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# EIGHTEENTH ANNUAL SYMPOSIUM OF TRINITY COLLEGE UNDERGRADUATE RESEARCH

## TABLE OF CONTENTS

<u>Poster #</u>	<u>Title</u>	<u>Page #</u>
-----------------	--------------	---------------

### BIOLOGY

1	<b>DUVANE DITERPENES ACCOUNT FOR THE DEFENSIVE ACTIVITY OF HAIR-BORNE DROPLETS IN TOBACCO BUDWORM (<i>HELIOTHIS VIRESCENS</i>) CATERPILLARS</b> Sarah Arnold 06	12
2	<b>ECONAZOLE AS A SUPERIOR INHIBITOR OF MYCOBACTERIALGROWTH IN <i>MYCOBACTERIUM BOVIS</i></b> Kari Bjornard 05	12
3	<b>EFFECTS OF SOCIAL INTERACTION ON PROLIFERATION AND VIMENTIN EXPRESSION IN WEAKLY ELECTRIC FISH, <i>APTERONOTUS LEPTORHYNCHUS</i></b> James Castellano 05	13
4	<b>ELECTROCOMMUNICATION DRIVEN DIVSERSIFICATION IN THE CENTRAL NERVOUS SYSTEM OF <i>APTERONOTUS</i></b> Jason Gallant 05	13
5	<b>ESTABLISHING A DATABASE OF THE NATURAL BACTERIAL FLORA OF THE UPPER RESPIRATORY TRACT</b> Margaret Gatti 05	14
6	<b>FROM ALGAE TO ANIMAL: <i>BRYOPSIS</i> CHLOROPLAST INGESTION AND INCORPORATION IN <i>ELYSIA CRISPATA</i>.</b> Gregory Gavelis 08	15
7	<b>TREATMENTS FOR THE EXTRACTION OF CHLOROPLAST FROM <i>CAULERPA RACEMOSA</i>.</b> Paula Guzman 06	15

<b><u>Poster #</u></b>	<b><u>Title</u></b>	<b><u>Page #</u></b>
<b>8</b>	<b>EVALUATION OF CRESTED CARACARA HABITATS IN SOUTH CENTRAL FLORIDA</b> Bridget Iwamuro 05	16
<b>9</b>	<b>INVENTORY OF MAMMALS AT TRINITY COLLEGE FIELD STATION</b> Priya Kalyan-Masih 05	16
<b>10</b>	<b>REGULATION OF PROTEOLIPID PROTEIN (PLP) EXPRESSION BY PPARS</b> Joanna Kulesz 05 and Jared Wasser 06	17
<b>11</b>	<b>THE EFFECT OF STARVATION ON DIGESTIVE ENZYME ACTIVITY LEVELS IN <i>ELYSIA CHLOROTICA</i></b> John LaPorta 05	17
<b>12</b>	<b>EVALUATING THE GENETIC DIVERSITY OF THE FLORIDA CRESTED CARACARA (<i>CARACARA PLANCUS AUDUBONII</i>) USING MICROSATELLITE ANALYSIS</b> Doris Luk 05	18
<b>13</b>	<b>PCR AMPLIFICATION AND CLONING OF PPAR<math>\delta</math> REGULATED GENES IN OLIGODENDROCYTES</b> Meagan Miller 08, Celia Rodriguez 08	18
<b>14</b>	<b>THE EFFECTS OF EXTENDED PERIODS OF ANOXIA ON <i>VAUCHERIA</i> PROPAGULES IN CONNECTICUT RIPARIAN SEDIMENTS</b> Alison Parpal 08	19
<b>15</b>	<b>CORTISOL INFLUENCES THE RATE OF CELL PROLIFERATION IN THE BRAIN OF ADULT WEAKLY ELECTRIC FISH, <i>APTERONOTUS LEPTORHYNCHUS</i></b> Erealda Prendaj 05	19
<b>16</b>	<b>USING P-INDUCED MALE RECOMBINATION IN THE CHARACTERIZATION OF IMPORTIN A1 IN <i>DROSOPHILA MELANOGASTER</i></b> Ravin Ratan 05	20
<b>17</b>	<b>GLANDULAR HAIRS: LARVAL CHEMICAL DEFENSE IN THE BUTTERFLY <i>ASCIA MONUSTE</i> (LEPIDOPTERA: PIERIDAE)</b> Douglas Rendell 05	20
<b>18</b>	<b>DIET ANALYSIS USING PELLETS FROM CRESTED CARACARAS IN FLORIDA</b> LingYan Wang 08	21

# CHEMISTRY

<u>Poster #</u>	<u>Title</u>	<u>Page #</u>
19	<b>USE OF ASYMMETRICAL DIYNE FORMATION ENROUTE TO 3-DIMENSIONAL HYDROCARBON CAGES</b> Kristen Allegue 05	22
20	<b>COMPARISON OF METHODS TO SYNTHESIZE 5-5'-DI-TERT-BUTYL-N-(9-FLUORENYLMETHYLOXYCARBONYL)-4-CARBOXYGLUTAMATE</b> Nicholas Callahan 06, Frank Mieles 07	23
21	<b>SYNTHESIS OF <math>\alpha</math>-BROMOSULFIDES</b> Jacqueline Corbett 06	23
22	<b>INDIUM PROMOTED COUPLINGS OF PROPARGYL ALDEHYDE MOIETIES WITH 1,2- AND 1,4- REGIOSELECTIVITY</b> Kwame Frimpong 08	24
23	<b>COMPARATIVE ARCHAEOOMETRY OF MODERN AND CAESAREAN POTTERY SHARDS</b> Adam Hill 08	24
24	<b>INDIUM PROMOTED COUPLING: THE EFFECTS OF ELECTRON WITHDRAWING GROUPS ON 1,2- AND 1,4-ADDITIONS.</b> Claire Lawlor 06	25
25	<b>SYNTHESIS AND CHARACTERIZATION OF POTENTIAL <math>\alpha</math>-HELIX TEMPLATES</b> Adam Lesser 06	25
26	<b>ALCOHOL SYNTHESIS FROM PROTECTED <math>\alpha,\beta</math> ACETYLENIC ALDEHYDES WITH INDIUM METAL</b> Adam Pangilinan 05	26
27	<b>GENERATING <math>\beta</math>-TURNS USING 1,1'-FERROCENEDICARBOXYLIC ACID AS A TEMPLATE</b> Mark Silva 05	26
28	<b>SYNTHESIS OF COMPLEX HYDROCARBON CAGES AND RELEVANCE TO ENDOHEDRAL COMPLEX FORMATION</b> Katharine Spencer 08	27

<b><u>Poster #</u></b>	<b><u>Title</u></b>	<b><u>Page #</u></b>
<b>29</b>	<b>INDIUM PROMOTED COUPLINGS OF PROPARGYL ALDEHYDE MOIETIES WITH 1,2- AND 1,4-REGIOSELECTIVITY</b> Joseph Wzorek 06	27
<b>30</b>	<b>SYNTHESIS OF METALLACYCLICPEPTIDES BY SIDE-CHAIN TO SIDE-CHAIN COORDINATION</b> Craig Yennie 06	28
<b>31</b>	<b>METALLACYCLICPEPTIDES: CYCLIC PEPTIDES THAT INCORPORATE METAL ATOMS</b> Richard Yoon 05	28

## **COMPUTER SCIENCE**

<b>32</b>	<b>STABLE MANAGEMENT APPLICATION</b> Kendall Church 05	29
<b>33</b>	<b>PIRATENET!</b> Jeremy Freeman 05	29
<b>34</b>	<b>DESIGNING A 3-DIMENSIONAL ROLE PLAYING GAME USING C++ AND THE DIRECTX LIBRARIES</b> Stephen Katuska 05	29
<b>35</b>	<b>TRINITY COLLEGE SQUASH WEBSITE</b> David Kelly 05	
<b>36</b>	<b>A QUICK LOOK AT TRINITY COLLEGE THROUGH THE EYES OF FLASH.</b> Victor Laboy 05	30
<b>37</b>	<b>TRINITY COLLEGE WRESTLING WEBSITE AND DATABASE</b> Jim Malone 05	30
<b>38</b>	<b>STEGANOGRAPHY: THE ART OF INFORMATION HIDING</b> Andres Molina 05	31
<b>39</b>	<b>MODELING HUMAN SUBJECTIVITY: PERSONALITY PROFILES AND IMPRESSIONS</b> James Piette 07	31

<b><u>Poster #</u></b>	<b><u>Title</u></b>	<b><u>Page #</u></b>
<b>40</b>	<b>USING BLENDER TO LEARN AMERICAN SIGN LANGUAGE (ASL)</b> Genevieve Wong 05	<b>32</b>
<b>41</b>	<b>IMPLEMENTATION OF A PUBLIC-KEY CRYPTOSYSTEM</b> William Zeller 06	<b>33</b>

## **ENGINEERING**

<b>42</b>	<b>HIPPOCAMPAL LTD IS RELIABLY INDUCED BY LOW FREQUENCY STIMULATION IN FREELY BEHAVING NEONATAL RATS</b> Rebecca Bell 05	<b>34</b>
<b>43</b>	<b>IMPLEMENTING SHAPE MEMORY ALLOYS INTO THE DESIGN OF A THERMAL LIQUID MIXING SYSTEM</b> Rob Bialobrzewski 05, Matt Webster 05	<b>35</b>
<b>44</b>	<b>REMOTE REPAIR AND REPROGRAMMING OF AUTONOMOUS SYSTEMS</b> Matthew Gillette 05	<b>35</b>
<b>45</b>	<b>LINKAGES BETWEEN EMOTION AND MEMORY: SIMULTANEOUS NEURONAL RESPONSES IN THE AMYGDALA AND THE HIPPOCAMPUS</b> Rachel Hartman 05	<b>36</b>
<b>46</b>	<b>DESIGN OF A ROBOTIC HAND USING SHAPE MEMORY ALLOYS</b> Nilsson Holguin 05	
<b>47</b>	<b>REAL-TIME IMAGE PROCESSING WITH FPGA</b> Bozidar Marinkovic 05	<b>36</b>
<b>48</b>	<b>ALVIN-VI TRINITY COLLEGE AUTONOMOUS GROUND VEHICLE</b> Bozidar Marinkovic 05, Susmita Bhandari 07, Matthew Gillette 05, Sam Lin 07, Maria Restrepo 06, Regardt Schonborn 06, David Pietrocola 08 and Kevin Harder 06	<b>36</b>
<b>49</b>	<b>FPGA IMPLEMENTATION OF RESPIRATION SIGNAL CLASSIFICATION USING A SOFT-CORE PROCESSOR</b> Bozidar Marinkovic 05, Matthew Gillette 05	<b>37</b>
<b>50</b>	<b>HOVERBOB, A FLYING ROBOT FOR UNDER \$100</b> Allison Mathis 07, Kashif Mohiuddin 08	<b>37</b>

<b><u>Poster #</u></b>	<b><u>Title</u></b>	<b><u>Page #</u></b>
<b>51</b>	<b>AUTONOMOUS UNDERWATER VEHICLE</b> Patrick McBrien 05, Ridgely Dodge 05	38
<b>52</b>	<b>AERODYNAMIC DRAG OF VARIOUS AUTOMOBILE BODIES</b> Kashif Mohiuddin 08, Amanda Rao 08 and Jeffrey Scalia 08	38
<b>53</b>	<b>SELECTIVE DATA LOGGING</b> Benjamin Nye 05	39
<b>54</b>	<b>STIRLING ENGINE AS A POWER SOURCE FOR SMALL ELECTRICAL NETWORKS</b> Jeffrey Pulaski 05, Jonathan Jeanes 05 and Kristopher Wee 05	39
<b>55</b>	<b>DJA2 A STUDY IN ROBOTICS PROGRAMMING</b> Rayn Sakaguchi 07 and Nabil Imam 08	40
<b>56</b>	<b>CONCEPT ROBOT</b> Reg Schonborn 06, Sam Lin 07, David Miliniak 08, David Pietrocola 08 and Neil Robertson 08	40
<b>57</b>	<b>AN IMPROVED WOOD COOKSTOVE USING FORCED DRAFT</b> Mark Witt 05	41

## **ENVIRONMENTAL SCIENCE**

<b>58</b>	<b>INVESTIGATION OF LAKE SEDIMENTS BY X-RAY DIFFRACTION ANALYSIS</b> Mosammat Fatema 06	42
<b>59</b>	<b>RECONSTRUCTION OF ENVIRONMENTAL CHANGE IN A NORTHWESTERN CONNECTICUT LAKE USING LOSS ON IGNITION ANALYSIS</b> MeiLin Fegan 06 and Daniel Scollan 05	42
<b>60</b>	<b>SEDIMENT SIZE ANALYSIS OF MUDGE POND, CONNECTICUT</b> Jenny Gragg 07 and Craig Curtis Schneider 05	43
<b>61</b>	<b>SALT MARSH RESTORATION IN GOOSENECK COVE, NEWPORT RI</b> Andrew Grosvenor 05	43

<b><u>Poster #</u></b>	<b><u>Title</u></b>	<b><u>Page #</u></b>
62	<b>ASSESSING THE VERTEBRATE COMPONENT OF THE DIET OF FLORIDA'S CRESTED CARACARAS</b> Kyle Pias 07	44
63	<b>PALEOMAGNETIC ANALYSIS OF LOUIS LAKE, WYOMING</b> Craig Curtis Schneider 05	44
64	<b>RECONSTRUCTION OF THE BIOLOGICAL HISTORY OF THE GREAT SOUTH BAY ESTUARY USING PRESERVED MOLLUSK RECORDS</b> Daniel Scollan 05	45
65	<b>RECONSTRUCTION OF LAKE LEVELS OF MUDGE POND, WESTERN CONNECTICUT THROUGHOUT THE HOLOCENE</b> Ryan Sultan 06	45
66	<b>MAGNETIC PROPERTIES OF LAKE SEDIMENTS</b> Jacques Swanepoel 06	46

## **HEALTH FELLOWS**

67	<b>LYME DISEASE, SEPTIC ARTHRITIS AND TRANSIENT SYNOVITIS; DO KOCHER'S MULTIVARIABLE PREDICTORS HOLD TRUE IN CONNECTICUT, A STATE WHERE LYME DISEASE IS ENDEMIC?</b> David Alderman 06	47
68	<b>CORRELATION OF BLOOD PRESSURE ELEVATION TO SEVERITY OF ILLNESS IN CHILDREN WITH GUILLAIN-BARRE SYNDROME</b> Nicholas Harrison 06	47
69	<b>CONTINUED EVALUATION OF THE UNIVERSAL JAUNDICE- SCREENING PROGRAM AT HARTFORD HOSPITAL</b> Bao Pham 06	48

## **MATHEMATICS**

70	<b>CLASSIFICATION OF QUADRIC HYPERSURFACES IN HIGHER DIMENSIONS</b> Leighann Kinter 08	50
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<b><u>Poster #</u></b>	<b><u>Title</u></b>	<b><u>Page #</u></b>
<b>71</b>	<b>EYE COLOR PROBABILITIES ACROSS GENERATIONS</b> Sarah Litman 05 and Lindsey Sheldon 05	<b>50</b>
<b>72</b>	<b>THE USE OF CONTINUED FRACTIONS TO APPROXIMATE SPECIAL FUNCTIONS</b> Lisa Pham 08 and Nikolay Atanasov 08	<b>51</b>
<b>73</b>	<b>WHETHER OR NOT WEATHER FOLLOWS A RANDOM WALK</b> Molly Stumbras 07 and Vijay Bhirud 05	<b>51</b>

## **NEUROSCIENCE**

<b>74</b>	<b>COMPARISON OF ROTENONE- AND MPP+-INDUCED TOXICITY IN DIFFERENT MURINE STRAINS</b> Daniel Cuzzzone 05	<b>52</b>
<b>75</b>	<b>DEFAULT MODE NETWORK ACTIVITY IN SCHIZOPHRENIA: A FUNCTIONAL MRI STUDY USING INDEPENDENT COMPONENT ANALYSIS</b> Abigail Garrity 07	<b>52</b>
<b>76</b>	<b>ADENOSINE A1R RECEPTOR DEFICIENCY ALTERS HIPPOCAMPAL PLASTICITY IN FREELY MOVING KNOCKOUT MICE</b> Jessica Koranda 05	<b>53</b>
<b>77</b>	<b>SYNAPTIC PLASTICITY IN 30 DAY OLD FREELY MOVING RATS</b> Timothy Scarella 08	<b>53</b>

## **PHYSICS**

<b>78</b>	<b>QUANTIFICATION OF ULTRA-FINE MAGNETIC GRAINS IN SOILS</b> Tamara Machac 06	<b>55</b>
<b>79</b>	<b>MAGNETIC ENHANCEMENT IN LOESSIC SOILS - EFFECTS ON MAGNETIC GRAINSIZE AND MINERALOGY</b> Alex Masi 08	<b>55</b>

# **PSYCHOLOGY**

<b><u>Poster #</u></b>	<b><u>Title</u></b>	<b><u>Page #</u></b>
<b>80</b>	<b>CENTER OF MASS CHANGE AND TOOL PREFERENCE IN WOMEN'S LACROSSE</b> Emily Allen 08	<b>57</b>
<b>81</b>	<b>RELATION OF MEDIA EXPOSURE, DIETARY RESTRAINT, AND STRESS</b> Patricia Allen 05	<b>57</b>
<b>82</b>	<b>CREATIVITY AND MADNESS</b> Sarah Bell 05	<b>58</b>
<b>83</b>	<b>THE INTERPERSONAL EXPERIENCE IN COLLEGE: A COMPARATIVE STUDY</b> Justyn Bellsey 05	<b>59</b>
<b>84</b>	<b>THE EFFECT OF BIRTH ORDER AND SIBLING RELATIONS ON ASPECTS OF SOCIABILITY</b> Justyn Bellsey 05, Melissa Rosenberg 05, Lindsey Fay 05 and Chase Nelson 05	<b>59</b>
<b>85</b>	<b>INVESTIGATION OF ATHLETICISM IN MEN'S AND WOMEN'S SPORTS</b> Tara Borawski 06, Samantha Strauss 06, Jessica Baker 05 and Matthew Krant 06	<b>60</b>
<b>86</b>	<b>PARENTS OR PEERS: WHO HAS MORE INFLUENCE OVER YOU?</b> Jacqueline Cintron 05, Samuel Dance 06, Jennifer Mingrino 06 and Sabrina Murray 05	<b>60</b>
<b>87</b>	<b>EFFECT OF TEMPERATURE ON ADENOSINE IN HIPPOCAMPAL SLICES</b> Carolyn Edwards 08	<b>61</b>
<b>88</b>	<b>HOOKING UP AND DATING AT TRINITY COLLEGE</b> Naralys Estevez 06, Sarah Litman 05, Maureen Skehan 06 and Laura Watson 06	<b>61</b>
<b>89</b>	<b>THE IMPACT OF MEDIA MODELS ON BODY SATISFACTION AND SELF-ESTEEM AS IT RELATES TO BODY MASS INDEX</b> Lindsey Fay 05	<b>62</b>

<b><u>Poster #</u></b>	<b><u>Title</u></b>	<b><u>Page #</u></b>
<b>90</b>	<b>THE CULTURAL CONSTRUCTION OF THE SELF: HINDUISM, AYURVEDA, AND THE CURRENT STATE OF MENTAL HEALTH AND ILLNESS IN INDIA</b> Beth Heaney 05	62
<b>91</b>	<b>DISCIPLINE STYLES: PARENTS VS. CHILDCARE CENTER TEACHERS</b> Ayres Heller 05, Beth Ramaley 05, Carey Robertson 05 and Amber Smith 05	63
<b>92</b>	<b>ADOLESCENTS AND THEIR MOTHERS' VIEWS ABOUT THE RELATIONSHIPS BETWEEN DECISION-MAKING IN THE HOME, PARENTING STYLES, AND ATTITUDES TOWARD CHILDREN'S RIGHTS</b> Ayres Heller 05 and Amber Smith 05	63
<b>93</b>	<b>ASSESSING A CHILDREN'S RIGHTS CURRICULUM PROJECT AT THE HARTFORD MAGNET MIDDLE SCHOOL</b> Carey Robertson 05	64
<b>94</b>	<b>STUDENT DRINKING BEHAVIOR AND FAMILY HISTORY</b> Lindsey Jordan 06, Alex Dargery 05, Jenna McMeekin 06 and Charkie Quarcoo 06	64
<b>95</b>	<b>SOCIO-CULTURAL INFLUENCES ON COLLEGE FEMALES REGARDING EATING-RELATED ATTITUDES AND BEHAVIOR, AND BODY IMAGE IN LAHORE AND HARTFORD: A CROSS-CULTURAL STUDY</b> Sana Khan 05	65
<b>96</b>	<b>MUSCLE DYSMORPHIC DISORDER AND THE MEDIA</b> Sarah Litman 05	65
<b>97</b>	<b>LEGAL VERSUS EXTRALEGAL: THE DEBATE OVER THE PREDICTIVE FACTORS OF BAIL DECISIONS IN CONNECTICUT.</b> Lysa Magazu 05	66
<b>98</b>	<b>THE RELATIONSHIP BETWEEN OCCUPATIONAL CATEGORIES AND STEREOTYPED PERSONALITY CHARACTERISTICS.</b> Lysa Magazu 05, Erin Michelson 06, Christine Myksin 07 and Paulette Studley 10	66
<b>99</b>	<b>SPORTS AND DEVELOPMENT</b> Tracy Nesbit 05, Erin Conley 05, Matthew Katzman 05 and Deirdre Savageau 04	67

<b><u>Poster #</u></b>	<b><u>Title</u></b>	<b><u>Page #</u></b>
<b>100</b>	<b>THE EFFECTS OF TASK DIFFICULTY AND ATTRIBUTIONAL FEEDBACK FOLLOWING SUCCESS ON SUBSEQUENT TASK ACHIEVEMENT AND MOTIVATION</b> Jennifer O'Brien 05	67
<b>101</b>	<b>DRAWING NEGATIVE SPACE</b> Melissa Rosenberg 05	68
<b>102</b>	<b>THE INFLUENCE OF ATHLETIC PARTICIPATION ON SELF-ESTEEM AND SOCIAL AND ACADEMIC COMPETENCE</b> Deirdre Savageau 06, Erin Conley 05, Matthew Katzman 05 and Tracy Nesbit 05	69
<b>103</b>	<b>THE PSYCHOLOGY OF FORGIVENESS IN SOUTH AFRICA'S TRUTH AND RECONCILIATION COMMISSION: PROSPECTS FOR FOSTERING FORGIVENESS</b> Ashley Tetu 05	69
<b>104</b>	<b>THE EFFECTS OF THE SEXUAL MEDIA ON SELF-ESTEEM AND BODY IMAGE</b> Maia Wojcik 05	70
<b>105</b>	<b>EFFECTS OF PERCEIVED INGROUP STATUS AND SOCIAL SKILLS ON DEPRESSION AMONG TRINITY COLLEGE STUDENTS</b> Marissa Wong 05	70

## **SCIENCE & SOCIETY**

<b>106</b>	<b>CONFLICT BETWEEN MATERNAL RIGHTS AND FETAL RIGHTS</b> Joanna Kulesz 05	72
<b>107</b>	<b>ASSESSING HARTFORD'S OPTIONS FOR USE OF THE CURRENT LANDFILL SITE AND WASTE MANAGEMENT IN TO THE FUTURE</b> Ashley Tetu 05	72

# BIOLOGY

1.

## **DUVANE DITERPENES ACCOUNT FOR THE DEFENSIVE ACTIVITY OF HAIR-BORNE DROPLETS IN TOBACCO BUDWORM (*HELIOTHIS VIRESCENS*) CATERPILLARS**

Sarah Arnold 06

Faculty Sponsor: Professor Scott Smedley (Biology)

The ability of insects to avoid predation is essential for their survival. Compared to other insects, slow-moving and soft-bodied caterpillars are particularly vulnerable to predators. Therefore, these organisms often rely on a wide range of physical and chemical defenses. Tobacco Budworm (*Heliothis virescens*) larvae coat hairs on their body surface with droplets of trichome secretion from their primary host plant, tobacco (*Nicotiana tabacum*). I provide conclusive evidence that these droplets are obtained through direct contact rather than through ingestive means. These droplets composed of tobacco-derived duvane diterpenes defend the caterpillars against the predatory ant *Crematogaster lineolata*. In bioassays with this ant, I found that these duvane diterpenes account for the defensive activity of the droplets. This research shows that *H. virescens* larvae sequester the tobacco's chemical defense and use it for their own protection.

2.

## **ECONAZOLE AS A SUPERIOR INHIBITOR OF MYCOBACTERIAL GROWTH IN *MYCOBACTERIUM BOVIS***

Kari Bjornard 05

Faculty Sponsors: Professors Hebe Guardiola-Diaz and Lisa-Anne Foster (Biology)

Tuberculosis is one of the leading causes of death in the world today, causing up to 2 million deaths per year. Multiple antibiotics aimed at targeting *Mycobacterium tuberculosis*, the causative agent of tuberculosis, have decreased the incidence of tuberculosis infections, however, the emergence of drug-resistant strains renders the current treatments ineffective. Therefore, it is important to identify new targets for anti-mycobacterial drugs in *M. tuberculosis*. Analysis of the *M. tuberculosis* genome identified a sequence that is similar to CYP51 (lanosterol-14 $\alpha$ -demethylase) and has been expressed as a soluble protein in *M. tuberculosis*. The high sequence similarity to CYP51s of mammals and fungi indicate that MT CYP51 may play an important role in the biosynthesis of the unique mycobacterial cell wall. Previous studies have shown that azole anti-fungal compounds, particularly econazole, inhibit growth of both *M. bovis* and *M. smegmatis*, two mycobacterial species that are closely related to *M. tuberculosis*. Because isoniazid, a current front-line treatment for tuberculosis, also targets the mycobacterial cell wall, we studied the relationship between isoniazid and econazole in tandem. Using growth bioassays, we were able to monitor mycobacterial growth and

found that in *M. bovis*, 100, 50, and 25  $\mu\text{M}$  econazole were complete inhibitors of mycobacterial growth whereas 0.045 and 0.025  $\mu\text{g/mL}$  isoniazid only had a minimal inhibitory effect on *M. bovis* growth. Subsequent analysis indicated that these concentrations of econazole may be bacteriocidal in *M. bovis*. These data suggest that econazole is a superior mycobacterial growth inhibitor to isoniazid and may lead to a new generation of anti-mycobacterial agents.

### 3.

#### **EFFECTS OF SOCIAL INTERACTION ON PROLIFERATION AND VIMENTIN EXPRESSION IN WEAKLY ELECTRIC FISH, *APTERONOTUS***

##### ***LEPTORHYNCHUS***

James Castellano 05

Faculty Sponsor: Professor Kent Dunlap (Biology)

The mammalian CNS has a very limited ability to generate new neurons during adulthood, and therefore degeneration or injury to the CNS often causes permanent behavioral deficits. Studies of other vertebrates with higher rates of cell proliferation may help to identify how social and environmental factors enhance adult neurogenesis. One great advantage of using weakly electric fish for studies of neurogenesis is that the neural circuitry underlying their communication behavior is extremely simple. Consequently, socially-induced changes in brain plasticity can be more easily linked to changes in behavior. We utilized fluorescent immunohistochemical protocols to determine the relationship between social stimulation (pairing of fish) and proliferation, neurogenesis, and radial glial fiber upregulation. We predicted that rates of cell proliferation in behaviorally relevant brain regions, and neurogenesis in these regions would be higher in paired fish than fish housed in isolation. We also predicted that paired fish would have an increased amount of radial glial fibers in the behaviorally relevant brain regions. Initial findings indicate that social stimulation, defined as a 7-day pairing, promoted proliferation and up-regulation of radial glia. However, neither neurogenesis nor gliogenesis was observed in the brain regions of interest. These results indicate that although differentiation did not occur, necessary cellular prerequisites to neurogenesis had occurred. We are currently examining the effect of shorter treatment time (1-day pairing) on radial glial fiber upregulation.

### 4.

#### **ELECTROCOMMUNICATION DRIVEN DIVERSIFICATION IN THE CENTRAL NERVOUS SYSTEM OF *APTERONOTUS***

Jason Gallant 05

Faculty Sponsor: Professor Kent Dunlap (Biology)

*Apteronotus* and other gymnotiform electric fish use weak electrical signals for communication and electrolocation behaviors. One well studied behavior in gymnotiform electric fish is the production of modulations of their electric organ discharge, termed chirps that they used in sexual communication. This project seeks to identify the links

between communication and evolutionary diversification *vis-à-vis* the central nervous system.

This project specifically considered the distribution of NMDA receptors as a factor in the diversification of chirps in two species of *Apteronotus*, which vary primarily in duration between *A. leptorhynchus* and *A. albifrons*. We hypothesized the difference in duration was due to interspecific differences in proportions of NMDA and non-NMDA glutamate receptors in the pacemaker nucleus. To test this hypothesis, we administered a highly selective NMDA receptor channel blocker MK-801 intraperitoneally into both species and monitored the effect on chirp duration, as well as used immunostaining to map distribution of mRNA transcripts of NMDA receptor subunits in the central nervous system for both species. While NMDA receptors were found to be involved in the chirping behavior of *A. albifrons* but not *A. leptorhynchus*, we also found significant alteration in the expression of the subunit NR2B in *A. albifrons* between males and females.

The project also attempts to discern if physiologically relevant differences between the two species manifests itself as a behavioral significance in *A. leptorhynchus*. In this study eight *A. leptorhynchus* subjects were placed in playback apparatus and subjected to synthetic signals generated by a computer program, designed to mimic either *A. albifrons* or *A. leptorhynchus*. Responses to artificial stimuli were analyzed for differences in chirp rate and chirp number, preliminarily indicating a differential response to conspecific signals.

## 5.

### **ESTABLISHING A DATABASE OF THE NATURAL BACTERIAL FLORA OF THE UPPER RESPIRATORY TRACT**

Margaret Gatti 05

Faculty Sponsor: Professor Lisa-Anne Foster (Biology)

In response to the increasing interest within the scientific community concerning the existence of a symbiotic relationship between microbes and their human host, this study was undertaken in order to create a database of the natural bacterial flora found in the upper respiratory tract. Throat cultures were taken from student subjects in order to collect a sample of the natural bacterial flora found on the pharynx. Due to the inability to culture some of the natural microbes found within the human body, all cultures were analyzed via 16s ribosomal RNA (rRNA) analysis. The 16s rRNA gene of these microbes was amplified via polymerase chain reaction (PCR), cloned into a plasmid and then transformed into *Escherichia coli* (*E.coli*) cells. The transformed *E.coli* cells were plated on selective kanamycin Luria-Bertani (LB) plates and allowed to grow for approximately 48 hours. After this time period, the plasmids containing the 16s rRNA inserts were isolated from cultures inoculated with individual clones and the 16s rRNA inserts were sequenced. The resulting DNA sequences were edited in order to isolate the 16s rRNA inserts and the 16s rRNA sequences were identified using the BLAST and Ribosomal Database Project (RDP) internet databases. The identities of each of the clones, as well as the sequence similarity scores from each of the respective internet databases, were then entered into the natural bacterial flora database created as a result of this project.

6.

**FROM ALGAE TO ANIMAL: *BRYOPSIS* CHLOROPLAST INGESTION AND INCORPORATION IN *ELYSIA CRISPATA*.**

Gregory Gavelis 08

Faculty Sponsor: Professor Kathleen Archer (Biology)

Some sea slug species exhibit the unique ability of kleptoplasty, an adaptation which allows them to incorporate ingested algal chloroplasts within their tissues. Chloroplasts pass through the digestive tract and, after subjection to digestive enzymes and acidic pH, are taken up by digestive gland epithelium intact. Incorporated chloroplasts continue to photosynthesize, sustaining the slug for up to nine months in sunlight without food. The mechanisms by which chloroplasts endure the digestive process are unknown. We studied the Caribbean species *Elysia Crispata*, which can feed upon the filamentous alga, *Bryopsis*. Populations of each organism were raised together in culture, where the slug punctured the giant algal cells for fluid feeding. (Preliminary observations showed that punctured *Bryopsis* cells released small, subcellular units (cytoplasts), which contained chloroplasts, into the medium.) We wondered if, during feeding, the slugs were ingesting similar structures, such that chloroplasts were passing through the digestive tract protected by the cytoplasm membrane. To confirm, fed slugs were fixed and prepared for TEM. Preliminary observations suggest our hypothesis is true, and further TEM analysis is in progress.

7.

**TREATMENTS FOR THE EXTRACTION OF CHLOROPLAST FROM *CAULERPA RACEMOSA*.**

Paula Guzman 06

Faculty Sponsor: Professor Kathleen Archer (Biology)

Sea slugs in the genus *Elysia* feed on algae digesting everything except the chloroplast. There the chloroplasts are maintained in a symbiotic relationship and the sea slugs use them to harvest energy. These sea slugs feed on giant celled algae such as *Vaucheria litorea* and *Caulerpa racemosa*. To understand how the chloroplasts are used by the slugs, it would be useful to have chloroplast isolated from algal cells for experiments. Due to wound healing mechanisms used by *Caulerpa*, chloroplasts are held within the cytoplasm by actin. In order to release the chloroplast, three treatment methods have been explored: latrunculin, thermolysin and trypsin. Latrunculin was used because it binds to actin but it only extracted 7.54% of chlorophyll from the tissue. Thermolysin, a mild protease was used since it will digest proteins in the cytoplasm. Various treatments were explored from different concentrations, overnight and shaking methods. Yet, thermolysin had a maximum extraction of 10-12%. Treatments with trypsin were explored because it is a stronger protease than thermolysin. Trypsin only extracted 4.41% of chlorophyll from the tissue. Hence, latrunculin, thermolysin and trypsin are ineffective in releasing chloroplasts from *Caulerpa racemosa*.



## 8.

### **EVALUATION OF CRESTED CARACARA HABITATS IN SOUTH CENTRAL FLORIDA**

Bridget Iwamuro 05

Faculty Sponsor: Professor Joan Morrison (Biology)

The Crested Caracara (*Caracara cheriway*) is a threatened bird of prey that inhabits the dry inland prairie lands of southern Florida. This species typically breeds and hunts throughout populated urban areas and cattle ranches, which dominate the south central Florida landscape. Determining the types of land that caracaras utilize most will allow conservation efforts to focus on protection of specific land types that will benefit these birds. Second-order selection, which compares selection of a home range area within a larger study area, and third-order selection, which relates use of habitat to availability within the home range, were evaluated based on telemetry data and land cover maps. Within the study area, each caracara selected a home range, which contained habitats that supplied essential foraging and breeding needs. Caracaras use of habitat was determined by individual telemetry points, collected over a period of two years from 27 marked individuals. Telemetry data were collected from plane and from land and error polygons were determined. In this study, caracara kernel home ranges averaged  $1541 \pm 130$  hectares. Compositional analysis of home range habitat types compared to types in the entire study area showed that caracaras use pasture and dry prairie lands predominantly over shrub and pinelands and urban areas. The compositional analysis also ranked each habitat type and found hardwoods hammocks and pasture to be the most important habitat types for caracaras. In contrast, caracara's use of habitat within their home ranges did not differ from the availability of those habitats. The investigation of attributes of home ranges provides us with meaningful data about how caracaras use available land. These important inferences can be used to determine what land should be preserved to manage the threatened caracara population in Florida.

## 9.

### **INVENTORY OF MAMMALS AT TRINITY COLLEGE FIELD STATION**

Priya Kalyan-Masih 05

Faculty Sponsor: Professor Michael O'Donnell (Biology)

In order to use the Trinity College Field Station (TCFS) for education and research, an inventory of the biotic diversity must first be completed. Long-term monitoring of biota will allow us to assess changes in the health of natural communities at TCFS. Documenting the presence of elusive carnivores is difficult, and trapping surveys are labor-intensive and have many drawbacks. Therefore, non-invasive methods must be used. This poster reports on the use of remotely triggered cameras as a non-invasive technique to survey mammals. Fifteen to twenty infrared motion sensor camera traps were stationed at TCFS over a period of 7 months. These cameras were placed throughout TCFS, in different habitats, with different mammal lures, and at various heights in an attempt to photograph mammals of all sizes. We report the detection-per-unit effort for each species, as an index of relative abundance. We examine changes in

the relative abundance over seasons, in different habitats, and with different lures at the camera sites. These data were also used to monitor deer behavior. For example, their sex ratio, date of fawning, and deer herds could be measured to help determine the health of the ecosystem.

## 10.

### **REGULATION OF PROTEOLIPID PROTEIN (PLP) EXPRESSION BY PPARS**

Joanna Kulesz 05 and Jared Wasser 06

Faculty Sponsor: Professor Hebe Guardiola-Diaz (Biology)

Myelin is the protective sheath around axons in the nervous system, acting as an insulator to the electrical signal that is conducted down axons as neurons fire. Demyelination of the nervous system is the cause of such diseases as Pelizaeus-Merzbacher syndrome and multiple sclerosis, which manifests in motor deficits. Oligodendrocytes provide support to axons and produce the myelin sheath. Within oligodendrocytes, proteolipid protein (PLP) functions in the assembly of myelin. The transcription of PLP is thought to be influenced by a heterodimer that forms between RXR (retinoid X receptor) and peroxisome proliferator activated receptor (PPAR)  $\alpha$ ,  $\delta$ , and  $\gamma$  and binds a specific piece of DNA, the peroxisome proliferator response element (PPRE). The purpose of this research is to determine which PPAR isoform has the highest affinity for the PPRE and which PPAR isoform best expresses PLP. The affinity for PPRE is being tested *in vitro* by purifying protein obtained from *E. coli* cells transfected with PPAR plasmids through gel affinity chromatography and subsequently running an Electrophoretic Mobility Shift Assay (EMSA). The expression of PLP is being tested *in vivo* by overexpressing PPAR with RXR in PLP PPRE-Luciferase transfected cells. These transfected cells are then evaluated based on electroporation of green fluorescent protein (GFP). Results are pending.

## 11.

### **THE EFFECT OF STARVATION ON DIGESTIVE ENZYME ACTIVITY LEVELS IN *ELYSIA CHLOROTICA***

John LaPorta 05

Faculty Sponsor: Professor Kathleen Archer (Biology)

Several species of slugs form symbiotic relationships with algal chloroplasts they consume in order to acquire photosynthetic energy. We tested the digestive enzymes of starved *Elysia chlorotica* to determine if they continue to produce these enzymes while denied their food, *Vaucheria*. Slugs were dissected at intervals of 4, 15, and 45 days starved, and their digestive glands were extracted. For each extract, the activity of lipase, amylase, and protease was examined. Enzyme activity levels decreased for each enzyme over time. Lipase was the only enzyme to show activity after 45 days. Starvation of these animals does indeed lead to a decrease in production of their digestive enzymes.

## 12.

### **EVALUATING THE GENETIC DIVERSITY OF THE FLORIDA CRESTED CARACARA (*CARACARA PLANCUS AUDUBONII*) USING MICROSATELLITE ANALYSIS**

Doris Luk 05

Faculty Sponsors: Professors Lisa-Anne Foster and Joan Morrison (Biology)

Crested Caracara are medium sized raptors classified in the falcon family. A small, isolated population of Crested Caracara is present in the south-central peninsula of Florida and is believed to have been isolated since the Pleistocene (~ 2 mya). Urbanization and agricultural development have lead to the degradation of the habitat of the population, and is thought to have contributed to the population decline in the past, and may continue to represent problems in the future. The objective of our study was to develop a baseline for the genetic diversity of the Florida Crested Caracara population based on the allelic richness and heterozygosities at microsatellite loci in the genome. Primers originally developed to amplify loci within the peregrine falcon (*Falco peregrinus*) were selected to amplify the same microsatellite regions in the related, Crested Caracara. Optimum PCR conditions to amplify Crested Caracara loci were determined. Size(bp) of the alleles was resolved using the fragment analysis program of a genetic analysis system (CEQ 8000).

## 13.

### **PCR AMPLIFICATION AND CLONING OF PPAR $\delta$ REGULATED GENES IN OLIGODENDROCYTES**

Meagan Miller 08 and Celia Rodriguez 08

Faculty Sponsor: Professor Hebe Guardiola-Diaz (Biology)

Oligodendrocytes are the cells responsible for myelination of neuronal axons in the Central Nervous System (CNS), contributing to their importance in research. In recent years, the ligand-activated Peroxisome Proliferated-Activated Receptor  $\delta$  (PPAR $\delta$ ) has been identified in the nucleus of the oligodendrocyte as a transcription factor. It is involved in the rate at which oligodendrocytes mature, facilitating rapid development of oligodendrocyte precursors. A previous experiment designed to find PPAR $\delta$ -regulated genes in oligodendrocytes identified two different genes. In our experiment, adult rat brain cDNA was used as a target during amplification of the DNA strand during PCR. The goal of our research is to generate full-length cDNA clones for these genes, namely the calcium sensor and ion transporter, using a PCR method for DNA amplification. The long-term purpose of making these DNA constructs is to test their specific role in oligodendrocyte development. In due course, this experiment may lend itself to an investigation in testing the role of the calcium sensor and ion transporter, enabling the identification of the specific stage or stages in oligodendrocyte development in which the two sensors are involved.

14.

**THE EFFECTS OF EXTENDED PERIODS OF ANOXIA ON *VAUCHERIA* PROPAGULES IN CONNECTICUT RIPARIAN SEDIMENTS**

Alison Parpal 08

Faculty Sponsor: Professor Craig Schneider (Biology)

Species of the yellow green alga *Vaucheria* (Vaucheriaceae, Chrysophyta) are found throughout the world in salt, brackish, and freshwater sediments. This common and resilient genus has demonstrated its ability to survive extreme environmental stresses by depositing hardy, dormant “seed banks” of propagules in the sediment in which it grows. The present project investigates the effect of periods of anoxia – a potential environmental stressor – on the germination/survival of *Vaucheria* propagules. Sediment samples used in this study were collected from a streambed on the Nipmuck Trail in Ashford, Connecticut, where nine species of *Vaucheria* have previously been collected. The raw samples were mixed and divided into small circular slabs, which were then placed in individual bags and relieved of oxygen in nitrogen-filled desiccating chambers in a dark cold room. Each month, one slab was removed from the chamber, allowed to cultivate in an incubator under optimal conditions, and observed for germination. Results have shown that at least four species of *Vaucheria*, - *V. aversa*, *V. frigida*, *V. uncinata* and *V. undulata*, - are able to withstand extended periods of anoxic dormancy. The results of this study will contribute to the existing body of knowledge on the ability of *Vaucheria* propagules to withstand environmental extremes.

15.

**CORTISOL INFLUENCES THE RATE OF CELL PROLIFERATION IN THE BRAIN OF ADULT WEAKLY ELECTRIC FISH, *APTERONOTUS LEPTORHYNCHUS***

Erealda Prendaj 05

Faculty Sponsor: Professor Kent Dunlap (Biology)

Neurogenesis, the generation of new neurons from precursor cells, was believed to be confined to the early developmental stages. Recent research, however, has shown that neurogenesis occurs also in the adult brain. Several factors regulate the rate of neurogenesis including hormones, environmental stimuli, and growth factors. This study, in particular, is investigating the influence of an adrenal hormone, cortisol, on the rate of adult neurogenesis in weakly electric fish *Apteronotus leptorhynchus*. Weakly electric fish serves as the model for the study due to its high degree of structural plasticity in the brain and simple neural circuitry controlling its communication behavior. Through cortisol implants we experimentally elevated the cortisol level in the fish. Our results indicate that cortisol increased the rate of cell proliferation in the brain, but we have not been able to identify the phenotype of these cells yet. Our future research will aim to determine whether these cells differentiate into neurons, glia, or simply die.

16.

**USING P-INDUCED MALE RECOMBINATION IN THE  
CHARACTERIZATION OF IMPORTIN A1 IN DROSOPHILA  
MELANOGASTER**

Ravin Ratan 05

Faculty Sponsor: Professor Robert Fleming (Biology)

Import of macromolecules into the nucleus is a tightly regulated process involving many soluble proteins. The pathway responsible for most nuclear import involves an importin  $\alpha$  adaptor protein which recognizes classical nuclear localization sequences (cNLSs) on proteins targeted to the nucleus and complexes with another soluble factor, importin  $\beta$ 1, to facilitate transport through a nuclear pore. In higher eukaryotes, importin  $\alpha$  proteins are divided into three highly preserved clades, *imp*  $\alpha$ 1, *imp*  $\alpha$ 2, and *imp*  $\alpha$ 3. Previous work done on null mutations of the *imp*  $\alpha$ 2 and *imp*  $\alpha$ 3 genes has shown that three clades have some unique and some redundant functions in *Drosophila*. Additionally, various *imp*  $\alpha$  paralogs in various systems have been implicated in functions unrelated to nuclear import. We aimed to create an *imp*  $\alpha$ 1 null to further investigate the individual roles that each clade member plays in cellular processes. To this end, we used P-induced male recombination to create small deletions which were then screened using PCR. Our preliminary analysis shows that animals homozygous for an *imp*  $\alpha$ 1 deficiency are sterile, a defect that is rescued by expressing an *imp*  $\alpha$ 1 transgene under an Act5c promoter. We are currently investigating the nature of the sterility in both males and females.

17.

**GLANDULAR HAIRS: LARVAL CHEMICAL DEFENSE IN THE BUTTERFLY  
ASCIA MONUSTE (LEPIDOPTERA: PIERIDAE)**

Douglas Rendell 05

Faculty Sponsor: Professor Scott Smedley (Biology)

Defensive glandular hairs have been documented in the caterpillars of two species of pierine butterflies (*Pieris napi*, and *P. rapae*). Additionally, chemical analyses of the two species have revealed mixtures of two novel lipid components, napolenes and mayolenes, respectively. Given these findings, I was eager to analyze an additional pierine genus. My morphological analysis of *Ascia monuste* caterpillars documented glandular hairs in all five instars. I am also determining if the *A. monuste* secretion serves a defensive function and am collaborating to characterize its chemical composition. Furthermore, I documented an unusual behavior in *A. monuste*: after molting, larvae eat the droplets on their shed cuticle.

**18.**

**DIET ANALYSIS USING PELLETS FROM CRESTED CARACARAS IN FLORIDA**

LingYan Wang 08

Faculty Sponsor: Professor Joan Morrison (Biology)

The crested caracara (*Caracara cheriway*), is a bird of prey that resides mostly in South and Central America. An isolated population of the species in Florida is classified as threatened due to rapid agricultural and residential growth within its range. The changes in land used affect the forging habitat of the raptor. Unlike other species, the caracara has a wide and diverse diet, ranging from plants to mammals. My project examines the eating habits of this raptor using pellets that were collected from 87 different nests around the Lake Okeechobee area during 1995 - 1999. Since little research had been done on this species' diet, my study focuses on developing a useful methodology for identifying and quantifying items in caracara pellets. The first task is to establish protocols for weighing the matrix material. Different factors, such as weight, length and humidity, were considered to influence estimation of the matrix. After quantifying the matrix, the non-plant materials such as hair would be identified using its specific patterns. The patterns would then be compared to other known hair's patterns. Both vegetative and non-vegetative materials in pellets allow understanding of where caracaras obtain their food. The quantification of plant materials allows me to realize the reason why a raptor is likely to eat plants. The identification of hair types would help recognize the identity of prey. This information is important for studying how changes in human land uses would contribute to the extinction of the population. The goal of this research is more than establishing a methodology for pellet analysis; it is about learning and understanding human-imposed threats to the caracara and its habitat. A better understanding of the caracara's diet through pellet analysis may help in preventing the loss of this unique population.

# CHEMISTRY

19.

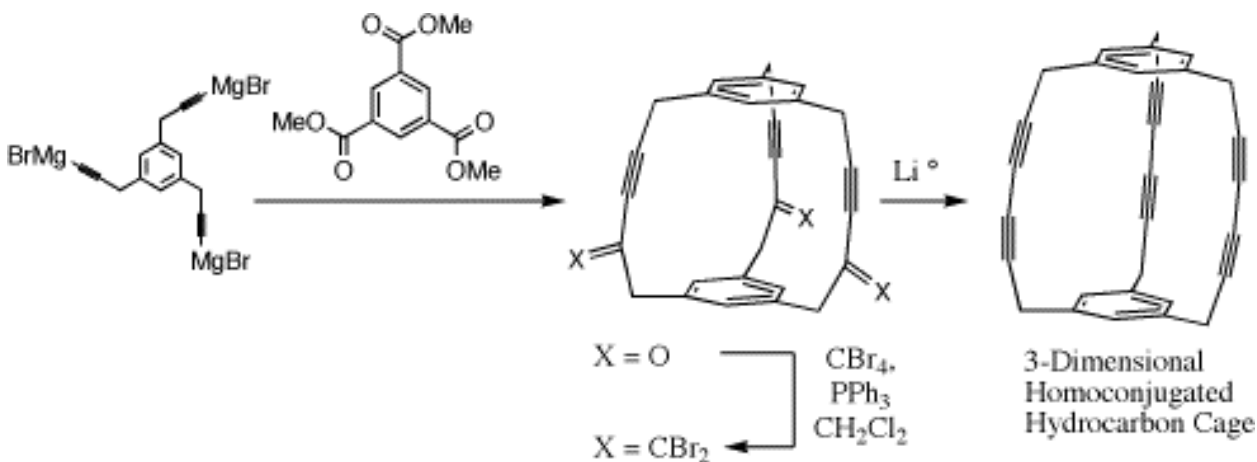
## USE OF ASYMMETRICAL DIYNE FORMATION ENROUTE TO 3-DIMENSIONAL HYDROCARBON CAGES

Kristen Allegue 05

Faculty Sponsor: Professor Thomas Mitzel (Chemistry)

The discovery of fullerene molecules in 1985 generated a tremendous amount of interest and has given way to many new discoveries. Studies of the unique electronic properties of fullerenes have rejuvenated interest in 3-dimensional electron flow and aromaticity. Hydrocarbon cages containing acetylene functional groups are excellent candidates for the study of electron flow and aromaticity in 3-dimensions and, have thus, become very intriguing synthetic targets.

This poster will describe progress toward the syntheses of homoconjugated hydrocarbon cages using asymmetrical diyne(1) complexes. This work opens new avenues into the synthesis of these compounds, and will aid in the advancement of hydrocarbon cage chemistry as well as open potential new pathways to fullerene syntheses.



- 1) Eisler, S.; Tykwinski, R. R. *J. Org. Chem.* **2000**, 122, 10736.

20.

**COMPARISON OF METHODS TO SYNTHESIZE 5-5'-DI-TERT-BUTYL-N-(9-FLUORENYLMETHYLOXYCARBONYL)-4-CARBOXYGLUTAMATE**

Nicholas Callahan 06 and Frank Miele 07

Faculty Sponsor: Professor Richard Prigodich (Chemistry)

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 is such a rare amino acid. There are two 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 then oxidized to a carboxylic acid. These two methods were used and this paper presents a comparison of the mechanisms and relative utility of the two approaches.

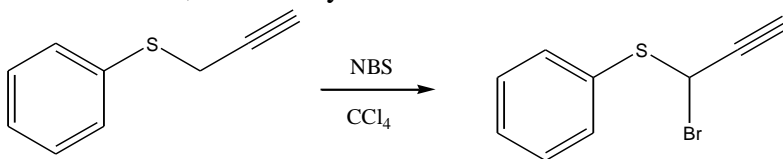
21.

**SYNTHESIS OF  $\alpha$ -BROMOSULFIDES**

Jacqueline Corbett 06

Faculty Sponsor: Professor Thomas Mitzel (Chemistry)

Addition reactions of  $\alpha$ -chlorosulfides to carbonyls mediated by indium metal have been studied and shown to exhibit diastereoselectivity. Furthermore, the products of these reactions can be used to synthesize enediynes and epoxydienes, which are important regions in anti-tumor medication. The purpose of this study is to synthesize  $\alpha$ -bromosulfides, which may be more reactive than  $\alpha$ -chlorosulfides in addition reactions.





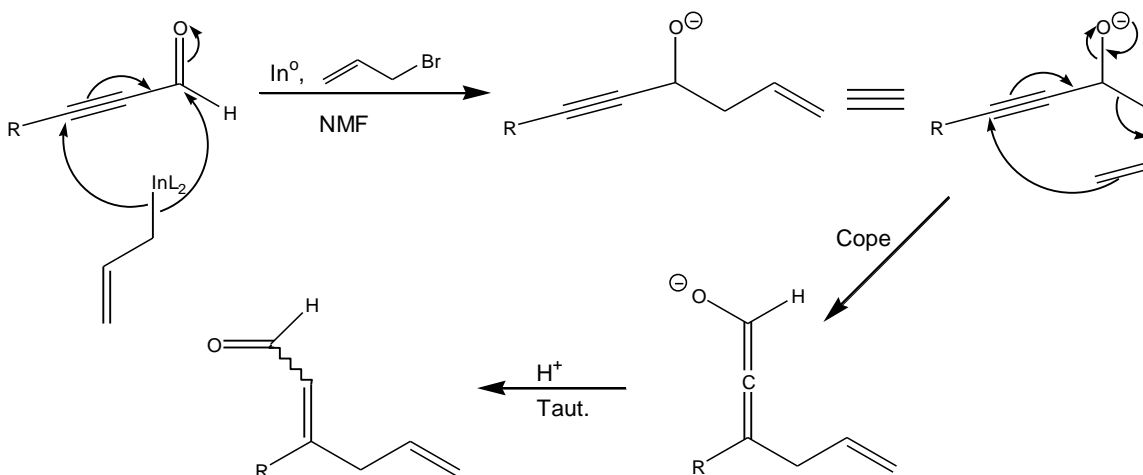
22.

## INDIUM PROMOTED COUPLINGS OF PROPARGYL ALDEHYDE MOIETIES WITH 1,2- AND 1,4-REGIOSELECTIVITY

Kwame Frimpong 08

Faculty Sponsor: Professor Thomas Mitzel (Chemistry)

Understanding the flow of electrons during synthetic reactions is important in chemistry as it helps construct models that predict product formation. Two of the more interesting reactions studied in organic chemistry are nucleophilic additions and Cope Rearrangements. This poster will describe the interplay of the nucleophilic reaction with a Cope Rearrangement as shown in scheme 1 below:



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

23.

## COMPARATIVE ARCHAEOMETRY OF MODERN AND CAESAREAN POTTERY SHARDS

Adam Hill 08

Faculty Sponsor: Professor Maria Parr (Chemistry)

The development of ceramics technology has mirrored the development of human civilization. More technologically advanced ceramics have been the results of better control over both the raw materials and the firing conditions in the kiln. Past experiments have shown there to be a quantifiable difference between ancient ceramics and those of the modern day. Pottery shards from Caesarea, on the Eastern coast of the Mediterranean, dating from about 1 A.D., were compared to a roofing tile from modern-day Croatia. A set of samples prepared using several methods were examined using a scanning electron microscope (SEM). All samples were coated in carbon to provide for the conductance of electrons. Samples were first imaged to ascertain the surface morphology and other pertinent information, including the size of quartz grains present in the clay and the fusing thereof. Energy dispersive X-ray microanalysis was then used to determine the elemental composition of the samples. As expected, there are significant differences between the ancient shard and the modern day tiles. The results show the

general advancement of ceramics technology over the past two millennia, and the effects of modern processing methods on the composition of clays used in ceramics.

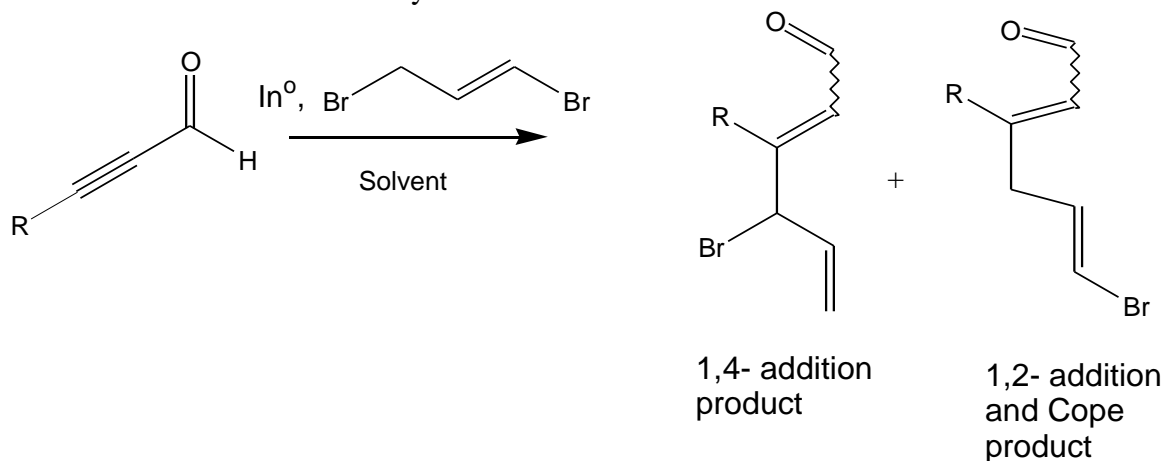
## 24.

### INDIUM PROMOTED COUPLING: THE EFFECTS OF ELECTRON WITHDRAWING GROUPS ON 1,2- AND 1,4-ADDITIONS

Claire Lawlor 06

Faculty Sponsor: Professor Thomas Mitzel (Chemistry)

Organic synthesis consists primarily of carbon-carbon bond formation. In our studies, we have attempted to elucidate the mechanism by which 1,4- products are formed in indium coupling reactions. Traditionally indium promoted couplings involve 1,2- additions to carbonyls. Yet systems including 1,4- conjugated propargyl aldehyde moieties introduce the potential for both 1,2- and 1,4-products. Addition to a carbonyl via a 1,2-addition followed by a subsequent oxy-Cope rearrangement theoretically allows for two pathways of 1,4- product formation. Previous studies have involved the analysis of these reactions without the addition of substituents located near the reactive region of these molecules. The poster will specifically discuss the theoretical effects of an electron withdrawing substituent located within this system.



## 25.

### SYNTHESIS AND CHARACTERIZATION OF POTENTIAL $\alpha$ -HELIX TEMPLATES

Adam Lesser 06

Faculty Sponsor: Professor Timothy Curran (Chemistry)

$\alpha$ -Helices are one of three main secondary structures in proteins. Unfortunately, these protein helices are not stable when removed from their native protein, which acts as a support structure. Study of the isolated helices is therefore difficult. A promising alternative is the creation of helix templates that induce the helical shape in short peptide chains. By correctly orienting the first few amide carbonyls, the templates have the potential to form the start of an  $\alpha$ -helix. Additional peptides added to this initiator would then adopt the helical shape in a fashion not unlike the workings of a zipper. The goal of

the current research is to synthesize such an initiator. The proposed initiator is a bicyclic dipeptide that constrains the amide carbonyls by placing the amino acid derivatives on a lactam ring. Recently, work done by Curran and Cooke has been done in the area of constructing an  $\alpha$ -helix template using a 7 membered lactam to induce the behavior desired. The current study investigates the possibility of an alternative synthetic method for these rings.

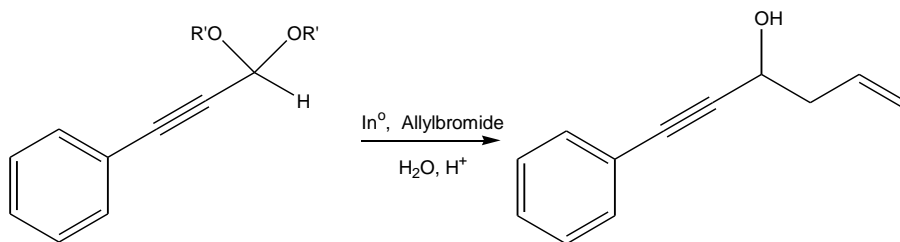
## 26.

### ALCOHOL SYNTHESIS FROM PROTECTED $\alpha,\beta$ ACETYLENIC ALDEHYDES WITH INDIUM METAL

Adam Pangilinan 05

Faculty Sponsor: Professor Thomas Mitzel (Chemistry)

Enediyne and epoxydiyne systems have been found to employ self reactions commonly referred to as Bergman cyclizations, a reaction similar to a cope rearrangement. Resulting from the Bergman cyclizations are two radicals that have potential to prevent replication of cancerous DNA by reacting with the DNA strands themselves. Significant in our research is the aldehyde protection, which is important to mimic a reaction step that will be utilized in the later synthesis of enediyne and epoxydiyne systems. The overall objectives of this research are to study a one-pot secondary alcohol synthesis from a protected  $\alpha,\beta$  acetylenic aldehyde with the use of environmentally safe and flexible indium, water, and an acid catalyst



## 27.

### GENERATING $\beta$ -TURNS USING 1,1'-FERROCENEDICARBOXYLIC ACID AS A TEMPLATE

Mark Silva 05

Faculty Sponsor: Professor Timothy Curran (Chemistry)

$\beta$ -turns are thought to nucleate the start of  $\beta$ -sheets. As such, conformationally constrained peptides that nucleate  $\beta$ -turns can be used to generate derivatives of bioactive peptides that possess  $\beta$ -sheet structures. Inclusion of a transition metal in the conformational constraint would provide a spectroscopic marker that could be used to locate the peptide derivative in vivo. In this work the use of 1,1'-ferrocenedicarboxylic acid to nucleate a  $\beta$ -turn structure has been probed. The 1,1'-ferrocenedicarboxylic acid was converted to the diacid chloride, which was then reacted with Boc-Lys-Lys-OMe to generate a metallacyclicpeptide in which the two lysine amines form amides with the

acylferrocene. The metallacyclicpeptide can then be incorporated into larger peptides using traditional peptide synthesis methods. The synthesis of the metallacyclicpeptide, and its incorporation into larger peptides will be presented, along with spectroscopic data that shows that the metallacyclicpeptide nucleates a  $\beta$ -turn.

## 28.

### **SYNTHESIS OF COMPLEX HYDROCARBON CAGES AND RELEVANCE TO ENDOHEDRAL COMPLEX FORMATION**

Katharine Spencer 08

Faculty Sponsor: Professor Thomas Mitzel (Chemistry)

One of the most interesting and useful aspects of Buckminsterfullerene, or  $C_{60}$ , is its ability to harbor a “guest” molecule. The guest molecule must enter the carbon cage through a benzene ring, limiting the size of the guest and requiring significant amounts of energy. The rational synthesis of complex hydrocarbon cages with large facial openings, precursors to Buckminsterfullerene, will allow for a guest molecule to be included in the formation of the  $C_{60}$  in a much more feasible and useful manner. In successfully forming these cages in this manner, endohedral complexes can then be formed with the carbon cages forming around the guest molecule. The resulting complexes have a largely untapped potential both in scientific research and applied organic chemistry in medicine and industry. Further research and experimentation on the synthesized hydrocarbon cages could lead to breakthroughs in many fields and will allow for the formation of the guest-host complexes in a more practical fashion.

## 29.

### **INDIUM PROMOTED COUPLINGS OF PROPARGYL ALDEHYDE MOIETIES WITH 1,2- AND 1,4-REGIOSELECTIVITY**

Joseph Wzorek 06

Faculty Sponsor: Professor Thomas Mitzel (Chemistry)

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 formation of natural products and synthetic templates. Indium metal has historically shown to add preferentially to unsaturated carbonyl moieties in a 1,2- in preference to a 1,4-addition pathway. Studies in our lab have shown that a 1,2-addition to propargyl aldehydes followed by an in situ oxy-Cope rearrangement allows synthetic flexibility to form either the 1,2- or the “1,4”-addition product. The poster will describe the mechanistic and synthetic studies behind this reaction.

**30.**

**SYNTHESIS OF METALLACYCLICPEPTIDES BY SIDE-CHAIN TO SIDE-CHAIN COORDINATION**

Craig Yennie 06

Faculty Sponsor: Professor Timothy Curran (Chemistry)

In previous studies done in our lab we have demonstrated it is possible to create a metallacyclic dilysine dipeptide. This was achieved by synthesizing a dilysine dipeptide in which alkyne groups were added to the lysine side chains. The two alkynes were then coupled to a tungsten complex to create the metallacyclicpeptide. We found that these metallacyclicpeptides can be easily synthesized and exhibit large amounts of conformational flexibility. We are currently in the process of creating a metallacyclic dilysine tetrapeptide in which the two lysines occupy the first and fourth positions using a similar synthetic strategy. We would like to know if the metallacyclic tetrapeptide can be synthesized and if the peptide will assume an  $\alpha$ -helix conformation.

**31.**

**METALLACYCLICPEPTIDES: CYCLIC PEPTIDES THAT INCORPORATE METAL ATOMS**

Richard Yoon 05

Faculty Sponsor: Professor Timothy Curran (Chemistry)

Cyclicpeptides are often used to probe structure-activity relationships for peptides and their receptors. Work in our lab is focused on developing novel ways to form cyclicpeptides that incorporate metal atoms (metallacyclicpeptides). Using the metal atom in the ring offers two potential advantages. First, the chemistry for making the cyclic species could be direct and easy to accomplish. Second, the metal atom provides a convenient spectroscopic marker for locating the cyclicpeptide. We have found that alkynylpeptides will react with  $W(CO)_3(dmtc)_2$  ( $dmtc$  = dimethyldithiocarbamate) to yield bis(alkynylpeptide) complexes. As an extension of this work, we have prepared peptides bearing two alkyne groups (dialkynylpeptides). The two alkyne groups were positioned at the N- and C-termini of the peptide. These dialkynylpeptides were reacted with  $W(CO)_3(dmtc)_2$  under high dilution conditions in order to prepare metallacyclicpeptides - a cyclicpeptide that incorporates tungsten in the ring. This poster will detail the synthesis of the dialkynylpeptides, and the synthesis and conformational behavior of the metallacyclicpeptides.

# COMPUTER SCIENCE

**32.**

## **STABLE MANAGEMENT APPLICATION**

Kendall Church 05

Faculty Sponsor: Professor Madalene Spezialetti (Computer Science)

The software being designed is a “stable management” application for horse and barn owners. The scope of the project will be geared toward boarding and breeding facilities, in particular. The technology being used is MySQL (software for the SQL database language) and PHP (web oriented scripting language).

**33.**

## **PIRATENET!**

Jeremy Freeman 05

Faculty Sponsor: Professor Chris Armen (Computer Science)

This project will be a model of a massively-multiplayer game with a pirate theme. The graphics will be 2-Dimensional and the point of the game will be to log in to the central server(s) and play as pirate characters as they interact with computer-controlled beings and other player-controlled characters.

**34.**

## **DESIGNING A 3-DIMENSIONAL ROLE PLAYING GAME USING C++ AND THE DIRECTX LIBRARIES**

Stephen Katuska 05

Faculty Sponsor: Professor Chris Armen (Computer Science)

Once a form of entertainment enjoyed primarily by a small portion of our society, computer video games have flourished in both popularity and have become a huge piece of the personal entertainment market. Video games budgets have taken on movie-like budgets in many cases, a testament to their popularity and sales volumes. A sector of the video game industry, which has been outgrowing the rest, is the role-playing genre. Categorized by vast, immersive story lines, and extremely in-depth characters, role-playing games have slowly become the most popular genre in the computer game industry. For my project, I will write a fully 3-dimensional role-playing game, using C++

combined with the DirectX libraries. Most video games are designed with the help of a programming director, art and modeling director, sound director, and main story writer, as well as countless other programmers and artists to bring the whole project to completion. In order to accomplish my goal of having a playable game, I will serve all of these roles, each in an abbreviated form, centering mainly on the game engine and artwork. In order to accommodate an easy demonstration of all four roles, I will construct an abbreviated version, containing roughly 10 to 15 minutes of story line, exhibiting all character models, as well as input and sound.

**35.**

### **TRINITY COLLEGE SQUASH WEBSITE**

David Kelly 05

Faculty Sponsor: Professor Chris Armen (Computer Science)

Over the last seven years, the Trinity Men's Squash program has grabbed the attention of the nation's and the world's squash fans. This season the men's team has won its seventh consecutive national championship and holds a record of one hundred twenty seven consecutive wins. One way of getting the information from the matches out to fans around the world is via the Internet. Four years ago, I developed a website for both the men's and women's squash teams that was coded simply and quickly. For this project, I wanted to make a new website using advanced technologies that would give the user a better experience and make for an easier update of the site for the webmaster. I decided to use Active Server Pages (ASP) with a Microsoft SQL Server database backend. This enabled quick and easy setup and maintenance of the site as a whole.

**36.**

### **A QUICK LOOK AT TRINITY COLLEGE THROUGH THE EYES OF FLASH**

Victor Laboy 05

Faculty Sponsor: Professor Madalene Spezialetti (Computer Science)

Graduating seniors in High School seldom have the opportunity to see the campuses of colleges and universities that are not near their homes. Students that do not see the campuses may be completely turned off from a school and not even apply. This virtual tour of the campus allows for students to admire virtual 360-degree views of the campus, while learning a thing or two as they "move" through the campus. Allowing for the beauty of Trinity to motivate potential students that are on the fence about going to an institution that far from home. The tour was created in Macromedia Flash, while HTML and Paint Shop Pro were used to enhance the tour.

**37.**

**TRINITY COLLEGE WRESTLING WEBSITE AND DATABASE**

Jim Malone 05

Faculty Sponsor: Professor Chris Armen (Computer Science)

Two important parts of Computer Science are database and website design. This project combines both with the creation of a website for the Trinity College wrestling team. There already exists such a webpage run by the school, but this one attempts to surpass the limits of that one. It has such features as a photo gallery, in depth wrestler statistics, and even directions to all of the team's matches. Microsoft Access was used to create the database, while Microsoft FrontPage was used for most of the website design.

**38.**

**STEGANOGRAPHY: THE ART OF INFORMATION HIDING**

Andres Molina 05

Faculty Sponsor: Professor Peter Yoon (Computer Science)

In a world where digital media is emerging as the predominant communication medium, it is increasingly important that messages are only seen and interpreted by their intended recipients. Cryptography is popular among people who send valuable information through the internet or un-secure networks. However, cryptography only makes data unintelligible; it does not hide the data completely. To achieve this effect steganography must be used. This program uses steganography to create an image file with a text message hidden within, producing a message-carrying image which looks exactly like its original version. The program can also be used to reverse the process and extract a hidden message from a carrier image file. In order for this program to function, both the sender and the recipient must have the program installed on their computers.

**39.**

**MODELING HUMAN SUBJECTIVITY: PERSONALITY PROFILES AND IMPRESSIONS**

James Piette 07

Faculty Sponsor: Professor Madalene Spezialetti (Computer Science)

Computers have the ability to objectively analyze data. Humans, however, may draw subjective conclusions from data because their "personality" affects the way that they interpret data. This abstract discusses the creation of a model which uses personality traits to derive varying perspectives on a data set. This model also helps to predict the interpretation of a data set given specific personality traits.

The model uses a numerical scale over the interval  $[-1, 1]$  to represent the degree of a certain trait. Every manifestation of a specific trait is represented by a personality factor, which places it somewhere on that scale. Personality factors of 1 and -1 represent the two most extreme manifestations of the trait. These personality factors determine the degree to which the trait effects the interpretation of the data. A personality profile is



formed by the collection of personality factor. By using this model, the computer can apply a personality profile to the data in order to derive a subjective interpretation of the data. Also, the model can build an impression of a personality profile based on observed behavior. This is extremely useful when creating expert systems that reflect human subjectivity.

This model has been applied in the development of a system to play Texas Hold'em Poker. Texas Hold'em is a variant of poker in which each player is dealt two cards face down. After a round of betting, three cards are placed face up in the center of the table for all players to use. Another two rounds of betting occur and two more cards are placed face up on the table. After a final round of betting, the players choose their best five-card hand to determine the winner.

In Texas Hold'em, different traits can be observed in betting behavior. The system defines two betting traits: passive/aggressive and loose/tight. A passive player rarely bets in a game, while an aggressive player is always raising the cost to play. A loose player chooses to play nearly every hand, while a tight player rarely plays anything but the best. The personality profile of a player influences their interpretation of how their hand should be played. Thus, a given hand can be interpreted in a variety of ways. As the game progresses, impressions of the players at the table are developed based on their betting strategies. These impressions are used to predict the strength of each player's hand. With this knowledge, a single player can determine the strength of their hand relative to the hands of the other players and, hence, can better gauge what action should be taken next.

This model of traits, personality profiles, and impressions provides a means by which the subjectivity of the human mind to be captured. As such, it helps create a link between humans and computers in such a way that computers can begin emulating and predicting the subjective actions and choices of humans.

#### **40.**

#### **USING BLENDER TO LEARN AMERICAN SIGN LANGUAGE (ASL)**

Genevieve Wong 05

Faculty Sponsor: Professor Michael Duff (Computer Science)

The goal of this project is to create a tool that will make learning ASL easier and more fun. It consists of an animated hand and a UI that takes in words and characters. Blender is a free, open source software package for creating computer graphics. Python is a computer language that will be used in conjunction with Blender to create an interactive tool. This tool will sign the user specified words and letters on the fly utilizing a 3D animated hand model. The hand will be represented by an underlying armature that is parented by a wire mesh. A texture will be applied to this mesh in order to maintain realism.

#### **41.**

##### **IMPLEMENTATION OF A PUBLIC-KEY CRYPTOSYSTEM**

William Zeller 06

Faculty Sponsor: Professor Takunari Miyazaki (Computer Science)

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 our own 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.

# ENGINEERING

**42.**

## **HIPPOCAMPAL LTD IS RELIABLY INDUCED BY LOW FREQUENCY STIMULATION IN FREELY BEHAVING NEONATAL RATS**

Rebecca Bell 05

Faculty Sponsor: Professor Harry Blaise (Engineering)

This study focuses on the induction of long-term potentiation and long-term depression of perforant path/dentate gyrus synapses in twelve-day old freely behaving rats. Long-term potentiation and long-term depression are important mechanisms in understanding learning and memory. We intend to compare our data in 12-day old animals to previous studies of conducted in 15- and 90-day old rats. Previous studies have shown that the transition from long-term depression to long-term potentiation is dependent on the frequency of the stimulation. We recorded evoked field potentials in awake behaving rats at 12 days of age. Thus far, we have only obtained data from one animal. Preliminary results indicate long-term depression can be reliably induced in animals as young as 12 days of age.

**43.**

## **IMPLEMENTING SHAPE MEMORY ALLOYS INTO THE DESIGN OF A THERMAL LIQUID MIXING SYSTEM**

Rob Bialobrzewski 05 and Matt Webster 05

Faculty Sponsor: Professor Suzana Popovic (Engineering)

Shape memory alloys (SMAs) are metals that exhibit two unique physical characteristics, shape memory and superelasticity. After being strained these “smart metals”, when heated, will return to their original size and shape very quickly. Although relatively new to the engineering world, SMAs have the potential to greatly impact the technologies of the future. The unique abilities of these alloys make them more versatile, providing more functional applications to modern engineering design than traditional metals such as steel, iron, or aluminum. The proposed project will involve an in depth study of Shape Memory Alloys. Research will be done to acquire knowledge of the various types of SMAs, the material properties of these metals, the physical behaviors under various environmental conditions, and responses to various loading conditions including applied forces and temperature/pressure changes. Acquired knowledge will be used to design and construct a working control system that employs shape memory alloy actuators.

**44.**

**REMOTE REPAIR AND REPROGRAMMING OF AUTONOMOUS SYSTEMS**

Matthew Gillette 05

Faculty Sponsor: Professor Taikang Ning (Engineering)

NASA Connecticut Space Grant Consortium

Stability and reliability is a goal for every project when it applies to space exploration. Every robot and every satellite is developed to be flawless; however, it is inevitable that sooner or later something will go wrong. It is critical that such autonomous systems as satellites and space exploring robots can be remotely repaired and reprogrammed. This became a very recent issue with the latest mars rovers, which, after landing on mars encountered some unforeseen difficulties and had to be remotely repaired; the Spirit rover, in particular, encountered errors so severe that it could not properly boot or communicate for ten days. Such errors can be very costly. The focus of this project is to develop a repairable and reprogrammable microprocessor based autonomous embedded system. This system will serve to demonstrate a reliable method for remote repair. The system will be repaired over a digital wireless connection. The main emphasis of this project will be on stability and reliability. The ultimate goal of the project is to ensure that the microcontroller system can be repaired, updated, and rebooted reliably under non-ideal circumstances.

**45.**

**LINKAGES BETWEEN EMOTION AND MEMORY: SIMULTANEOUS NEURONAL RESPONSES IN THE AMYGDALA AND THE HIPPOCAMPUS**

Rachel Hartman 05

Faculty Sponsor: Professor Harry Blaise (Engineering)

NASA Connecticut Space Grant Consortium

The dentate gyrus, a region of the hippocampus, plays an important role in the formation of memories. The basolateral amygdaloid nucleus (BLA), a region of the amygdala, is believed to be associated with the emotional aspect of memories. It is believed that emotional events activate the BLA which in turn affects the strength of synaptic activity in the dentate gyrus. Thus, the BLA creates an “emotional tag” on the formation of memories in the hippocampus. The research presented here aims to determine whether or not there are linkages between the responses of the amygdala and hippocampus. The methods used in this study were that recording electrodes were placed into the dentate gyrus and the BLA and a stimulating electrode was placed in the perforant path. Stimulation pulses were delivered to the perforant path at 10 bursts of 5Hz, with 10 pulses per burst. Extra cellular evoked responses were recorded from the dentate and the BLA. The population spike amplitude was obtained for individual waveforms. The mean values of the amplitude were calculated and used to determine the time-dependent simultaneous changes in synaptic plasticity in both the amygdala and the hippocampus. Results showed that stimulation of the perforant path induced long term potentiation (a form of memory) in both the BLA and dentate. In addition this long term potentiation was sustained for 48 hours. These results indicate that emotion and memory are linked.

**46.**

**DESIGN OF A ROBOTIC HAND USING SHAPE MEMORY ALLOYS**

Nilsson Holguin 05

Faculty Sponsor: Professor Suzana Popovic (Engineering)

As NASA becomes more interested in the far beyond, more missions will consist of robots doing the traveling for people as the Opportunity is doing on Mars. An important aspect of NASA's mission will be the retrieval of rocks from the Mars surface for testing. Currently, sample-return technologies are not on their two rovers but the scientists of AMPB at NASA Langley Research Center have shifted their focus to smart structures. On one NASA collaborated project one author wrote, "Configurations of interest may be in the form multi-fingered biomimetic robot hands to handle delicate and small space objects such as small samples of space rocks<sup>1</sup>." Shape memory alloys (SMA) may be used to control the bending of several grips because of their properties as "smart" structures. The study of smart structures is a relatively new topic and further study and success with these materials will prove to be beneficial because of its ability to remember its original form after a strain at a characteristic transformational temperature.

**47.**

**REAL-TIME IMAGE PROCESSING WITH FPGA**

Bozidar Marinkovic 05

Faculty Sponsor: Professor Taikang Ning (Engineering)

The project proposes a real-time image processing system design through reconfigurable hardware, Field Programmable Gate Array (FPGA). Such design enables the implementation of application specific image processing hardware within the logic cells of FPGA, thus removing the burden of using microprocessors to decode and execute instructions on image data. In addition, the flexibility of FPGA can accelerate image processing speed with optimized pipelined data processing blocks and parallel data flow structures. Customized hardware blocks can be coupled with other modules such as soft-core processor, on-chip memory, data buses and interfaces for external (off-chip) devices. All the components are integrated into a single FPGA to give a unique image processing solution through system on a programmable chip (SOPC) design. The resultant design can provide tremendous processing speed gains over microprocessor based approach for real-time image processing applications.

**48.**

**ALVIN-VI TRINITY COLLEGE AUTONOMOUS GROUND VEHICLE**

Bozidar Marinkovic 05, Susmita Bhandari 07, Matthew Gillette 05, Sam Lin 07, Maria Restrepo 06, Regardt Schonborn 06, David Pietrocola 08 and Kevin Harder 06

Faculty Sponsor: Professor David Ahlgren (Engineering)

ALVIN is an autonomous ground vehicle designed by the students of the Trinity College Robot Study Team (RST) to compete in the Intelligent Ground Vehicle Competition

(IGVC). The sixth generation of ALVIN will be entered in the 2005 competition. The robot features following set of sensors: four ultrasound (for obstacle detection), GPS and compass (for navigation) and two fire-wire cameras (for line extraction). It moves using two stepper motors that are controlled by two National Instrument (NI) processors. The whole robot is powered by two military Ultralife batteries (for the motors) and one Bosch battery (for the rest of the system). The robot will be competing in two challenges. The GPS Navigation Challenge, which consists of finding the waypoints with the GPS and avoiding any obstacles on the way. The Autonomous Challenge, which consists of running the robot through the outdoor obstacle course. Currently, the team is working on improvements for power supply system. The remaining time until the competition will be devoted to algorithm development and improvements.

**49.**

#### **FPGA IMPLEMENTATION OF RESPIRATION SIGNAL CLASSIFICATION USING A SOFT-CORE PROCESSOR**

Bozidar Marinkovic 05 and Matthew Gillette 05

Faculty Sponsor: Professor Taikang Ning (Engineering)

The focus of this project was to implement an automatic classification of respiratory signals using a Field Programmable Gate Array (FPGA). It has been shown for this type of respiratory signal that second order autoregressive modeling (AR) combined with a modified zero-crossing algorithm results in close to 100% consistency between manual and automatic classification methods. This algorithm was improved by adding calibration procedures and adjusted to run on an FPGA. Altera's development tools and Intellectual Property (IP) Mega-Core functions were utilized to implement a "soft-core" processor capable of running compiled C algorithms inside the Stratix FPGA chip. In addition, the high density and flexibility of the FPGA allowed for coupling of the soft-core processor with other hardware modules to form a fast interface between off-chip devices. The external SRAM, flash memory, and an LCD were interfaced with the NIOS II soft-core processor through a System on a Programmable Chip (SOPC) design.

**50.**

#### **HOVERBOB, A FLYING ROBOT FOR UNDER \$100**

Allison Mathis 07 and Kashif Mohiuddin 08

Faculty Sponsor: Professor David Ahlgren (Engineering)

One of the many categories of the Trinity College Fire-Fighting Home Robot Contest is for robots which cost under \$100. This year we are trying to build a robot that will not only meet the budget restrictions but will fly rather than drive through the maze. This idea came from the fact that this year's mazes will include carpets in some places, which increase friction, but not uniformly, throughout the maze. As hovercrafts do not touch the surface they are gliding on, the increased friction will be no problem. The goal of this project is for the robot to be able to navigate the maze and extinguish a candle. During the course of the year many different bodies were tried trying to find the optimum

material, foam, plastic, cardboard and paperclips were all considered. Although almost every model hovered after a fashion, only one had enough power to hold anything besides itself, and it was too small to use in the contest. Due to the deadline of the Firefighting contest in April we ended up having to use a hovercraft kit to generate enough lift for all the instruments we needed to carry. Many different possible extinguishing techniques were considered, but for the sake of cost efficiency and weight we have decided to attach a balloon to the front of the robot. When the balloon touches the flame the air inside will expand, popping the balloon and blowing out the candle in the process. To navigate around the maze we will use sharp sensors to determine the robot's distance from the walls, the information gathered will be used to determine when the robot should turn either right or left, which will be accomplished with a set of rudders on a servo. Currently we are working on the navigation system.

## **51.**

### **AUTONOMOUS UNDERWATER VEHICLE**

Patrick McBrien 05 and Ridgely Dodge 05

Faculty Sponsor: Professor Lance Smith, Professor David Ahlgren (Engineering)

Autonomous Underwater Vehicles (AUVs) are submersibles that have no link to human control once activated. The unit is self-contained; there is no tether to carry a signal or power supply. AUVs are suitable in reconnaissance in hostile environments, or for data collecting over a long periods of time such as studying ocean currents. This project consists of designing and building an AUV in order to freely explore a 30ft by 30ft body of water up to 10 ft deep. To move through the water the vehicle must dive and rise, along with turning left and right. An 8 bit Handy Board microcontroller controls pumps to thrust and turn the vehicle, along with a 12 V DC motor that shifts the center of gravity to control pitch. Diving is accomplished by propelling the neutrally buoyant vehicle downward due to its angle in the water. Position and orientation will be sensed with the aid of IR sensors, tilt sensors, pressure transducers. Currently we are implementing and testing the autonomous functions

## **52.**

### **AERODYNAMIC DRAG OF VARIOUS AUTOMOBILE BODIES**

Kashif Mohiuddin 08, Amanda Rao 08 and Jeffrey Scalia 08

Faculty Sponsor: Professor Joseph Palladino (Engineering)

Any object immersed in a fluid experiences forces retarding its movement. These forces are known as aerodynamic forces. The horizontal component of the force that opposes the objects forward motion is called aerodynamic drag and the vertical component is known as lift. The drag force is used to calculate the drag coefficient of an object, which is the measure of its efficiency when traveling through certain media. Scale model cars were placed in a wind tunnel and tested at various velocities to find an initial drag coefficient. Different body pieces were fabricated or modified and the cars were again tested at varying velocities in order to see if the newly shaped bodies had any effect on the drag

coefficient of the car. The drag coefficient is directly related to the shape of the body in question. The normal force was also scrutinized in order to determine whether the cars would lift off the ground since the drag was reduced. The drag coefficients were determined for each run in the wind tunnel by using the equation  $C_d = 2(\text{Force of drag})/(v^2 \cdot A \cdot \rho)$ , where  $A$  is the frontal area of the body,  $\rho$  is the density of the fluid, and  $v$  is the velocity of the fluid. Using the determined drag coefficients, horsepower needed to cruise at certain speeds was determined. Lowering the drag coefficients of automobiles reduces the horsepower needed to cruise at high speeds, and increases fuel economy. Fuel efficient cars can be produced simply by changing the shape of their bodies, and these cars will reduce air pollution as well as prolong our current fuel supply.

### **53.**

#### **SELECTIVE DATA LOGGING**

Benjamin Nye 05

Faculty Sponsor: Professor Taikang Ning (Engineering)

In situations such as a car crash or a heart attack, some of the most important information lies before the event is noticeable. Using a microcontroller-based system, the final revision of this project will implement a three-stage method of logging data. Initially a signal will be retained at set intervals in a RAM memory block (Block A), overwriting previously logged data. After the trigger of some event, such as a sharp rising edge or a particular sequence of values- the first block of data will remain untouched and a second set of data will be collected after the event in a second RAM block (Block B). After these two RAM blocks are filled, the data will be committed to permanent Flash storage device, where it will be held until activated to transmit this data out by UART serial. The final result should be a reliable, recoverable data logging and storage system capable of collecting data before and after an incident has been detected.

### **54.**

#### **STIRLING ENGINE AS A POWER SOURCE FOR SMALL ELECTRICAL NETWORKS**

Jeffrey Pulaski 05, Jonathan Jeanes 05 and Kristopher Wee 05

Faculty Sponsor: Professor Lance Smith (Engineering)

A Stirling engine is a closed cycle air engine which utilizes external hot and cold reservoirs to create a pressure variance suitable for generating mechanical power by means of piston displacement. While not commonly used in everyday applications, Stirling engines are a unique energy source because of their high efficiency, cleanliness because of the absence of internal combustion and their relative quietness. The goal of this project is to design, build and test a Stirling engine geared specifically toward use in small electrical networks. The target power output for such applications was determined to be 100 W, however expecting an approximate efficiency of 30% the expected power output is 30 W for a temperature difference of 280-300 degrees C. Modeling the design after a displacer-type engine, the prototype consists of three main components: a



displacer, power piston and flywheel/linkage assembly. Work is currently being done to fully integrate the flywheel and linkages to the displacer and power piston. Following completion of the prototype, power measurements will ensue immediately to confirm our designed power output through the use of a Prony break. Once power production reaches an acceptable level the engine will be coupled with the appropriate electrical devices to test its ability to directly power instrumentation.

## **55.**

### **DJA2 A STUDY IN ROBOTICS PROGRAMMING**

Rayn Sakaguchi 07, Nabil Imam 08

Faculty Sponsor: Professor David Ahlgren (Engineering)

The Trinity College Fire-Fighting Home Robot Contest is held each year to test the ability of robots to navigate a maze and put out a fire. The goal of this project was to re-program an existing robot to enter into this competition. The project used a robot previously built by trinity students named DJA1.5, which utilized a Vesta Basic programming environment. The robot was entered into the competition and qualified, however did not complete any of the three runs during the competition.

## **56.**

### **CONCEPT ROBOT**

Reg Schonborn 06, Sam Lin 07, David Miliniak 08, David Pietrocola 08 and Neil Robertson 08

Faculty Sponsor: Professor David Ahlgren (Engineering)

The introduction of the "Concept maze" in the 2005 Trinity College Fire-Fighting Home Robot Contest presented a new robotics design problem. The goal was to build a robot that would be able to navigate through a 2x2 inch hole in the maze wall and then proceed to locate and extinguish a candle (height 15-20cm). The main focus of our research was to obtain the optimized design layout of the robot to overcome the size restriction, while fitting the main components necessary for the robot to complete its tasks. The methods that were used to achieve this goal was to design most of the robot's components ourselves in order to fit the body and layout. The robot made use of two 'SHARP' distance sensors to navigate through the small hole and an Infra-Red sensor to locate the candle. The candle was extinguished using a fan powered by two Lithium Ion battery cells. The robot won first prize at the Fire Fighting competition by going through the hole and extinguishing the candle in a time of 28 seconds.

57.

### **AN IMPROVED WOOD COOKSTOVE USING FORCED DRAFT**

Mark Witt 05

Faculty Sponsor: Professor Lance Smith (Engineering)

People around the world use wood as their primary fuel source. Over half of humanity cooks over woodfires. However, traditional wood burning stoves are terribly inefficient, unsustainable, and polluting. Harmful levels of particulate matter cause respiratory illness in millions of women and children each year and the effects of carbon monoxide can range from an inconvenient headache to death. Stoves can be improved upon significantly and inexpensively to reduce these negative effects by using advanced combustion techniques. The main obstacle to reaching complete wood combustion is the difficulty in creating good mixing between the fuel and air. When wood combusts, volatiles are released from the wood as gas and then the gas ignites when mixed with air and spark. Using this principle, a two-stage gasification system was designed and implemented using forced air convection from a centrifugal fan. Gasification occurs in the lower, fuel-rich region using small vertical air jets. In the higher, fuel-lean combustion region, the gas fuel and air are mixed using larger horizontal air jets. This allows for a much hotter and cleaner combustion process. Previous fan-driven stove designs have failed due to fan motor burn-out. During initial testing, the stove prototype was operated for 30 minutes at full heat without an increase in the fan motor surface temperature. Final testing for efficiency and emissions will be conducted at Aprovecho Research Center. This stove design requires some scrap metal and an electrical source. Thus, implementation should only be considered in areas where both are available, such as the urban areas of India or Mexico where people have access to electricity but still cook over woodfires.

# ENVIRONMENTAL SCIENCE

**58.**

## **INVESTIGATION OF LAKE SEDIMENTS BY X-RAY DIFFRACTION ANALYSIS**

Mosammat Fatema 06

Faculty Sponsor: Professor Christoph Geiss (Environmental Science)

This study was undertaken to investigate the sediment cores from Mudge Pond located in Sharon, Connecticut. Sediment core analysis is applied to understand local and global climatic changes in addition to ice core and fossil analysis because “lakes are dynamic response systems that integrate environmental, climatic and tectonic forcings into continuous, high resolution archive of local and regional change” (Kelts, p.141). The diverse components derived from various sources in lake sediments contain key information regarding climatic, spatial, and depositional environment of a specific time period. Some of the sources for lake sediments include “detrital sediment grains, algal or terrestrial organic matter, and inorganically precipitated carbonate and saline minerals, along with numerous other fossil components” (Kelts, p.143). In addition, the structure of the components in the sediment may potentially reveal information regarding the mechanical, and biochemical processes of the formation of the lake sediments. Using X-ray diffraction I identified changes in mineralogy for lake sediments from Mudge Pond. This technique allows the identification of different carbonate, and silicate minerals, which can be interpreted in terms of environmental change.

**59.**

## **RECONSTRUCTION OF ENVIRONMENTAL CHANGE IN A NORTHWESTERN CONNECTICUT LAKE USING LOSS ON IGNITION ANALYSIS**

MeiLin Fegan 06 and Daniel Scollan 05

Faculty Sponsor: Christoph Geiss (Environmental Science)

Historical environmental changes can be traced by studying lacustrine (lake) sediments. A core was taken from Mudge Pond in northwestern Connecticut. Using the Loss on Ignition method, the carbonate minerals and organic content in sediment can be measured. LOI is preferred due to its use of basic lab equipment, speed, precision and accuracy and adaptation to large sample sizes compared to other methods. Dry powdered samples of sediment were ignited in a muffle furnace at 550 degrees C. The difference in weight before and after tells the amount of organic carbon, which evolves from the

sediment at this temperature. Samples are then heated at 1000 degrees C, when carbon dioxide evolves from carbonate minerals like calcite. In addition, smear slides were used to examine the composition of the carbonate minerals present. The percentage of carbonate minerals can reveal changes in physical lake conditions such as water level or pH. The percentage of organic content shows changes in the lake's biological productivity. These results, in combination with data from X-Ray crystallography, magnetic analysis and grain size analysis will further specify the environmental history of Mudge Pond.

## **60.**

### **SEDIMENT SIZE ANALYSIS OF MUDGE POND, CONNECTICUT**

Jenny Gragg 07 and Craig Curtis Schneider 05

Faculty Sponsor: Professor Christoph Geiss (Environmental Science)

Mudge Pond, in Sharon Connecticut, was the site of the coring that we used to establish a quantitative analysis of the distribution of each type of sediment to its relative depth. In the winter of 2005, the Geology 204 class set out to the pond and obtained a nine-meter long core. To perform a grain-size analysis study, we subsampled the core into ten, 300-gram samples. In order to prepare the sample for taking measurements, we had to dissolve the organic material and carbonates. After this was done, hydrometer testing was used to determine grain-size distribution by means of gravity and time. Once the measurements were recorded, Stokes' law was used to determine the diameter of the particles. Knowing the distribution of sediment size at any given depth determines approximately where the coastline was at a given time, as well as determines the soil composition. This information will be used in collaboration with other student research to better understand the sediment properties of Mudge Pond.

## **61.**

### **SALT MARSH RESTORATION IN GOOSENECK COVE, NEWPORT RI**

Andrew Grosvenor 05

Faculty Sponsor: Professor Joan Morrison, Professor Christoph Geiss (Environmental Science) and Marci Cole PhD, Coastal Ecologist - Save the Bay

Save the Bay is a Rhode Island based environmental group dedicated to the preservation and restoration of Narragansett Bay, which is the body of water that forms virtually all of the state's coastline. An essential aspect of these duties is the preservation and restoration of the remaining salt marshes on the bay. Salt marshes are very delicate and very important ecosystems. They play a large role in erosion prevention and provide the habitat for a tremendous number of coastal plants and animals. Protecting these marshes involves regular monitoring of their vegetation and the salinity levels in the ground water, as well as assessment of the invertebrate and fish populations in the marsh. If a marsh is unhealthy, a plan needs to be developed for restoration, and this can involve the planting of native plants, the widening of culverts, or any number of other important factors. Save the Bay works to manage and restore the remaining 3,738 acres of salt marsh in the bay,

which is estimated to be around 50% of the marsh acreage at the time of European colonization. The restoration of Gooseneck Cove marsh in Newport is currently under way, and the second year of monitoring has been completed as a plan for a restoration project is developed. The data gathered from salinity and vegetation monitoring has been essential to this process, and combined with GIS mapping technology has allowed for a very detailed picture of the marsh's health to be developed.

## **62.**

### **ASSESSING THE VERTEBRATE COMPONENT OF THE DIET OF FLORIDA'S CRESTED CARACARAS**

Kyle Pias 07

Faculty Sponsor: Professor Joan Morrison (Environmental Science)

We studied the vertebrate component of the breeding season diet of the Northern crested caracara (*Caracara cheriway*) in south-central Florida, where this species occurs as an isolated population and is threatened by widespread habitat loss. From 75 prey remain samples collected at active nests in 40 different breeding areas during February – June 1994-1997, we identified 299 prey items representing 53 different prey types from 5 vertebrate classes and 37 families. Mammals comprised the largest proportion of all prey items (31.4%) followed by reptiles (24.1%), fish (23.7%), birds (13.4%), and amphibians (7.4%), and many of these items were probably taken alive. One hundred ninety-two prey items (64.2%, 17 different families) represented species that use wetlands during all or part of their life history, suggesting dependence of this raptor on wetlands for foraging, at least during the breeding season. Carrion comprised approximately 33% of the diet of nesting caracaras in Florida. Our results differ from those reported for the diet of crested caracaras in Mexico, Argentina, and Andean Patagonia possibly due to differences in habitat diversity, land use, and carrion availability.

## **63.**

### **PALEOMAGNETIC ANALYSIS OF LOUIS LAKE, WYOMING**

Craig Curtis Schneider 05

Faculty Sponsor: Professor Christoph Geiss (Environmental Science)

Louis Lake, near Lander Wyoming, was the site of a coring that tried to reconstruct a long history of paleoclimate for the Rocky Mountain region. In the winter of 2004, a small crew set out to the lake and obtained an eleven-meter long core. This core was sent back to the east coast to be sampled and tested by me in Trinity College's Environmental Science Lab. To perform a paleomagnetic study we subsampled each drive into small, weakly magnetic plastic cubes. Measurements of magnetic susceptibility show how much ferromagnetic material is present in the samples throughout the core. Following this study, selected samples were chosen for alternating field demagnetization analyses. The results of these measurements allow us to reconstruct changes in the inclination and intensity of the earth's magnetic field over the past 10,000 years. By comparing this information to the Paleomagnetic record of other lakes we are able to constrain the age of the Louis sedimentary record.

64.

**RECONSTRUCTION OF THE BIOLOGICAL HISTORY OF THE GREAT SOUTH BAY ESTUARY USING PRESERVED MOLLUSK RECORDS**

Daniel Scollan 05

Faculty Sponsor: Professor Christoph Geiss (Environmental Science)

Robert Cerrato, Stony Brook University

Ecological restoration requires determination of natural baseline conditions. This study examined the Great South Bay, a major estuary on the southern shore of Long Island, New York. A survey was conducted of the molluscan death assemblage in sediment cores collected in the bay. The assemblage can reveal information about the ecological conditions of the Great South Bay over time, especially in conjunction with other sedimentary analyses. The specific history of the mollusk assemblage is also important to determining restoration goals for the bay's declining shellfish population. Mollusk shells were present in upper most deposits resembling the current estuarine environment. Eight species of both bivalves and gastropods were identified. All of these species were present in recent surveys of the Great South Bay, suggesting that there have no significant changes in the mollusk community of the bay over its lifetime. Of particular interest, the commercially valuable Hard Clam, *Mercenaria mercenaria*, was found at the top and very bottom of the estuarine sequence, despite its dramatic decline in population since the 1970s.

65.

**RECONSTRUCTION OF LAKE LEVELS OF MUDGE POND, WESTERN CONNECTICUT, THROUGHOUT THE HOLOCENE**

Ryan Sultan 06

Faculty Sponsor: Professor Geiss Christoph (Environmental Science)

As part of an ongoing analysis of lakes in western Connecticut, five cores were taken from Mudge Pond, near Sharon Connecticut along a transect through the lake basin. Cores were analyzed using radiocarbon dating, changes in sedimentology, magnetic susceptibility, and total organic carbon content. Based on the analyses from these five cores I reconstructed changes in lake levels through the Holocene (last 10,000 years). Two major types of sedimentary units were established, organic rich mud and grey glacial clay. The organic rich mud was then divided into four layers based on the culmination of changes in color, magnetic susceptibility and percent organic carbon. Grey glacial clay showed two layers. These were differentiated by their difference in magnetic susceptibility. The depths that the layers were present for varied depending on the location of the core. Generally, due to erosion, the layers became thicker when moving from the shore to the center of the lake. The presence of beaches were also used as a determining factor for distinguishing layers. Beaches were particularly important in reconstructing of lake levels since they provide a decisive point of where the water level was when that layer was deposited. The analysis has shown lake levels to be greatly variable during that time period with pronounced low-stands during the early Holocene.

**66.**

## **MAGNETIC PROPERTIES OF LAKE SEDIMENTS**

Jacques Swanepoel 06

Faculty Sponsor: Professor Christoph Geiss (Environmental Science)

Lake sediment can act as natural archives for different environmental processes. The magnetic records of lake sediments can provide environmental information on issues like recent pollution, human and climate impact on hydrological processes and climate change, and different erosional processes. There are several factors that influence the magnetic susceptibility of lake sediments, which include dilution effects, particle size, reductive diagenesis of ferrimagnetic materials, and authigenic iron sulphides. Samples were taken at five centimeter intervals from sediment cores taken from Mudge Pond in Connecticut. The core depths range from 9.50 meters to 18.50 meters. Magnetic susceptibility measurements were taken for each sample. These magnetic susceptibility measurements are affected by all the iron-bearing minerals present in the sediment. Anhysteretic remanance magnetism (ARM) measurements were also taken from every second sample. There are many factors that could influence the magnetic measurements taken from sediments and all of these are not very well understood. This is because research on sediment magnetic properties has mainly occurred during the past twenty-five years. It has become very common largely due to the fact that magnetic properties diminish very slowly, which makes it very accurate and consistent.

# HEALTH FELLOWS

67.

## **LYME DISEASE, SEPTIC ARTHRITIS AND TRANSIENT SYNOVITIS; DO KOCHER'S MULTIVARIABLE PREDICTORS HOLD TRUE IN CONNECTICUT, A STATE WHERE LYME DISEASE IS ENDEMIC?**

David Alderman 06

Faculty Sponsor: Professor Laurel Baldwin-Ragaven (Health Fellows)

Jeffery Thomson, MD CCMC, Department of Orthopaedics

Children who present with acute hip effusion can have a myriad of potential diagnoses, the most urgent of which is septic arthritis. Whereas septic arthritis requires emergency attention, including possible incision and drainage, transient synovitis and Lyme arthritis require a different treatment prescription than the surgery and IV antibiotics ordered for septic arthritis. A retrospective chart review was conducted to evaluate the utility of four criteria outlined by Kocher and used by clinicians to distinguish between septic arthritis and transient synovitis, without consideration of Lyme Disease. Eighty-eight eligible pediatric patients aged 0 to 21 who had been operated on by orthopedic surgeons at the Connecticut Children's Medical Center (CCMC) between 2001 and 2005 were included in the study. Their charts were reviewed for Kocher's four criteria: refusal to weight bear, fever, serum white blood cell count and the erythrocyte sedimentation rate, as well as serology for Lyme Disease. Preliminary results indicate that Kocher's multivariable predictors hold true for the orthopaedic population at CCMC; however, it would be necessary to access patients from Rheumatology and Infectious Disease in order to eliminate the possibility of an orthopedic bias.

68.

## **CORRELATION OF BLOOD PRESSURE ELEVATION TO SEVERITY OF ILLNESS IN CHILDREN WITH GUILLAIN-BARRE SYNDROME**

Nicholas Harrison 06

Faculty Sponsor: Dr. Sarah Raskin Dr. Laurel Baldwin-Ragaven (Health Fellows)

Francis DiMario MD Mentor, Connecticut Children's Medical Center

Guillain-Barre syndrome (GBS) is a demyelinating polyneuropathy affecting the peripheral nervous system, characterized by progressive, symmetrical motor weakness of more than one limb and areflexia or hyporeflexia.<sup>1,2,3</sup> Current estimates of incidence in children range 0.1/100,000 to 1.7/100,000 population.<sup>2</sup> Guillain-Barre syndrome is



currently the most common cause of acute generalized paralysis in all age groups.<sup>2,3</sup> 15% to 20% of adults with GBS require mechanical ventilation. Other less common though serious autonomic disturbances include tachyarrhythmias, bradyarrhythmias, and hypertension or hypotension.<sup>1,2</sup> Currently there are few prognostic indicators of expected severity. Those such as severe reduction of compound motor action potentials (CMAP),<sup>2,4</sup> decreased arm strength and coordination,<sup>5</sup> and time from nadir until improvement<sup>2</sup> are of little use in determining treatment in the early stage. To date there has been only one study suggesting that blood pressure elevation has been associated with highest disease stage and longer hospital stay in children.<sup>6</sup> One other study correlated higher incidence of respiratory failure and higher incidence of mortality (20%) with hypertension complicating GBS.<sup>7</sup> Blood pressure elevation could be useful as a prognostic marker for disease severity and final outcome for treatment decisions if results could be replicated. In this study we have been reviewing Connecticut Children's Medical Center's experience with children treated for GBS over the period 1996-2004. We postulated that autonomic dysfunction and blood pressure disturbance in particular may be a marker of greater disease severity requiring more treatment interventions and longer hospitalization. We do not think that the degree of autonomic dysfunction predicts worse outcome. Currently, we are trying to finish data tabulation and analysis.

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## 69.

### **CONTINUED EVALUATION OF THE UNIVERSAL JAUNDICE-SCREENING PROGRAM AT HARTFORD HOSPITAL**

Bao Pham 06

Faculty Sponsor: Professors Laurel Baldwin-Ragaven and Sarah Raskin (Health Fellows)  
Victor Herson MD Connecticut Children's Medical Center Neonatal Intensive Care Unit

In an effort to prevent brain damage (kernicterus) from occurring in newborns with severe hyperbilirubinemia (define as having concentration higher than 18 mg/dl), Harford Hospital initiated a universal jaundice-screening program to detect hyperbilirubinemic infants. The program requires the use of a transcutaneous device called the BiliCheck and an hour specific nomogram to determine the infants' risk. A previous project has been done to analyze results for the first year of the new protocol and we are continuing with the chart review to analyze the second year experience. The data is divided into three periods. The first period includes patients who were born between November 1, 2001 and

October 31, 2002, the year before the screening program was established. The second period includes patients born between November 11, 2002 and November 30, 2003, the first year of the program. The second period includes patients born after December 1, 2003. All patients were born at Hartford Hospital and were then admitted to Connecticut Children Medical Center for hyperbilirubinemia within the first fourteen days of life. Our goals are to analyze the sensitivity of the screening tests, to determine whether the screening program reduced the proportion of infants admitted CCMC with severe hyperbilirubinemia and to determine if the program resulted in more stringent follow up plans for newborns after discharge.

# MATHEMATICS

**70.**

## **CLASSIFICATION OF QUADRIC HYPERSURFACES IN HIGHER DIMENSIONS**

Leighann Kinter 08

Faculty Sponsor: Professor David Cruz-Uribe, Professor Cristian Rios (Mathematics)

All linear transformations in any higher dimension can be described by multiple translations and rotations along the planes of the axes. By defining a new set of axes to express these translations and rotations, the equations of an object can be represented in the standard form, allowing the location, size, and shape of the object to be more easily determined. An eigenvector approach is used to determine the rotations needed to represent the equation of the object without mixed variable terms and the translations needed to represent the equation of the object without single-variable terms. Patterns observed among the transformations of the second and third dimensions allow for the generalization of transformations to higher dimensions.

**71.**

## **EYE COLOR PROBABILITIES ACROSS GENERATIONS**

Sarah Litman 05 and Lindsey Sheldon 05

Faculty Sponsor: Professor Philip Brown (Mathematics)

Eye color in offspring is determined by the genotype of the two parents. However, because some genes are recessive and others are dominant, eye color cannot be determined solely by the phenotype of the parents. The model here examines the probabilities of each genotype and subsequent phenotype for any given set of parents. State diagrams, tree diagrams, and transition matrices are used to determine the Markov chain model.

72.

### THE USE OF CONTINUED FRACTIONS TO APPROXIMATE SPECIAL FUNCTIONS

Lisa Pham 08 and Nikolay Atanasov 08

Faculty Sponsor: Professor Nancy Wyshinski (Mathematics)

A continued fraction is an expression of the form

$$x = a_0 + \frac{b_1}{a_1 + \frac{b_2}{a_2 + \frac{b_3}{a_3 + \dots}}},$$

where  $a_i$  and  $b_i$  may be complex numbers or, more generally, functions of a complex variable  $z$ . Continued fractions are used for computing rational approximation to real numbers as well as for solving Diophantine and Pell's equations. From a number theoretical point of view, continued fractions were used to expand rational fractions; from an analytic theoretical point of view, continued fractions were used to manipulate and derive approximations for complex functions. Since they offer accurate rational approximations to complex functions, continued fractions for special functions were examined and compared to power series approximations. In particular, the logarithmic function written as a hypergeometric function

$${}_2F_1(1,1,2;-z) = \log(1+z)$$

was analyzed. By comparing the continued fraction approximation to the power series approximation, results showed that the continued fraction has a great advantage as far as speed and domain of convergence are concerned. Fast and accurate estimations of logarithmic functions, or any other special function, are important because of its adaptability to high-speed computing machines. Broader applications of the continued fractions are associated with the development of cryptosystems for secret communication in business and banking.

73.

### WHETHER OR NOT WEATHER FOLLOWS A RANDOM WALK

Molly Stumbras 07 and Vijay Bhirud 05

Faculty Sponsor: Professor Philip Brown (Mathematics)

Weather is one of the most important facets of everyday life; it can dictate fashion, moods and daily activities. With that in mind, the accuracy of professional weatherman is not always as high as some people might hope. We have two hypotheses regarding day-to-day weather fluctuations. If day-to-day variations are independent of one another a Monte Carlo simulation will provide an accurate simulation. If weather patterns follow a random walk a Markov chain is appropriate for weather prediction. We will test both models and compare them to the actual weather from fall 2004.

# NEUROSCIENCE

74.

## **COMPARISON OF ROTENONE- AND MPP+-INDUCED TOXICITY IN DIFFERENT MURINE STRAINS**

Daniel Cuzzone 05

Faculty Sponsor: Professor William Church (Neuroscience)

Ventral mesencephalic cells from different murine strains, show variable susceptibility to MPP+ treatment. Rotenone is a neurotoxin whose mechanism, similar to MPP+, involves inhibition of complex I of the mitochondrial electron transport chain. The current study was conducted to determine if susceptibility differences observed with MPP+ treatment also existed for rotenone treatment. CD-1 and C57/bl mouse ventral mesencephalic cells were grown in culture for 7days (DIV 7) and 11 days (DIV 11) and then treated with either MPP+ or Rotenone. DA cells were identified by immunochemical staining for tyrosine hydroxylase (TH+). TH+ cells were stained for the co-expression of the NMDA receptor subunit NR1. MPP+ and Rotenone toxicity was quantitated using standard cell counting techniques. A dose-dependent loss of DA neurons was observed for both neurotoxins. NMDA receptor antagonism by MK-801 was evaluated in both MPP+ and Rotenone stimulated murine cultures.

75.

## **DEFAULT MODE NETWORK ACTIVITY IN SCHIZOPHRENIA: A FUNCTIONAL MRI STUDY USING INDEPENDENT COMPONENT ANALYSIS**

Abigail Garrity 07

Faculty Sponsor: Professor Daniel Lloyd (Neuroscience)

Vince Calhoun PhD Yale University and The Institute of Living

Default mode network consists of several brain areas that are coactivated during the resting state of brain function. Areas implicated in the default mode network include those that present abnormalities and decreased metabolism in patients with schizophrenia. Because of this, it was hypothesized that schizophrenics would exhibit an atypical default mode as compared to healthy patients. To test this hypothesis, independent component analysis of fMRI data was used to isolate default mode in a group of 21 schizophrenic patients and 21 age-matched healthy controls while performing an auditory oddball task. Healthy controls exhibited greater deactivation during the task in parietal areas, the visual association cortex, thalamus, posterior cingulate and temporal areas. Schizophrenic patients exhibited greater deactivation in frontal areas which is consistent with hypofrontality in schizophrenia.

**76.**

**ADENOSINE A1R RECEPTOR DEFICIENCY ALTERS HIPPOCAMPAL PLASTICITY IN FREELY MOVING KNOCKOUT MICE**

Jessica Koranda 05

Faculty Sponsor: Professors Harry Blaise and Susan Masino (Neuroscience)

Hippocampal long-term potentiation (LTP), assumed to be the neurophysiological basis for learning and memory, indicates an increase in synaptic efficacy, while long-term depression (LTD) represents a weakening of synaptic strength. LTP and LTD expression is thought to rely on N-methyl-D-aspartate (NMDA) receptor activation. Adenosine represents one molecule whose effect on synaptic efficacy remains unclear. Adenosine works via the activation of adenosine A1 receptors (A1R) and is densely located in the hippocampus. When activated, A1R receptors inhibit Ca<sup>2+</sup> influx while also facilitating K<sup>+</sup> efflux. Combined, these two effects create an overall inhibition in the CNS leading to a smaller degree of NMDA receptor activation. Thus, it can be predicted that eliminating the effects of adenosine will lead to an increase in both LTP and LTD expression in the hippocampus. In order to test this hypothesis, LTP and LTD were induced in three groups of mice. Control animals (+/+) have normal A1R expression, heterozygous animals (+/-) express approximately 50% of the receptors seen in controls, and homozygous/knockout animals (-/-) lack A1R receptor expression. Microelectrodes were chronically implanted into the hippocampus of each animal. LTP was then induced by stimulating the hippocampus at 100 Hz using 900 single train pulses at 300  $\mu$ A. Conversely, LTD was induced at 5 Hz at using 900 single train pulses at 700  $\mu$ A. Percent change in EPSP and PSA was then calculated to determine the effects of adenosine on synaptic efficacy. Results show that (-/-) animals displayed the greatest degree of both LTD and LTP with (+/+) showing the least. Heterozygous animals fell somewhere in between. Because adenosine seems to negatively impact synaptic efficacy, it is thought that adenosine serves to play a neuroprotective role during times of increased energy demand in the brain. Thus, eliminating A1R's increases the chance of excitotoxicity and irreversible cell damage.

**77.**

**SYNAPTIC PLASTICITY IN 30 DAY OLD FREELY MOVING RATS**

Timothy Scarella 08

Faculty Sponsor: Professor Harry Blaise (Neuroscience)

The hippocampus has long been thought to be a brain structure implicated in learning and memory processes. One mechanism for memory that has become prominent is that of long-term potentiation (LTP), the enhancement of synaptic efficacy after stimulation. LTP can be quantified by measuring the percent change in excitatory post-synaptic potential (EPSP) slope and population spike amplitude (PSA) in the perforant path of the hippocampus after stimulation. The perforant path is a neuropathway in the brain implicated in the memory process. The frequency at which potentiation occurs has been found to be age dependent in rats, and has been established in our lab for immature (15 day old) and adult (70 day old) rats. This study seeks to establish the frequency at which

LTP occurs in rats of intermediate ages, specifically 30 day old rats. 30 day old male Sprague-Dawley rats were anesthetized and surgery was performed to implant ground, monopolar recording, and concentric bipolar electrodes in the hippocampal region of the brain. After a 48 hour recovery period, the perforant pathway was stimulated using a continuous 900 pulse burst at different frequencies. Readings were taken at various intervals afterwards in order to determine percent change in EPSP slope and PSA over time. We expect that the results will indicate that the frequency at which LTP occurs in 30 day old rats will be in between the frequencies of LTP in adult and immature rats.

# PHYSICS

**78.**

## **QUANTIFICATION OF ULTRA-FINE MAGNETIC GRAINS IN SOILS**

Tamara Machac 06

Faculty Sponsor: Professor Christoph Geiss (Physics)

The abundance of ultrafine ( $d < 100$  nm) magnetic grains in soils is thought to vary with changes in climate, especially precipitation. The relationship between modern soil magnetic properties and present day climate and buried soil horizons hopefully can shed more light on past climatic changes. My research investigates a cheaper, faster and possibly more sensitive method to quantify the abundance of very small (less than 100nm) grains in natural soil samples.

Our experimental approach is based on work done by Worm (1999), which exploits the principle that the time dependence of IRM (Isothermal Remanent Magnetization) acquisition and frequency dependent susceptibility measurements give equivalent information about the presence of ultrafine particles. I designed a small field coil wrapped around a plastic pipe that can produce a magnetic field between 2.5 and 78 mA/m. Using this simple device, samples can be exposed to a magnetic field for about 0.02s by dropping the sample through the vertically oriented pipe. 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. I measured the magnetic remanence of the samples after I exposed the sample to the coil's magnetic field for first 0.02, and then two seconds, and used the difference between the two remanence measurements to estimate the abundance of ultrafine magnetic particles.

In general, the abundance of these particles increases dramatically for soils at shallow depths, and then decreases as depth greatly increases. Also, the abundance is much greater in wet soils, rather than in dry ones.

Worm, H.U. (1999). Time dependent IRM: A new technique for magnetic granulometry. Geophysical Research Letters 26, 2557-2560.

**79.**

## **MAGNETIC ENHANCEMENT IN LOESSIC SOILS - EFFECTS ON MAGNETIC GRAINSIZE AND MINERALOGY**

Alex Masi 08

Faculty Sponsor: Professor Christoph Geiss (Physics)

Recently, scientists have discovered that, because magnetic minerals are present in a majority of natural substances, by analyzing the magnetic properties of sediments one can determine changes in climate, such as variations in precipitation, and determine the rate and regional gradients of climatic change. Our work quantifies the presence of hematite, which can appear as a product of weathering, generally reflecting warm climate



conditions, or can appear in areas with ample rainfall. In order to detect the presence of hematite, isothermal remanent magnetization, or IRM, will be used. IRM is induced by exposing a sample to a known magnetic field. This magnetic field is produced within a large coil and whatever magnetic materials are present in the sample will have their magnetic moments at least partially aligned by the applied field. Thus far our research has confirmed the presence of hematite in soil samples from Nebraska. The next step in our research is to quantify its presence at various depths soil in the soil profile. Results from our research will help us to establish hematite concentrations in soils as a paleoclimate indicator and to learn more about the contribution of weakly magnetic minerals, such as hematite, to the magnetic properties of soils.

# PSYCHOLOGY

**80.**

## **CENTER OF MASS CHANGE AND TOOL PREFERENCE IN WOMEN'S LACROSSE**

Emily Allen 08

Faculty Sponsor: Professor William Mace (Psychology)

Research in non-visual perception has been centered on how the human body can determine the physical properties of an object through dynamic touch. This research has been applied to several simple systems and actions such as determining the length of a stick by wielding it freely without looking at it. The study of dynamic touch has been applied to several tasks by focusing on different aspects of that task. The perceptions of certain physical properties of an object were studied while performing some of these tasks. In addition, the preferences of an object as a tool for certain tasks have also been studied. Changing the center of mass within a lacrosse stick affects the effectiveness of the stick being used as a tool for specific tasks. Some tasks which are studied for tool preference are both for precision and power. Four lacrosse sticks with different centers of mass within the shaft will be used to test how the preference of each stick is applied to four different tasks. Two of the four tasks focus on precision and will include throwing a rubber lacrosse ball at a target as well as intercepting a moving rubber lacrosse ball. The other two tasks focusing on power will be throwing a rubber lacrosse ball for speed and for distance. The placement of each mass will be at the top of the shaft, at the location of the dominant hand, between the two hands, and at the location of the non-dominant hand. These four sticks will then be used to determine how well they can be used to complete either a precision or power task. The hope is that the different locations of mass within each stick will determine whether or not mass placement and dominant hand use of a tool will affect the preference of that tool for each of the four tasks. It is expected that locating the center of mass under the dominant hand will be ideal for the lacrosse precision task. This experiment will help better the understanding of dynamic touch with complex movements and tool preference, and will lead to a better understanding of non-visual perception beyond dynamic touch, such as understanding the roles of the dominant and non-dominant hand within a bimanual action.

**81.**

## **RELATION OF MEDIA EXPOSURE, DIETARY RESTRAINT, AND STRESS**

Patricia Allen 05

Faculty Sponsor: Professors Claire Wiseman and David Reuman (Psychology)

Psychological and emotional stimuli can influence neurobiology by releasing stress hormones that are linked with important cognitive and biological functions (Ursin &

Levin, 1991). An abundance of research documents the negative psychological and emotional effects that idealized body images have on non-clinically disordered women. However, it is unclear how dietary restrainers, or chronically dieting, non-clinically disordered persons who are driven by weight concern (Herman & Polivy, 1984), experience the portrayal of media models. Research suggests that restrainers tend to have higher baseline levels of cortisol (Anderson et al., 2003), a stress hormone released in response to psychological or physical threats, and significantly lower self- and body-esteem. It was hypothesized that restrainers would report more perceived stress when exposed to the thin ideal and have higher cortisol levels in general. Still, because it is believed that restrainers suffer from chronically high levels of stress, we predict that an increase in cortisol would only be observed in nonrestrained women, whom are not desensitized by hypercortisol secretion. If nonrestrained women experience stress in response to thinness ideals as portrayed by the media, this study would grant further support for the potentially dangerous relationship between media, stress, dieting, and the etiology of eating disorders. To test this hypothesis, normal and restrained women provided salivary cortisol samples before and after exposure to superthin models, plus-size models, or neutral (control) images. Additionally, participants reported on perceived stress, body-esteem, and self-esteem. Contrary to prediction, restrainers exhibited more perceived stress and declining body-esteem in response to plus-size, rather than superthin, models. Nearly significant trends suggesting self-enhancement effects for restrainers in the superthin condition provide support for the “thinness fantasy” proposed by Myers and Biocca (1992). Currently, we are in the process of analyzing and determining the relationship of cortisol with the aforementioned variables. Problems associated with chronically elevated levels of cortisol and implications for eating disorders are considered.

## **82.**

### **CREATIVITY AND MADNESS**

Sarah Bell 05

Faculty Sponsor: Professor Randolph Lee (Psychology)

The postulated link between madness and creativity has been noted by centuries of mentally ill artists, composers, writers, poets, and scientists. However, questions still remain about whether it is the psychoses, mood disturbances, intoxications, or extreme characterological defects that enhance inspiration and change their perception of reality. In an attempt to answer this question, this paper will compare two famous creators, Vincent Van Gogh and Sylvia Plath, who suffered from Complex Partial Seizure Disorder and Bipolar Affective Disorder, respectively. Their environmental influences combined with their brain abnormalities will be examined as a function of their creativity. From these explorations and from additional research, it is hypothesized that creativity is often stimulated by the progressive change of both physiological and psychological brain function due to various psychiatric disorders. The depth of an individual's creative ability changes as the disorder progresses.

**83.**

**THE INTERPERSONAL EXPERIENCE IN COLLEGE: A COMPARATIVE STUDY**

Justyn Bellsey 05

Faculty Sponsor: Professor Randolph Lee (Psychology)

The college years are essential for development and growth. An individual enters as a freshman, ready to take on life independently for the first time. However, the college experience is more than just expanding academically. One learns to mature through interpersonal relationships and social interactions, specifically, through the interactions of peers, faculty, family, and roommates. In 1970 Dr. Randolph Lee examined interpersonal development during college. He assessed its' dimensions and influences of important intrapersonal and environmental variables. Using the College Interpersonal Development Survey (CIDS), a 68-item original measure, Lee obtained nine basic dimensions of interpersonal development in college: parental relations, sexual attractiveness and influence, independence and sexual identity, leadership influence, peer attachment and influence, academic purpose, wholeness and generativity, maturing sexuality, and finally interpersonal communication and understanding. The purpose of this study is to examine the college environment thirty five years later. I will examine the shift in ideas of gender roles, parental influence, and social life. I will be administering the CIDS to a new generation of Trinity Students to examine the possible change in dimensions and patterns of relationships of college students. I believe results will show a significant change in certain aspects of the college interpersonal experience. The college culture and environment have evolved over the years and as a result, interpersonal relationships will be altered. The following questions will guide my study. 1. What are the important developmental factors in the college interpersonal experience presently compared to what Lee found in the 1970s? 2. How do the factors change throughout the years and is there a comprehensive pattern to this change?

**84.**

**THE EFFECT OF BIRTH ORDER AND SIBLING RELATIONS ON ASPECTS OF SOCIABILITY**

Justyn Bellsey 05, Melissa Rosenberg 05, Lindsey Fay 05 and Chase Nelson 05

Faculty Sponsor: Professor Dina Anselmi (Psychology)

Previous research suggests there will be observable differences across birth order positioning (Gfroerer, K.P., Gfroerer, C.A., Curlette, W.L., White, J., and Kern, R.M., 2003). What this research shows is that first born children show more leadership qualities and a greater degree of social competence. The purpose of this study was to examine the effect of birth order on elements of risk taking behavior, sensation seeking behavior, and self esteem among college students. Participants were recruited from various introductory level courses at Trinity College. We predicted that there will be a significant birth order effect for risk taking behavior. More specifically, we expect to find that last born individuals will engage in riskier behavior than their siblings. Only

children will display similar characteristics to first born children, but will carry with them a greater sense of entitlement.

**85.**

**INVESTIGATION OF ATHLETICISM IN MEN'S AND WOMEN'S SPORTS**

Tara Borawski 06, Samantha Strauss 06, Jessica Baker 05 and Matthew Krant 06

Faculty Sponsor: Professor Dina Anselmi (Psychology)

Recent research shows that often sports are perceived as more masculine as opposed to feminine endeavors (Lauriola, 2004; Royce, Gebelt & Duff, 2003). Our study investigated athletes and non athlete's perceptions of the acceptability of physical contact in different types of sports. We also looked at participants rating of acceptability of rule differences between sports that are played by both males and females. We hypothesized that because men are perceived as bigger and stronger that they are presumed to have more athletic abilities than are women and that psychical aggressiveness is more acceptable in men's sports than in women's sports.

**86.**

**PARENTS OR PEERS: WHO HAS MORE INFLUENCE OVER YOU?**

Jacqueline Cintron 05, Samuel Dance 06, Jennifer Mingrino 06 and Sabrina Murray 05

Faculty Sponsor: Professor Dina Anselmi (Psychology)

There has been significant attention to the question of whether parents or peers have a greater influence on adolescent's behaviors. Research shows that peers will have more of an influence over certain things such as clothing, music and risky behavior, whereas parents will have more of an influence on an adolescent's academic and career goals (Galotti & Mark, 1994; Kandel & Andrews, 1987). The present study investigated parental and peer influence in three different domains: 1) everyday decisions such as study habits, choice of friends, television programs watched, extracurricular activities and choice of clothing, 2) life choices such as spirituality/religion, career goals, college major, financial decisions and romantic relationships, and 3) risky behaviors such as smoking, drug use, sexual activity, alcohol use and violent behavior. We asked Trinity college students from freshmen to seniors questions about the relative influence of peers and parents in each domain. We expected to find several things: 1) more parental influence in life choices and more peer influence in risky behavior and everyday decisions, 2) more parental influence in the freshmen and sophomore classes and more peer influence in the junior and senior classes and 3) more parental influence in females than in males.

**87.**

### **EFFECT OF TEMPERATURE ON ADENOSINE IN HIPPOCAMPAL SLICES**

Carolyn Edwards 08

Faculty Sponsor: Professor Susan Masino and Dr. Chris Swart (Psychology)

The neuromodulator adenosine plays a role in sleep, arousal, and epilepsy, and in the effects of ethanol and chronic drug use. However, little is known about how adenosine influences these complex physiological conditions or how adenosine is regulated. Recent electrophysiological studies have found that changing the temperature from 32.5° to 38.5°C increases the amount of adenosine in the hippocampus, a brain region important for memory formation. This increase in adenosine inhibits excitatory synaptic transmission, indicating that adenosine is modulated by temperature. Notably, the temperature used in neurobiological studies varies between 23° and 38°C, a range when adenosine levels are likely to be affected. In this experiment hippocampal slices from adult Sprague-Dawley rats were tested at temperatures varying from 23° to 38°C to determine how adenosine levels vary with different temperatures, if there is an optimal temperature with respect to adenosine regulation and if so, what that temperature is. After a consistent baseline activity was measured, an adenosine receptor antagonist, theophylline, or an enzyme which degrades adenosine, adenosine deaminase, was added to remove the influence of adenosine on synaptic transmission. Using this pharmacological approach we found the biggest influence of adenosine at 23° and 38°C and the smallest at 33°C. Based on published reports it appears that keeping the slices at 33°C best mimics the in vivo influence of adenosine in the hippocampus. In general, experimenters using electrophysiological recordings need to be cognizant of the temperature at which they are keeping their slices or differing levels of adenosine will influence their results.

**88.**

### **HOOKING UP AND DATING AT TRINITY COLLEGE**

Naralys Estevez 06, Sarah Litman 05, Maureen Skehan 06 and Laura Watson 06

Faculty Sponsor: Professor Dina Anselmi (Psychology)

At Trinity College, it is a common belief that students are more likely to “hook up” with each other than they are to be involved in a romantic relationship with each other. Hooking up is defined as any sexual interaction, with a minimum of tongue kissing. There is an understanding that nothing beyond physical contact will result from the hook up. A relationship is defined as a romantic attachment that involves going out on dates and having a more intense level of commitment. A survey was given to fifty male and fifty female Trinity College juniors and seniors to determine how factors such as social norms, gender, and drugs and alcohol influence hooking up and dating patterns. We expected to find that more students will have engaged in behaviors defined as “hooking up” than in behaviors associated with a romantic relationship. We expected that alcohol and drugs will play a significant role in instances of hooking up. Furthermore, we predicted that males will have hooked up more often than females. Conversely, we expected females to be more interested in relationships, as it is more socially acceptable

for females to show more attachment than males, while males stereotypically exhibit a greater lack of interest in long-term relationships.

**89.**

**THE IMPACT OF MEDIA MODELS ON BODY SATISFACTION AND SELF-ESTEEM AS IT RELATES TO BODY MASS INDEX**

Lindsey Fay 05

Faculty Sponsor: Professor Claire Wiseman (Psychology)

In our individualistic society, there is a strong cultural value placed on thinness (Paquette & Raine, 2004). This study seeks to examine the relationship between the viewing of overweight and underweight media models on the body esteem and body dissatisfaction of individuals with varying Body Mass Index scores. Participants will first complete a pre-test questionnaire that will examine self-esteem, body satisfaction, and eating attitudes. One week later, following a viewing of 42 slides of either overweight or underweight models, an identical post-test questionnaire will be administered.

**90.**

**THE CULTURAL CONSTRUCTION OF THE SELF: HINDUISM, AYURVEDA, AND THE CURRENT STATE OF MENTAL HEALTH AND ILLNESS IN INDIA**

Beth Heaney 05

Faculty Sponsor: Professor Randolph Lee (Psychology)

To fully understand mental illness we must place individuals in the social and cultural contexts in which they live and learn. Money, government, religion, and family all play critical roles in the perception of mental health and illness. The treatment a person receives depends on “a constellation of cultural variables and socioeconomic realities.”(Lefley, 1994) By investigating beliefs about the soul and what constitutes personhood in a society such as India, a more holistic view of people and psychology can be generated. Western psychology, as we are taught, claims universalism, but without much support for such claims. We know of “ample evidence from many cultures of how truths of mainstream Americans are not necessarily applicable to the rest of the world.” (Matsumoto, 2004) Researching notions of the self in a collectivist context, such as India, will develop into an understanding of the treatment a person perceived as mentally ill receives in that society.

India’s dynamic history of diversity and attempted unification results in a unique national identity. For the individual that identity is enhanced by religion and belief structures. The India of today displays a strong Hindu tradition. From that tradition arose the world’s oldest practiced medical system, Ayurveda. Combining Hinduism and Buddhism, Ayurveda now interacts with allopathic medicine to treat mental and physical disorders simultaneously, not recognizing the Western dichotomy of mind and body.

An investigation into the historical, religious, and medical perception of selfhood reveals the self as a cultural construct. In India the concept of the self is temporally dynamic, drawing from a history of diversity, Hinduism, and Ayurvedic philosophy and practice.

**91.**

**DISCIPLINE STYLES: PARENTS VS. CHILDCARE CENTER TEACHERS**

Ayres Heller 05, Beth Ramaley 05, Carey Robertson 05 and Amber Smith 05

Faculty Sponsor: Professor Dina Anselmi (Psychology)

This study investigated the views that parents and the childcare center teachers have about disciplining children under the age of five. Attitudes were measured using the Perceptions of Discipline Questionnaire (PDQ) (Staley, 1993) a 40-item scale that measures views about child discipline. Participants were 19 parents and 8 teachers from the infant, toddler, and preschool classrooms at the Trinity College Childcare Center. Based on previous research findings we hypothesized that both parents and teachers would support the need for the discipline of young children, but that teachers would be more supportive of the need for consistency in discipline than parents. We also expected to find that both parents and teachers would support the use of a moderate amount of authority. For example, parents and teachers may support the use of redirecting the child away from a negative behavior, as opposed to either ignoring the behavior (not exerting authority) or correcting every single negative behavior (exerting authority).

**92.**

**ADOLESCENTS AND THEIR MOTHERS' VIEWS ABOUT THE  
RELATIONSHIPS BETWEEN DECISION-MAKING IN THE HOME,  
PARENTING STYLES, AND ATTITUDES TOWARD CHILDREN'S RIGHTS**

Ayres Heller 05 and Amber Smith 05

Faculty Sponsor: Professor Dina Anselmi (Psychology)

Decision-making in the home and parenting styles are important family issues as well as potential sources of conflict between adolescents and their parents. Parents and children's beliefs that decisions should be made in a shared context may be related to parenting styles and moreover, research suggests that attitudes about children's rights are related to parenting styles. However, the exact relationship between all of these variables has not yet been determined. Thus, the current study examined adolescents' and their mothers' views about parenting styles, decision-making in the home, and children's rights for both. Local high school adolescents and their mothers were given a series of surveys assessing these three domains. A sub-sample of mothers participated in a follow-up interview which asked them to keep track of actual decisions in the home and how they were resolved.



**93.**

**ASSESSING A CHILDREN'S RIGHTS CURRICULUM PROJECT AT THE HARTFORD MAGNET MIDDLE SCHOOL**

Carey Robertson 05

Faculty Sponsor: Professor Dina Anselmi (Psychology)

The UN Convention on the Rights of the Child focuses on establishing and maintaining rights for children. An important aspect of the CRC is that countries are responsible for educating children about their rights, thus, an important research question is how best to educate children about their rights. Covell & Howe (1999) instituted a children's rights curriculum in fifth and sixth grade classrooms and discovered that children who experienced the curriculum had an increased acceptance of minorities, perceived greater levels of support from teachers and classmates, and had a more in-depth understanding of rights in general. Peterson-Badali and Ruck (2003) measured college students' attitudes about children's rights and found that they were supportive of nurturance rights (e.g., every child has the right to live in a good quality house) but were less supportive of self-determination rights (e.g., parents, not children, should decide which school a child should attend). The purpose of this study was to determine the efficacy of a yearlong children's rights project. Subjects were given an empathy scale before work on the project began and again at the end of the spring semester. Subjects were also asked to respond to a series of dilemmas about children's rights and answer open-ended questions about rights that assessed their understanding of children's rights. We expected that both eighth graders and first year students would show an increase in their knowledge of children's rights and that eighth graders would show an increase in empathy. We also expect that the freshman would become more supportive of rights in general.

Thirty-nine eighth grade students from the Hartford Magnet Middle School and twenty-seven freshmen from Trinity College participated in this study. Nineteen eighth graders and thirteen freshmen comprised the experimental group, which learned about children's rights through class discussions and collaborative work on a children's rights project. At the end of the year, each group presented their research and findings at the children's rights fair.

**94.**

**STUDENT DRINKING BEHAVIOR AND FAMILY HISTORY**

Lindsey Jordan 06, Alex Dargery 05, Jenna McMeekin 06 and Charkie Quarcoo 06

Faculty Sponsor: Professor Dina Anselmi, Professor David Reuman (Psychology)

Research suggests that those who have a family member with an alcohol related problem are more likely to drink heavily. College is a time of "new found freedom" where individuals have the ability to experiment and make their own decisions (Molstad, McMillan, Kher, Kilcoyne, 1998). This study investigated the influence of family history on the drinking habits of Trinity College students. We predicted that students whose parents were excessive drinkers during their teens will be more likely to have more prominent binge drinking behaviors. We also predicted that students who had no history of drinking before college were more likely to engage in binge drinking behavior. Lastly,

we believe that students whose parents were extremely lenient or whose parents were extremely strict in regards to underage drinking would be more likely to engage in binge drinking than students whose parents had moderate rules or attitudes about underage drinking.

**95.**

**SOCIO-CULTURAL INFLUENCES ON COLLEGE FEMALES REGARDING EATING-RELATED ATTITUDES AND BEHAVIOR, AND BODY IMAGE IN LAHORE AND HARTFORD: A CROSS-CULTURAL STUDY**

Sana Khan 05

Faculty Sponsor: Professor David Reuman (Psychology)

The primary goal of this study was to conduct a cross cultural examination of body esteem, shape, and ideal; eating-related attitudes and behavior; and perceptions of socio-cultural influences and pressure in Pakistani and U.S. college females. Traditionally, the prevalence of eating disturbances have been lower in developing than Western countries; however, this trend seems to be changing in recent years with the rapid Westernization of many developing countries and with it the adoption of Western influences. Furthermore, socio-cultural factors that exert pressure on women to conform to a thin body ideal have received tremendous attention in the past few years. These include factors such as the media, familial, and peer influence. It is believed that eating disturbances cannot be looked at in isolation and must be understood in the socio-cultural context in which they develop. I hypothesized that the ideal body image would be similar for both populations. Furthermore, there would be pressure exerted by family, friends, and the media on both samples, and this pressure would result in an equivalent amount of either restrictive or compensatory behaviors. In general, the results showed that media as a socio-cultural factor was more likely to affect the U.S. sample as compared to the Pakistani sample, whereas, opinions and pressures from family and friends were more likely to affect the Pakistani sample. There was no significant difference in the level of compensatory or restrictive behavior. Finally, Pakistani women were more likely to report a thinner body ideal; however, there was a greater percentage of females in the U.S. that felt pressured to meet a certain body ideal. The results and further implications of the results will be discussed.

**96.**

**MUSCLE DYSMORPHIC DISORDER AND THE MEDIA**

Sarah Litman 05

Faculty Sponsor: Professor Claire Wiseman (Psychology)

Muscle dysmorphic disorder is a type of body dysmorphia in which the individual, usually male, is preoccupied with his muscularity. The individual typically spends hours lifting weights, eats mostly power shakes and bars, and may use steroids or performance-enhancing drugs. Eating disorders research focused on women shows that the media negatively affects women's self- and body-esteem. Because eating disorders are

diagnosed less frequently in men, few studies have examined this trend with respect to male populations. In this study, college-aged men complete pre-test surveys, view images of either thin or muscular men, and then complete post-test surveys measuring body-esteem, self-esteem, eating behaviors, and drive for muscularity. It is hypothesized that viewing thin images will be correlated with higher body- and self-esteem and a lower drive for muscularity, and viewing muscular images will be correlated with lower body- and self-esteem and a higher drive for muscularity.

**97.**

**LEGAL VERSUS EXTRALEGAL: THE DEBATE OVER THE PREDICTIVE FACTORS OF BAIL DECISIONS IN CONNECTICUT**

Lysa Magazu 05

Faculty Sponsor: Professor Sharon Herzberger (Psychology)

Researchers have long been interested in decision-making in the criminal justice system. Until recently, pretrial release decisions have received less attention than other decisions at other stages in the legal system. However, due to stereotypes about certain groups, which are used as cognitive shortcuts, in addition to past research that has exposed the use of “extralegal” factors in bail decisions, it is necessary to continue examining what factors are predictive of bail decisions. This study analyzed data for 101 defendants in Connecticut, in order to investigate the factors upon which judges make pretrial release decisions. I examined legally valid decision factors, such as offense severity, and prior convictions, and looked as well at the role of extralegal factors such as race and sex. It was found that while legal criteria influence these decisions, there are also significant jurisdictional differences in bail setting, as well as sex differences.

**98.**

**THE RELATIONSHIP BETWEEN OCCUPATIONAL CATEGORIES AND STEREOTYPED PERSONALITY CHARACTERISTICS**

Lysa Magazu 05, Erin Michelson 06, Christine Myksin 07 and Paulette Studley 10

Faculty Sponsor: Professor Dina Anselmi (Psychology)

Occupations have traditionally been classified into male and female jobs. For example, it is generally assumed that the position of manager is a male job, and the position of nurse is a female job. In turn, personality characteristics deemed masculine or feminine are often associated with success in different stereotyped professions; for instance, a manager’s position might be assumed to require masculine traits such as dominance, while a nurse’s position might require feminine traits such as nurturance. Despite changing proportions of individuals in these occupations, such that neither male jobs nor female jobs are primarily sex segregated, it is still interesting to note that the qualities emphasized in each profession have not deviated from their original stereotyped classification as a male or female job. Male jobs, such as a manager, still require employees to possess masculine qualities, such as assertiveness, in order to be successful in that profession (Powell, Butterfield, & Parent, 1999). Because manager is the

occupation most often studied, the present study sought to examine what qualities are deemed necessary in several other stereotypically male, female, and neutral professions. We asked Trinity College students to describe both themselves, as well as 12 professions, using the short form of the Bem Sex Role Inventory (BSRI). Furthermore, students were asked to rate the prestige of each profession to determine if there is a relationship between prestige and traits described as appropriate for a profession. Despite the change towards non sex-segregated jobs, it was hypothesized that rather than occupations requiring more androgynous individuals, individuals will instead adapt to what traits the profession calls for. Females will adopt masculine traits and behaviors in order to succeed as a manager, and males will adopt feminine traits to succeed in female occupations.

**99.**

### **SPORTS AND DEVELOPMENT**

Tracy Nesbit 05, Erin Conley 05, Matthew Katzman 05 and Deirdre Savageau 04  
Faculty Sponsor: Professor Dina Anselmi (Psychology)

Our goal in this study is to examine the influence athletic participation has on an individual's developmental outcome. We hypothesize that the greater involvement an individual has in athletics, the more likely they are to have a positive developmental outcome. We have administered an online survey consisting of four measures to assess developmental outcome including self-esteem, youth experience, perceived academic success, and social competence. Self-esteem is measured by using the Rosenberg Self-Esteem Scale in order to indicate how an individual feels about him/herself. The youth experience survey involves a series of questions regarding the influence that sport has had on various aspects of the subject's life. Additionally, there is series of questions about the subject's perceived success in college academics including measurements such as need for achievement, peer acceptance, power motivations, and fear of failure. Lastly, a scale for social competence is used as an adjustment evaluation indicating social acceptance among one's peers. Currently, we are collecting the results obtained from our online survey. After compiling the scores from each individual scale, the computer program SPSS will be used to compute the analyses and determine the levels of significance. We will use these results in comparison with our hypotheses to further gather conclusions and discussions about this study.

**100.**

### **THE EFFECTS OF TASK DIFFICULTY AND ATTRIBUTIONAL FEEDBACK FOLLOWING SUCCESS ON SUBSEQUENT TASK ACHIEVEMENT AND MOTIVATION**

Jennifer O'Brien 05

Faculty Sponsor: Professor David Reuman (Psychology)

This study explores the relationship between Graham's (1990) and Schunk's (1983) theories regarding the role of performance feedback in student achievement motivation.

Graham (1990) argued that giving positive feedback for success on an easy task can cause a student to infer that he/she has low ability for the task and decrease his/her motivation to achieve on subsequent tasks. Schunk (1983) found feedback attributing success to ability increased subsequent task motivation and achievement more than feedback attributing success to effort. I tested the integration of these theories in a 2 (task difficulty level) x 3 (attributional feedback condition) experimental design using anagram word puzzle tasks. My primary hypothesis was that Graham's model would predict the effects of effort feedback better than the effects of ability feedback, i.e. only effort feedback following success on an easy task would lead to lower achievement and motivation on subsequent tasks. Additionally, I predicted main effects that would support both theories, i.e. on subsequent achievement and motivation measures, participants in the difficult task condition would perform better than participants in the easy task condition and participants in the ability feedback condition would perform better than participants in the effort feedback condition. Participants completed a practice anagram task (either easy or difficult), were informed their performance was highly successful, received attributional feedback (either ability, effort, or control), and then completed a test set of anagrams and a questionnaire which measured aspects of motivation and attributions for performance. Contrary to predictions, results did not support either predicted main effect. An interaction effect opposite to that predicted occurred, i.e. participants who received effort feedback following an easy task showed greater achievement and motivation on a subsequent anagram task than those who received effort feedback following a difficult task. Implications of these results for motivational theory will be discussed.

## **101.**

### **DRAWING NEGATIVE SPACE**

Melissa Rosenberg 05

Faculty Sponsor: Professor William Mace (Psychology)

Drawing in perspective has been an ongoing struggle for novice artists. The difficulty lies in attempting to take a 3-dimensional real life scene and replicate it in one point of view on a 2-dimensional plane such as a piece of paper, or a canvas. This struggle has been attributed to the problem of trying to draw what you "see" as opposed to drawing what you "know". With this issue in mind, artists and art teachers have developed procedures and tricks that help to equate positive and negative space, by giving the background or negative space a distinct form, this helps to divert attention away from seeing objects. Historically, this issue has been acknowledged by renowned artists, and the Fauvist art movement demonstrates this by outlining the negative space as though it were positive space. Psychologists have also acknowledged this discrepancy and have studied what they call the figure/ground phenomenon. Gestalt psychology has devised ambiguous examples (vase and faces exercise) to illustrate figure/ground psychology. Both artists and psychologists agree that it is difficult to see both figure and ground simultaneously, and even more difficult to see background, or negative space as having its own shape. This experimental study aims to utilize the successful artistic perspective "tricks" in order to assess the process of how one acquires an understanding of perspective. Participants

will be asked to draw the negative space of 3-dimensional real life situations, as well as the same situation in a 2-dimensional photograph. They will also be asked to complete visual recognition tasks, where they will need to recognize the shape and form of negative space/background in 2-D examples, through multiple choice exercises.

**102.**

**THE INFLUENCE OF ATHLETIC PARTICIPATION ON SELF-ESTEEM AND SOCIAL AND ACADEMIC COMPETENCE**

Deirdre Savageau 06, Erin Conley 05, Matthew Katzman 05 and Tracy Nesbit 05

Faculty Sponsor: Professor Dina Anselmi (Psychology)

Our study examined the influence of athletic participation on an individual's self-esteem, social competence, and academic aptitude. We hypothesized that a greater involvement in athletics will lead to positive developmental outcomes such as high self-esteem, social competence, and academic achievement. We administered an online survey consisting of four measures to assess self-esteem, sports participation as a youth, perceived academic success, and social competence. Self-esteem was measured by a scale that indicated how an individual feels about him/herself. The youth experience survey involved a series of questions regarding the influence that sport had on various aspects of the subject's life. Additionally, there was series of questions about the subject's perceived success in college academics including measurements such as need for achievement, peer acceptance, power motivations, and fear of failure. Lastly, a scale for social competence was used as an adjustment evaluation indicating social acceptance among one's peers.

**103.**

**THE PSYCHOLOGY OF FORGIVENESS IN SOUTH AFRICA'S TRUTH AND RECONCILIATION COMMISSION: PROSPECTS FOR FOSTERING FORGIVENESS**

Ashley Tetu 05

Faculty Sponsor: Professor Randolph Lee (Psychology)

The South African Truth and Reconciliation Commission was instituted as an alternative method for dealing with the human rights abuses that took place during apartheid. It has been praised for its efficacy for promoting reconciliation in the country, however many have argued that the TRC process was very harmful to many of the victims. In order to weigh this claim and consider if such harm was justified by the outcomes of the TRC, it is pertinent to consider the potential the TRC held for actually achieving its goals. One of many precursors to reconciliation is forgiveness, the achievement of which in victims may counter the harm done by retraumatization and disempowerment. It is hypothesized that several specific factors may have seriously restricted the TRC's ability to promote forgiveness and in turn advance reconciliation. The TRC process is analyzed in the context of four major psychological models of forgiveness and the implications of this analysis are discussed. There are several factors that, according to those models, may have seriously restricted the TRC's ability to promote forgiveness and in turn advance

reconciliation. These limits include the nature of the relationship between the victim and perpetrator, the factors creating an interaction in which forgiveness can take place, and the basic nature of forgiveness.

**104.**

**THE EFFECTS OF THE SEXUAL MEDIA ON SELF-ESTEEM AND BODY IMAGE**

Maia Wojcik 05

Faculty Sponsor: Professor Claire Wiseman, Professor David Winer (Psychology)

Past studies have shown that advertised images of highly attractive female models can have a negative impact on girls' and women's self-esteem and body image (Martin & Gentry, 1997; Richins, 1991). This has been explained using the concept of social comparison (Festinger, 1954). Additionally, advertisements have become increasingly more sexual in nature throughout the past few decades (Reichert et al., 1999). These provocative ads are often noticed and remembered to a greater degree than are non-sexual ads (Reid & Soley, 1983). Despite the prevalence of sexually loaded media images, researchers have not yet determined the psychological effects that such ads may have on adolescents and young adults. This study was conducted to discover the effects of highly sexual ads on the self- and body-esteem of college students. It was hypothesized that highly sexual ads will have a negative effect on a person's, especially a female's, self-perception. It was also hypothesized that those who are less sexually experienced will feel worse about themselves after viewing highly sexual ads compared to those with higher levels of sexual experience.

Seventy male and female Trinity College students participated in the study. Subjects were given a survey form one week before, as well as after viewing either highly provocative ads or family/non-sexual ads. No differences were found in self or body esteem between the two ad conditions, but in general men felt significantly more secure about their weight and appearance than did women. A near significant trend was seen where students who had been sexually active felt better about themselves after seeing the sexual ads, and those who had not had sex felt worse. These findings may be attributed to the normative societal pressures on women to be thin and attractive, as well as the increasing media pressure on both men and women to be sexy.

**105.**

**EFFECTS OF PERCEIVED INGROUP STATUS AND SOCIAL SKILLS ON DEPRESSION AMONG TRINITY COLLEGE STUDENTS**

Marissa Wong 05

Faculty Sponsor: Professor David Reuman (Psychology)

Despite the effort of college administrators to target and help struggling students, feelings of alienation are still common on college campuses, particularly for students of color. Alienation involves feelings of powerlessness, loneliness, depression, low self-esteem, and anxiety; it can also lead to lower grades and attrition rates (Astin, 1993; Pascarella &

Terenzini, 1991). Factors that protect against alienation may be effective social skills and athletic team membership. In order to test such factors, this study examined effects of perceived ingroup status and the buffering effects of high levels of social skills (assertiveness and empathy) and athletic team membership on degree of depression among Trinity College students. I predicted that a) students who perceive themselves as part of the high status group will be less depressed than low status group members; b) students who reported low levels of social assertiveness and empathy will be more depressed than students with high levels of social skills; c) and the effect of social skills on depression will more pronounced among low status group members than high status group members. I also hypothesized that White students and athletes will be more likely (than students of color and non-athletes, respectively) to perceive themselves as high status members. 125 Trinity College students completed a web-based questionnaire. As predicted, perceptions of high status group membership were associated with lower levels of self-reported depression. As predicted, low levels of empathy were associated with higher levels of depression. Contrary to prediction, assertiveness was unrelated to depression. Observed interaction effects were only partially consistent with predictions.



# SCIENCE & SOCIETY

**106.**

## **CONFLICT BETWEEN MATERNAL RIGHTS AND FETAL RIGHTS**

Joanna Kulesz 05

Faculty Sponsor: Professor Laurel Baldwin-Ragaven (Health & Human Rights)

Legal, social, and political attitudes in the United States over the last 30 years have influenced policies toward women's rights in opposition to fetal rights. These attitudes have affected policies on abortion, prosecution of pregnant women for prenatal substance abuse, feticide, and employment discrimination based on potential fetal harm. Legal policies also interact on the international level within regards to human rights, including but not limited to the right to life, liberty, security of person, and freedom from discrimination. The increased recognition of the fetus as a person through biomedical advances, gains by pro-life advocates, and court judgments is threatening the autonomy and bodily security of pregnant women.

**107.**

## **ASSESSING HARTFORD'S OPTIONS FOR USE OF THE CURRENT LANDFILL SITE AND WASTE MANAGEMENT IN TO THE FUTURE**

Ashley Tetu 05

Faculty Sponsor: Professor Laurel Baldwin-Ragaven (Health & Human Rights)

In light of the impending closure of Hartford's landfill, it is critical that the Hartford community be informed about the possibilities for use of the landfill area after closure, as well as the new technologies that have potential for use in waste management in the area. Such education is important for the empowerment of local communities if they are to play a role in the construction and implementation of new waste management systems that minimize the health and environmental impact on local communities. Participation in this manner prevents environmental racism from occurring; it is not unusual for landfill sites to be located in poor or minority neighborhoods, where the community has few resources for protesting the construction of such facilities. This paper outlines a number of ways in which the current landfill site can be utilized after closing, as well as new technologies that have the potential to reduce the impact of waste management on surrounding neighborhoods. Such minimization has the potential to lessen adverse health effects, environmental conditions including poor air quality, and aesthetic issues such as the smell of decomposing waste.