06, Naralys Estevez '06
Faculty Sponsor: Dina Anselmi

During adolescence, children begin to feel the need for independence. Many times discrepancies exist among parental and adolescent conceptions of their rights to make autonomous decisions. The UN Convention on the Rights of the Child (CRC) was created to protect and empower children and the rights they are entitled to, which include: provision, protection, and participation rights. These rights can be separated into two larger categories: nurturance orientation and self-determination orientation. The nurturance orientation is society's provision and protection of rights that are beneficial to the child and the self-determination orientation is society's protection and provision of rights that allow children to have some control over their own lives (Ruck, 1994). Research on children's rights has shown that parents of older children are more likely to support self-determination rights than parents of younger children (Ruck, Peterson-Dadali & Day, 2002). Previous studies have shown that in families with older adolescents, the children are permitted to make more independent decisions (Bosma, et al., 1996). Furthermore, views of parental jurisdiction versus adolescent authority tend to differ based on specific types of issues (Smetana, 1988, 1994, 1995). The goal of the current study was to investigate the relationship

between attitudes towards children's rights, parenting style, and decision-making practices in adolescents and their parents. This study aimed to examine whether or not parents' and children's perception of decision making changes with increasing age. Participants included eighth graders and eleventh graders from an urban school and their parents. Each participant completed four separate questionnaires and demographic information. We hypothesized that parents of eleventh grade students would allow their adolescents to make more independent decisions than parents of eighth grade students. In addition, we predicted that adolescents and their parents would be equally supportive of nurturance rights but that adolescents would be more supportive of self-determination rights than their parents.

140.

GENDER, SEX, AND ALTRUISM

Steven Schmidt '08, Megan Fallon '08, Kelly Howard '08
Faculty Sponsor: Dina Anselmi

American society tends to foster over-generalized stereotypes by assigning feminine behaviors and attitudes to women and masculine behaviors and attitudes to men based on cultural norms. In general, altruistic behaviors have been more associated with women than men. This is partly due to the fact that women are culturally regarded as nurturing and believed to place the needs of others before their own. Psychological studies have shown that women are indeed more likely to display altruistic behavior in day to day situations. However, past research has focused on anatomical sex and not gender traits such as femininity and masculinity as determining factors of altruism (Eagly & Crowley, 1986). Since not all women fall into the feminine category and not all men fall into the masculine category, one interesting question is whether anatomical sex should not be regarded as the key identifier for altruistic behavior. While there may be a correlation between anatomical sex (female/male) and gender traits (femininity/masculinity), this study analyzes whether the gender traits of individuals are a stronger predictor of altruistic and helping attitudes and behaviors.

141.

INFLUENCE OF STEREOTYPE THREAT AND FAMILY ACADEMIC VALUES ON THE RACE GAP IN ACHIEVEMENT

Alyssa Shuman '06
Faculty Sponsor: David Reuman, Dina Anselmi

A racial gap in achievement has existed in the United States for decades, where White and Asian-American students achieve substantially higher than Black and Hispanic students on standardized tests. The present study focuses on school and home factors that may influence the race gap in achievement. Local 7th and 11th grade students, within a single, suburban public school district, as well as their parents, were surveyed in order to assess how strongly stereotype threat and family academic values would influence the achievement gap. Hopefully the findings of this study will have important implications that will help to reduce the race gap in achievement, as well as promote higher levels of achievement across all races.

142.

STUDENT IDEAS ABOUT THEIR OWN AND THEIR PARENT'S VIEWS REGARDING INTER-RELIGIOUS, INTER-RACIAL, AND SAME-SEX DATING AND MARRIAGE

Samantha Strauss ‘06, Sydney Meckler ‘08, Marissa Zanno ‘08
Faculty Sponsor: Dina Anselmi

This study investigates the views that students have about themselves and their parents regarding inter-religious, inter-racial, and same-sex dating and marriage. A random sample of students was given an online survey, which assessed their views about religion, race, and gender in terms of dating and marriage. They were also asked about their parent’s views about these same topics. We hypothesized that students will be more tolerant to inter-religious, inter-racial and same sex dating and marriage than their parents. Another hypothesis was that more highly religious students and their parents, as well as minority racial groups, would be more inclined to date and marry within their religion or race. We also hypothesized that people with little religious affiliation would be more tolerant to sexual orientation and would be more likely to date and marry outside their religion and race.

143.

THE EFFECTS OF HEALTH, MOBILITY, AND SOCIO-ECONOMIC STATUS FACTORS ON THE RACE GAP IN ACHIEVEMENT

Rebecca Wetzler ‘06
Faculty Sponsor: David Reuman

Previous research has shown that Black and Hispanic students tend to achieve at significantly lower levels than Asian and White students on standardized tests (Barton, 2003; Rothstein, 2004). The purpose of this study was to examine the influence of health, mobility, and socio-economic status on the achievement gap, as well as how highly correlated these factors are with race. To test these effects, I administered surveys to 7th and 11th graders at schools in a suburban school district and mailed corresponding questionnaires to parents at home. I used information from these surveys and questionnaires, as well as student grades from transcripts, scores from state-administered achievement tests, and district-gathered information on whether or not the student was eligible for free/ reduced-price lunch. Policy implications of the results will be discussed.

144.

DISSIMILAR EFFECTS OF POSITION AND DIRECTION IN FORWARD AND BACKWARD SERIAL RECALL

Rachel Nies ‘06
Faculty Sponsor: Karl Haberlandt

My study examined accuracy as a function of list position and recall direction in serial recall. In serial recall, subjects are presented with a list of items that they must recall in order. The study of serial recall is important because of its application in everyday tasks (ex: recalling a phone number), as well as IN neuropsychological diagnoses. In my task, 103 undergraduate students recalled 7-digit lists in either a forward or backward direction over the course of 120 trials. My results indicated that accuracy was significantly better in forward recall than in backward recall.

In both recall directions, there were primacy effects. The recency effect was small and limited to the final output position. In addition, I observed an interaction between recall direction and list position. Specifically, accuracy declined more steeply as a function of output position in backward recall than in forward recall. My results were consistent with my predictions. Based on the dissimilar accuracy patterns between forward and backward recall, my results implied that different cognitive strategies may be employed depending on the direction of recall.

145.
SERIAL POSITION EFFECT OF LATENCIES IN DIRECTIONAL RECALL: A LATERAL INHIBITION NETWORK MODEL
William Chapman ‘06
Faculty Sponsor: Karl Haberlandt

The serial recall task is a robust and widely used paradigm in memory research. This experiment examines the effects of output position and recall direction on the latency of correct responses in a serial recall task. Examining the latency of correct responses in this task can give insight into the cognitive processes involved with ordered recall. Forward and backward recall directions were studied because they are thought to make use of different processes. Results were interpreted using lateral inhibition network architecture to incorporate the effects of several encoding and output principles thought to most affect the latency of correct responses; primacy, response suppression, response competition, recency, and item inhibition. For this experiment, participants studied 7-digit lists from 0-9 without repetition and were post-cued to report them either forward or backward. The latencies of correct responses exhibited asymmetrical bow-shaped trends in both directions with overall slower responding for backward recall. In forward recall the relatively fast responses for early items were attributed to high initial activation predicted by the primacy principle. Slow responses for middle items were attributed to inhibition from response competition. The fastest responses for late items were attributed to reduced inhibition caused by response suppression. In backward recall the relatively fast responses for early items were attributed to the suppression of inappropriate responses by item inhibition. Slow responses for middle items were attributed to decay from recency effects and implicit forward cycling. The fastest responses for late items were attributed to primacy effects and response suppression. Overall slower responding for backward recall was attributed to the combined effects of implicit forward cycling and increased use of executive functions required for item inhibition. The steeper latency peak observed for middle items in backward recall is attributed to the combined effects of implicit forward cycling and mental grouping.

146.
SUBJECT PREFERENCE FOR ANTICIPATION ERRORS IN SERIAL RECALL
Brendan Murray ‘06
Faculty Sponsor: Karl Haberlandt

Although the serial recall paradigm has been used for many years to examine the different stages of memory processing, little examination has been devoted to the types of recall errors subjects commit. When a subject commits an error, it is typically a transposition: the displacement of a study digit to an incorrect output position. The present study examined the pattern of such transpositions – if subjects were equally likely to transpose digits to earlier and later positions, or

if one error was favored over the other. 103 undergraduates from Trinity College participated in the current study. Each student was presented with 120 lists of seven digits, and was post-cued to recall the list in forward or backward order.
The study determined that, regardless of output direction, subjects were most likely to recall items too early rather than too late. These results were consistent with those found by Haberlandt, Thomas, Lawrence, and Krohn (2005), and fit the predictions of the Start-End Model (SEM) presented by Henson (1998). The results were interpreted in light of the SEM, and principles of serial recall suggested by Farrell & Lewandowsky (2004). Specifically, recall performance appeared to be influenced by the principle of item marking. This principle suggests that when items are encoded in memory, they are associated with a list-external context that helps maintain list order. Henson's SEM assumes a method of item marking in which each list item is affected by gravitational "start" and "end" markers, which pull list items towards the start or end of the list. Because early input items tend to be recalled better, the SEM assumes a primacy gradient such that the "start" marker is stronger than the end marker, producing more anticipations. This assumption is consistent with the findings of the present study.

147.

ITEM STRENGTH AND DISPLACEMENT DEGREE: THE TWO DETERMINANTS OF ERROR RESPONSE TIMES IN SERIAL RECALL

Lilia Vazova '06
Faculty Sponsor: Karl Haberlandt

I examined serial recall performance to explore what factors influence encoding and retrieval processes in short-term memory. During the encoding phase of serial recall, participants are presented with lists of items, such as digits, letters, or words. During the output phase, they are asked to recall the items in a specific order. In forward recall participants are prompted to retrieve the items in their presentation order, and in backward recall – in their reverse order.
The 103 participants in the experiment memorized lists of 7 digits and were post-cued to recall the digits either forward or backwards, entering their responses one at a time on a keyboard. My research focused on transposition errors. These are items recalled away from their target positions. Transpositions are of two kinds: anticipations and postponements. Anticipations take place when an item is recalled too early; postponements take place when an item is recalled too late.
I examined Latency Displacement Functions (LDFs): error response times as a function of the distance from the correct item position. The results indicated that in both recall directions anticipations were slower than postponements. These differences in response times were more pronounced at small displacements than at large displacements. Furthermore, in both recall directions, response times were fast for errors close to correct item positions and slow for remote errors. I suggested that anticipations are slower than postponements because in both forward and backward recall they include weaker items replacing stronger items in output. The relative strength of items resulted from item inhibition, the primacy gradient (in forward recall), and the input-output interval (in backward recall). For large displacements, the differential effects of these factors were mediated by the displacement degree, hence the smaller differences in response times for remote errors.

SOCIOLOGY

148.
THE RESTRUCTURING OF COMPANIES AND ITS EFFECT ON CORPORATE CRIME
Ashley Plosky ‘06
Faculty Sponsor: Theresa Morris

Are corporations really restating financial statements more now than in the past? Over the past few decades, corporations have moved from using the multi-divisional subsidiary form to the multi-layered subsidiary structure. This was largely spurred by legal changes embodied in the Tax Reform Act of 1986, which left revenue transfers between subsidiary corporations and their parents unexamined. This gave corporations an incentive to structure in this way and an opportunity to use the structure to misconstrue their revenues. Thus, this change allowed corporations to commit corporate crimes due to the lack of supervision of the corporation by government agencies. Using resource dependence theory and organizational theories of deviance, I hypothesize that corporations with many subsidiaries and many layered subsidiaries are more likely to commit corporate crimes. I will use a sample of Fortune 500 corporations to test this hypothesis by analyzing the impact of the multi-layered subsidiary structure on the odds of a corporations’ restating its financial statements, controlling for pertinent organizational characteristics.

149.
CLASS AT COLLEGE: THE EFFECT OF SOCIAL CLASS ON STUDENTS' COLLEGE
Jessi Streib ‘06
Faculty Sponsor: Stephen Valocchi

Much is known about how race affects minorities’ experiences at predominately white, selective liberal arts colleges. Much less is known about how students’ class backgrounds affect their academic and social experiences at these same colleges. Data from the Quality of Life Surveys and the Enrolled Student Survey are used in conjunction with qualitative interviews to determine if class is a major factor in students’ experiences and perceptions of academic and social life at Trinity College. The results show that class is a significant factor in social but not academic life.