Spring 2014

2014 Annual Research Symposium Abstract Book

Trinity College

Trinity College
HARTFORD CONNECTICUT

TWENTY-SEVENTH ANNUAL SCIENCE RESEARCH SYMPOSIUM

Table of Contents

Ferris Athletic Center
May 1, 2014
1:00 – 3:00pm

TWENTY-SEVENTH ANNUAL SYMPOSIUM OF TRINITY COLLEGE UNDERGRADUATE RESEARCH

TABLE OF CONTENTS

Poster #	Title

8. **ULTRASTRUCTURE AND CHEMICAL COMPOSITION OF CORN SNAKE EGGSHELLS**
Glory Kim '17, Kathryn Powers '17, Cionna Rosenthal '17

9. **THE ECOLOGY OF FEAR: DOES THE POTENTIAL OF PREDATION AFFECT SQUIRREL CACHING BEHAVIOR?**
Heidi Pi '14

10. **ANALYSIS OF INVERTEBRATE VISITATION TO COMPOST PILES WITH VARIED CONTENTS THROUGH TULLGREN FUNNEL SAMPLING**
Bridget Tevnan '15

11. **THE EFFECTS OF CAFFEINE ON THE FRESHWATER DIATOM TABELLARIA FLOCCULOSA (TABELLARIACEAE, FRAGILARIOPHYCEAE)**
Nikolaus E. Schultz '14

12. **A MORPHOLOGICAL AND MOLECULAR STUDY OF THE GENUS *LOBOPHORA* (DICTYOTALES, PHAEOPHYCEAE) IN THE WESTERN ATLANTIC, INCLUDING A CLARIFICATION OF *L. VARIEGATA* (J.V. Lamour.) EX E.C. Oliveira**
Nikolaus E. Schultz '14, Dylan S. Spagnuolo '17, Phong K. Quach '17

13. **THE EFFECT ON THE NORMAL FLORA OF THE UPPER RESPIRATORY OF CHILDREN IN CERTAIN AGE GROUPS WITH ASTHMA**
Abigail Whalen, '15, Catherine Guariglia '14

14. **THE ANNOTATION OF MYCOBACTERIOPHAGES FUNSTON AND WHABIGAIL7**
Sara Bunker '17, Elizabeth Craig '17, Sasha DiNitto '17, Haley Rafferty '17

15. **EXPLORING THE FUNCTIONS OF A CLUSTER C1 BACTERIOPHAGE**
Melindy Dorcin '17, Laura Nee '17, Luke Maynard '17

16. **TIME OF DIVERGENCE**
Maura Griffith '17, Glory Kim '17, Elliot Pollack '17

17. **PUTATIVE INTEIN IDENTIFICATION IN C1 MYCOBACTERIOPHAGE TORTOISE16**
Peter Jung '17

18. **THE RELATIONSHIP BETWEEN CODON BIAS IN CLUSTER C1 MYCOBACTERIOPHAGE AND VARIOUS *MYCOBACTERIUM* SPECIES**
Tom McNamara '17

Poster #	Title

19. STRUCTURAL AND FUNCTIONAL DIFFERENCES IN C-CLUSTER PHAGES WITH CONTRACTILE TAILS
Christopher Mulhern '17, Josh Knopf '17, Scott Buchanan '17

20. SUBCLUSTER C1 MYCOBACTERIOPHAGES: DETECTING ADAPTIVE EVOLUTION BY EXAMINING AMINO ACID REPLACEMENT IN NRDC-ENCODING GENE AND A PHAMILY 565-ENCODING GENE
Kathy Rodogiannis '17

CHEMISTRY

21. ALKYNYL β-SHEET PEPTIDOMIMETICS RETAIN THEIR ANTI-PARALLEL SHEET CONFORMATION WHEN CORDINATED TO TUNGSTEN
Adam N. Boynton '12, Shawna M. Berk '13, Elena-Marie C. Pedro '17

22. CONSTRUCTING A SYSTEM FOR MICROCHIP ELECTROPHORESIS LASER-INDUCED FLUORESCENCE (LIF)
Eleanor Clerc '17

23. DISCOVERY OF A DIMERIC BY-PRODUCT IN THE PREPARATION OF A TUNGSTEN BIS-ALKYNYLPEPTIDE COMPLEX
Lauren Davidson '16

24. SYNTHESIS OF A PHOSPHONAMIDITE FOR FUTURE SOLID-PHASE OLIGONUCLEOTIDE SYNTHESIS
Florence Dou '16

25. THE DEVELOPMENT OF A SYNTHETIC ROUTE FOR A DI-SUBSITITUTED DIPHENYLACETYLENE AND ITS CONFORMATIONAL CHARACTERISTICS UPON COORDINATION TO TUNGSTEN: A PROSPECT FOR BETA-SHEET STUDIES
Francis Herman '14

26. ANALYSIS OF SYNTHESIZING CAROLACTON
Hamilton Herr '14

27. TOTAL SYNTHESIS OF MICROTUBULE-STABILIZING AGENT CERATAMINE A
Woojung Ji '15

28. PROBING RIDITY IN CYCLIC TUNGSTEN-FERROCENE DIALKYNYLAMIDE COMPLEXES
Woojung Ji '15

Poster #	Title

29. THE CONTINUED SYNTHESIS OF TRIARYLMETHYL CATIONS
Mazin Khalil '15

30. THE TOTAL SYNTHESIS OF BREVISAMIDE
Mazin Khalil '15

31. THE APPLICATION OF DIRECT ANALYSIS IN REAL TIME – TIME OF FLIGHT MASS SPECTROMETRY IN THE DETECTION AND CHARACTERIZATION OF SYNTHETIC CATHINONES
Heather S. Loring '15

32. EFFECT OF SAMPLE PRE-TREATMENTS ON THE SOLID PHASE MICROEXTRACTION OF DESIGNER DRUGS FROM AQUEOUS SOLUTIONS
Matthew Lucas '17, Sarah Talcott '17

33. OXIDATION OF TURBOMYCIN SUBSTITUTED COMPOUNDS
Brooke Moore '15

34. SYNTHESIS AND STUDY OF A CYCLIC TUNGSTEN BIS-ALKYNE COMPLEX DERIVED FROM A 1,1'-FERRPCENEDOALKYNYL ESTER
Niranjana Pokharel '15

35. COMPARING MEASUREMENTS OF THE FORMIC ACID, WATER, AND SODIUM CHLORIDE LIQUID-VAPOR INTERFACE
Jeff Pruyne '15

36. INVESTIGATION OF THE COMPOSITION OF ALKALI METAL HALIDES' CRYSTAL
Phong Kim Quach '17

37. SYNTHESIS OF TURBOMYCIN ANALOGUES FOR THE DEVELOPMENT OF NEW ANTIBIOTICS: VARIATION OF THE INDOLE COMPONENT
Christine Reavis '15, Phong Kim Quach '17, Abigail Whalen '15

38. TOTAL SYNTHESIS OF (-)-PRZEWALSKIN B
Alex Shea '14

39. CHARACTERIZATION OF THE STABILITY OF SUPPORTED BILAYER MEMBRANES IN POLYDIMETHYLSILOXANE MICROFLUIDIC DEVICES
Livia Shehaj '15

40. THE PATH TOWARDS A CYCLIC TUNGSTEN BIS-ALKYNE COMPLEX DERIVED FROM m-XYLENEDIAMINE
Edgar Soto '15

Poster #	**Title**

41. **SYNTHESIS OF ASPARTIC ACID AND GLUTAMIC ACID DIPEPTIDES AND COORDINATION TO TUNGSTEN VIA ACYLATED SIDE CHAINS**
John Stiller '14

42. **HS-SPME/GC-MS METHOD DEVELOPMENT FOR THE ANALYSIS OF PIPERAZINES IN ORAL FLUID: *ON-FIBER VS. IN-MATRIX DERIVATIZATION***
Alexandre X. Zhang '14, Matthew Lucas '17

COMPUTER SCIENCE

43. **DEVELOPMENT OF A MACHINE LEARNING ALGORITHM TO PREDICT NATIONAL HOCKEY LEAGUE GAME WINNERS**
Alexandre X. Zhang '14

44. **ACQUIRE ONLINE**
Marin Abernethy '14

45. **CONSTRUCTION ALGORITHMS FOR EXPANDER GRAPHS**
Vlad Burca '14

46. **SYM A DYNAMIC APPROACH TO THE 0-1 KNAPSACK PROBLEM USING THE DISCRETE SHUFFLED FROG LEAPING ALGORITHM**
Rahul Chandrashekhar '17

47. **SYMMETRIC TRIDIAGONAL EIGENVALUE PROBLEM ON MULTI-GPU SYSTEMS**
Hyunsu Cho '15

48. **NOTEWORKS – TAKE NOTES BETTER**
Liam Doran '14

49. **USING DECISION TREES WITH FINANCIAL MOMENTUM TO CLASSIFY COMPANIES' FUTURE GROWTHS**
Zach Freedman '14

50. **GROUP STEINER PROBLEM ON THE GPU USING CUDA IMPLEMENTATION**
Basileal Imana '17, Suhas Maringanti '17

51. **MUSICIAN'S TOOLBOX**
Christina Lipson '14

Poster #	Title

52.   **SOCIALMINIMAP**
Nathaniel Maynard '14

53.   **NULI XUEXI: A MOBILE PHONE APPLICATION FOR STUDYING CHINESE**
Tanya D. Nongera '14

54.   **WHATSON: A MOVIE RECOMMENDATION SYSTEM FOR MOVIES ON REDBOX AND IN THEATRES**
Jamie Recas '14

55.   **A CALENDAR WEBSITE FOR ROWERS TO TRACK PROGRESS**
Lauren Yianilos '14

ENGINEERING

56.   **SUTURE GRASPER FOR LAPORASCOPIC PORT SITE CLOSURE**
Meredith Apfelbaum '14, Shea Kusiak '14, Mark Yanagisawa '14

57.   **APPLICATION OF HIGH-LIFT WINGS FOR R/C MODEL AIRCRAFT**
Sydney Doolittle '17, Tristan Peirce '17, Catherine Poirier '17, Phillip Winser '17

58.   **EARTHQUAKE SIMULATOR DESIGN AND SEISMIC ISOLATION TESTING**
Marco R. Eberth '14

59.   **ROBOBOAT**
John Fasano '14, Bach Nguyen '14, Alexa Pujol '14, Jonathan Rothendler '14, Arbaaz Tanveer '14

60.   **ROTATIONAL FIXTURE DESIGN FOR FRONT FUSELAGE OF THE F4U-4 CORSAIR AIRCRAFT**
Elizabeth Gerber '14, Renzo Hidalgo '14, Lucas Knight '14

61.   **DIGITAL IMAGE PROCESSING FOR DIAGNOSTICS OF MIDDLE EAR INFLAMMATION**
Jessica L'Heureux '14, Georgia McAdams '14, Joanna Wycech '14

62.   **DESIGN OF DATA COMPRESSION EMBEDDED SYSTEM USING DISCRETE-WAVELET TRANSFORM (DWT)**
Jin Feng Liu '14

63.   **DYNAMIC STRESS REDUCTION SYSTEM**
Junius Santoso '14, Stacy Sodergren '14, Erik Quiñonez '14

Poster #	Title

64. **DEVELOPMENT OF AN ELECTROLARYNX CAPABLE OF SUPPORTING TONAL DISTINCTIONS IN MANDARIN**
Bicky Shakya '14, Vishal Bharam '14, Alexander Merchen '14

65. **A ROUTING PROTOCOL DESIGN AND IMPLEMENTATION FOR VEHICULAR AD-HOC NETWORKS (VANETS)**
Hokchhay Tann '14, Peter Burrows '14

ENVIRONMENTAL SCIENCE

66. **MEASURING VEGETATION GROUND COVER: VISUAL ESTIMATES VERSUS ANLAYSIS OF DIGITAL IMAGERY**
Jacob Ammon '17

67. **THE EFFECT OF CLEAR CUTTING ON SUB-ALPINE FOREST SOIL NUTRIENT CONCENTRATIONS OF ALUMINIUM AND CALCIUM WITHIN THE WHITE MOUNTAIN NATIONAL FOREST, NEW HAMPSHIRE**
Justin Beslity '15, Lauren Tierney '16, Jack Agosta '17

68. **ANALYSIS OF MAGNETIC SEDIMENTS AT OTSEGO LAKE, NY**
Matt D'Andrea '17, Hadley Merrill '17, Celeste Popitz '17, TJ Sherman '17

69. **SOIL CARBON GRADIENTS AT KNOX PRESERVE, MYSTIC, CONNECTICUT**
Jordan Fisk '17, Tracy Keza '17

70. **SOIL SALINITY GRADIENTS AT KNOX PRESERVE, MYSTIC, CONNECTICUT**
Kate Furgueson '15

71. **ASSESSING TRACE METAL CONCENTRATIONS UNDER BRIDGES IN THE PARK RIVER WATERSHED, CT**
Linnea Gotberg '14, Bridget Kitchen '15, Simona Fried '16

72. **THE EFFECT OF CLEAR CUTTING ON SUB-ALPINE FOREST SOIL MERCURY (Hg) AND ORGANIC MATERIAL WITHIN THE WHITE MOUNTAIN NATIONAL FOREST, NEW HAMPSHIRE**
Daniel Hong '15, Lupita Barajas '17

73. **ANALYSIS OF GROUND TEMPERATURE DATA ON THE TRINITY COLLEGE CAMPUS**
Lia Howard '15

HEALTH FELLOWS

Poster #	Title

84. **AN OVERVIEW OF THE SYNTHESIS OF ORGANIC NANOCARS AS ORIGINALLY DESCRIBED BY SHIRAI et al.**
Ryan Geelan '15

85. **AN INVESTIGATION OF THE RELATIONSHIP BETWEEN ANTIBIOTIC RESISTANT GRAM-NEGATIVE BACTERIA AND PATIENT RISK FACTORS AT CONNECTICUT CHILDREN'S MEDICAL CENTER (CCMC)**
Sara Khalil '15

86. **QUALITY IMPROVEMENT PLAN FOR INFLUENZA VACCINE ADMINISTERED TO HUMAN IMMUNODEFICIENCY VIRUS (HIV) PATIENTS**
Lorena Lazo de la Vega '14

87. **LOADING PEPTIDES INTO *DICTYOSTELIUM DISCOIDEUM* USING PINOCYTOSIS, ELECTROPORATION, MYRISTOYLATION, AND CELL PENETRATING PEPTIDES**
Lorena Lazo de la Vega '14

88. **CORRELATING BODY MASS INDEX WITH FACTORS DESCRIBING CHRONIC PAIN IN THE PEDIATRIC POPULATION AT THE CCMC CHRONIC PAIN CLINIC**
Taylor Murtaugh '14

89. **SYNTHESIS OF DIBARRELANE: THE THREE MAJOR SYNTHETIC STEPS**
Taylor Murtaugh '14

90. **IMPLEMENTATION OF ELECTRONIC HEALTH RECORDS' AFFECT ON PEDIATRIC RESIDENTS' LEARNING EXPERIENCE**
Selena Patel '15

91. **EPIDEMIOLOGY OF PEDIATRIC AND ADOLESCENT CONCUSSION IN AN OUTPATIENT YOUTH SPORTS MEDICINE CLINIC**
Nick Pettinelli '15

92. **CONNECTICUT TEEN MOTOR VEHICLE FATALITIES AND GRADUATED DRIVER LICENSING LAW NONCOMPLIANCE**
William Schreiber-Stainthorp '15

93. **PARENTAL OPINION ABOUT PEDIATRIC BIOSPECIMEN PERMISSION**
Julia M. Vresilovic '14

Poster #	Title

MATHEMATICS

94. **PRE-STORM ESTIMATION OF POWER OUTAGES USING STATISTICAL MODELS**
Pranav Bhandari '17, Subekshya Bidari '17

NEUROSCIENCE

95. **THE EFFECTS OF ALCOHOL CONSUMPTION ON PROSPECTIVE MEMORY IN COLLEGE STUDENTS**
Sharmy Dhaliwal '16

96. **SEX-DEPENDENT EFFECTS OF THE KETOGENIC DIET IN THE EL MOUSE MODEL OF AUTISM AND EPILEPSY**
Jessica Fortin '14

97. **OBJECTIVE CLASSIFICATIONS OF THE DRINKING BEHAVIOR OF COLLEGE AGED STUDENTS**
Sarah Isaac '14

98. **PROSPECTIVE MEMORY IN INDIVIDUALS WITH TRAUMATIC BRAIN INJURY AND HEALTHY ADULTS**
Navneet Kaur '12, Consuelo Pedro '15, Erin Aisenberg '16, Tessa Bloomquist '16

99. **THE MEMORY FOR INTENTIONS SCREENING TEST**
Constance Ky '17, Rey Llena '15, Jennifer Reavis '17

100. **ANALYZING THE EFFECTS OF WILD-TYPE GLIAL CONDITIONED MEDIA MOLECULAR WEIGHTS ON SH-SY5Y CELLS**
Francesca Marino '16

101. **ANALYZING THE POLY-(I:C) MOUSE MODEL OF AUTISM**
Michelle Murphy '14

102. **THE EFFICACY OF VARIOUS WELL PLATE COATINGS IN CULTURING, TREATING, AND STAINING HUMAN NEUROBLASTOMA CELLS**
Sheila Njau '17, Thomas Naragon '17

103. **PURINE DETERMINATION BY HPLC**
Jake Rubin '15, Amina Kureshi '16

Poster #	Title

104. THE EFFECTS OF EVEN- AND ODD-NUMBERED MEDIUM CHAIN
TRIGLYCERIDE KETOGENIC DIETS ON AUTISTIC BEHAVIORS IN A
MOUSE MODEL
Lisa Saa '14

PHYSICS

105. THE RADIO SKY
Chris Buesser '14

106. VERY LOW FREQUENCY RADIO ASTRONOMY
Derek DeCagna '14

107. SOLAR ENERGY DIFFUSION AND EFFECTS ON CLIMATE CHANGE
Bobby Tella '17

PSYCHOLOGY

108. LEARN 2 LEARN: A METACOGNITIVE INTERVENTION
Taylor Godfrey '14, Melva Lopez '14

109. THE CULTURAL CHANGE IN COLLEGE STUDENT LANGUAGE
Louise Balsmeyer '14, Taylor Godfrey '14, Connor Proctor '14, Annie Scalambrino '14

110. SECOND AND FIFTH GRADE CHILDREN'S ATTITUDES TOWARDS AUTISM
SPECTRUM DISORDERS (ASD)
Louise Balsmeyer '14

111. THE EFFECTS OF EXERCISE ON STATE AND TRAIT ANXIETY
Lauren Blau '14

112. COLLEGE STUDENTS' PERCEIVED RISKS OF ECSTASY USE AND THE
STATE OF ECSTASY PREVENTION
Maria Young '14

113. THE EFFECT OF PARENT RELATIONSHIPS ON INIMATE RELATIONSHIPS
IN COLLEGE STUDENTS
Midge Daniel '14, Maria Young '14, Polly Maroni '15, Melody Fulton '15,
Ashley Ravesloot '15

114. THE CONTENT AND MALLEABILITY OF COLLEGE STUDENTS'
PERCEPTIONS OF NON-PRESCRIPTION STIMULANT USE
Henry Eff '14

Poster #	Title

115. **ROMANTIC RELATIONSHIPS AND CULTURAL IDENTITY**
Moe Khine '15, Daniel Luke '14, Malcolm Williams '14

116. **MINDFULNESS AND ITS ABILITY TO ALLEVIATE STATE AND TRAIT ANXIETY IN COLLEGE STUDENTS**
Kaity Mascioli '14

117. **PSYCHOLOGICAL AND DEMOGRAPHIC PREDICTORS OF NON-PRESCRIPTION STIMULANT EXPECTANCIES AND MISUSE IN COLLEGE STUDENTS**
Constance Minot '14

118. **DO STATISTICS COURSES AFFECT CRITICAL THINKING ABILITY AND USE OF HEURISTICS AND BIASES?**
Mitchell Mirtil '14

119. **EFFECT OF GENDER AND TYPE OF GAMING ON AGGRESSIVE AND PROSOCIAL BEHAVIOR**
Valerie Scelsa '14, Nikita Singhal '14

120. **BICULTURALISM AND PSYCHOLOGICAL ADJUSTMENT IN COLLEGE STUDENTS**
Nikita Singhal '14, Valerie Scelsa '14, Sara Bess '14

121. **GENDER DIFFERENCES AMONG COLLEGE STUDENTS WITH RESPECT TO WORK-PARENTING BALANCE**
Sara Bess '14

122. **AN EXPLORATORY STUDY OF COLLEGE STUDENTS' ATTITUDES ABOUT ECSTASY**
Rachel Reingold '14

123. **GENDER ROLES AND CAREGIVING PRACTICES IN TRINITY COLLEGE FACULTY**
Berkley Singer '15, Rachel Reingold '14, Nikita Wadhwa '15, Alexis Deschenes '15

124. **CULTURAL VARIATIONS IN DISTRESS TOLERANCE: INFLUENCE ON SEEKING SOCIAL SUPPORT**
Melissa Sital '14

125. **REDUCING PROACTIVE INTERFERENCE THROUGH A SEREIES OF DISTRACTOR TASKS**
Jeffrey Smullen '14

Poster #	Title

137. **HOW MUCH IS TOO MUCH: AN IN-DEPTH STUDY OF THE RELATIONSHIP BETWEEN ALCOHOL CONSUMPTION AND ACADEMIC PERFORMANCE.**
Al Nejmeh '17

138. **MINIMUM WAGE: A CASE OF CLASS INTEREST**
Michael G. Newkirk '14

139. **PAYING COLLEGE ATHLETES: THE ANSWER IS BLACK AND WHITE…**
Kyle Pulek '16

140. **INTERSECTIONAL RELATIONSHIP OF BREASTFEEDING OUTCOMES AND SOCIOECONOMIC CLASS**
Olivia Reny '16

141. **EDUCATIONAL DISPARITIES: DOES RACE INFLUENCE A SUDENT'S CHANCE OF GRADUATING FROM COLLEGE?**
Malaine Thorpe '15

142. **MEDIA'S INFLUENCE ON RELATIONSHIP SATISFACTION**
Tessa van der Meer '16

BIOLOGY

1.

THE EFFECT OF SALINITY AND LIGHT INTENSITY ON GREEN ALGA
***MONORAPHIDIUM ARCUATUM* (CHLOROPHYTA, SPHAEROPLEALES)**
Sadichhya Adhikari '14, Jessica Smith '14
Faculty Sponsor: Craig Schneider

The population growth of unicellular algae can be attributed to many factors, including light intensity and salinity. Salinity is important because many physiological processes involve the use of sodium, and photosynthesis requires light. Changes in these factors can lead to a change in the growth rate of unicells. Using *Monoraphidiumarcuatum*, a freshwater green alga isolated from Lower Bolton Lake and cultured in Bold's Basal medium, we conducted a 5 da experiment in triplicate, with varying concentrations of NaCl to test salinity tolerance and window screening to test light shading tolerance. Our solutions were tested using a fluorometer for relative chlorophyll a levels. For analysis, the trials were averaged and standard deviations found. *Monoraphidiumarcuatum* grew better overall in the reduced light grouping and the zero salinity treatment was statistically higher on the last three days. In the full (high) light grouping, all the treatments were grouped together, however none of the salinity treatments grew as well as the control. Our results demonstrate that increased salinity does affect the growth of an isolate of this freshwater species negatively with reduced sunlight, and in particular, that in high light, no salinity condition was optimal.

2.

RAPTORS ON THE EAST COAST: A SHIFT IN THE TIMING OF AUTUMN MIGRATION
Jason Baird '14
Faculty Sponsor: Joan Morrison

My research aims to test whether or not raptors on the east coast are shifting the timing of their autumn migration. I analyzed 38 years of passage data at three count sites across New England: Hawk Mountain, Quaker Ridge, and Lighthouse Point. We studied four raptors with diverse natural history traits: Buteo jamaicensis (Red-tailed Hawk), Buteo platypterus (Broad-winged Hawk), Accipiter striatus (Sharp-shinned Hawk), and Circus cyaneus (Northern Harrier). I also investigated possible factors associated with any documented shift, including climate, distance of migration, diet, and population trend. I predicted that species in decline would show little or no shift in timing; species unable to adjust to climate change are likely at a disadvantage. Long-distance migrants should delay their migration and short-distance migrants should advance their migration, as seen in numerous other taxa in America and raptors in Europe. I also predicted that raptors that feed primarily on birds will advance their migration. Finally, species advancing their migration should advance it further in warm years, while species delaying their migration should delay it further in warm years. The Red-tailed Hawk and Northern Harrier have delayed their autumn migrations, while the Sharp-shinned Hawk has advanced and the Broad-winged Hawk has not shifted its phenology. Some of these results match our predictions based on the raptors' life history traits, but some do not, suggesting that American raptors are responding to climate change differently than European raptors. The Broad-winged Hawk is the only raptor among the four that is not shifting and the only raptor among the four that is currently declining in

population; it may be more "hard-wired" to migrate at a certain date every year, and that inability to shift may cause it to decline in the coming years.

3.

THE EFFECTS OF PREDATION RISK AND THERMOREGULATION COST ON THE FORAGING BEHAVIOR OF THE EASTERN GRAY SQUIRREL (*SCIURUS CAROLINENSIS*)
Anne E. Collier '14
Faculty Sponsor: Michael O'Donnell

In this study, the effects of predation risk and thermoregulation cost on the foraging behavior of the urban eastern gray squirrel were examined. There were two objectives in this study. The first was to determine if either thermoregulation cost or predation risk had a more significant effect on foraging behavior. The second was to find out if foliar cover or distance to refuge was a more important cue of predation risk. To accomplish these goals, giving-up density and temperature data were collected at feeding trays both under the canopy and outside of the canopy at two deciduous trees and two evergreen trees. It was found that there was no difference in temperature between areas under canopy cover and areas in the open, and therefore, thermoregulation costs did not affect foraging in terms of giving-up density. Also, giving-up density was always lower under the canopy than in the open no matter how much foliar cover was available. This indicated that distance to refuge is a more important cue of predation risk than canopy cover. Therefore, the affect of microhabitat on foraging behavior should be taken into account when considering urban wildlife management and conservation.

4.

DEVELOPMENT OF SERRATE GENE CONSTRUCTS FROM SYNTHESIZED SEQUENCE FOR THE ACTIVATION AND INHIBITION OF THE NOTCH PATHWAY
James Curlin '15
Faculty Sponsor: Robert J. Fleming

The Notch signaling system is an important developmental pathway responsible for key developmental changes that take place in a wide variety of organisms, including humans and fruit flies. In *Drosophila melanogaster*, the Notch pathway is controlled by two different ligands. Known as Delta and Serrate, these molecules act to inhibit or activate the Notch receptor, depending on their relative locations to the Notch receptor. Serrate activates Notch when located on adjacent cells, but inhibits Notch when located within the same cellular membrane. Serrate has 14 EGF-like repeats in its extracellular domain, each of which has a unique amino acid sequence. Inhibition of Notch appears to be controlled by EGF-like repeats 4, 5 and 6. Removal of these repeats results in a lack of inhibition with no affect on Notch activation. Interestingly, when these three repeats were relocated to a position after repeat 12, this form of Serrate resulted in a retention of activation ability, but a loss of inhibitory capabilities. This suggests that the position of repeats 4-6 relative to the N-terminal regions responsible for Notch activation may be critical. Construction of a new Serrate construct is currently ongoing, and will attempt to relocate EGF-like repeats only a single repeat over, right after repeat 7. Whether or not this new construct will be able to inhibit Notch will provide help determine the role of location in inhibition.
5.

THE EFFECTS OF VARYING CAFFEINE CONCENTRATIONS ON THE BIOMASS OF THE GREEN ALGAE *SPHAEROCYSTIS SCHROETERI* (CHLOROPHYTA, SPAEROCYSTIDACEAE)
James Fifer '14, Walter Jongbloed '16
Faculty Sponsor: Craig W. Schneider

Caffeine is an organic wastewater contaminant that has recently been observed in effluent of water treatment facilities. Caffeine is likely to stay in the water column for an extended time because of its high solubility. Because this chemical is not found in these environments naturally, small concentrations may have an effect on cell maintenance and growth. Caffeine has been found in a variety of different concentrations near water treatment facilities in the United States with some reporting up to 42 µg/L and others reporting lower than 10 µg/L. Caffeine has been associated with algal blooms, but also with a decrease in algal biomass leading to speculation of its toxicity. In order to test the effects of caffeine on algal growth, we exposed varying concentrations to a common freshwater alga, *Sphaerocystis schroeteri*, isolated in culture from Lower Bolton Lake in Tolland County, Connecticut. The alga was grown in 20 ml of Bold's Basal medium with caffeine concentrations of 0 mg/L, 5 mg/L, 25 mg/L, 50 mg/L, 100 mg/L, 150 mg/L & 500 mg/L and stored for seven days at 15°C in 16L/8D conditions. Using a fluorometer, fluorescence units (chlorophyll a) were measured at day 0, 1, 3, 6, 7, 8, and 9. Results will be reported.

6.
INVESTIGATION OF THE NORMAL FLORA AND THE PREVALENCE OF ALPHA-HEMOLYTIC STREPTOCOCCI IN THE UPPER RESPIRATORY TRACT OF ASTHMATIC AND NON-ASTHMATIC CHILDREN
Catherine Guariglia '14
Faculty Sponsors: Lisa-Anne Foster, Connecticut Children's Medical Center

Asthma is a chronic inflammatory disease that affects almost 20 million adults and 8 million children in the United States. This disease can be very serious and debilitating and currently has no cure. This study was aimed at investigating the relationship between asthma and the normal microbial communities present in the upper respiratory tract of children. The normal flora of the human body has been found to play an important in protection against diseases and in the modulation of inflammation. Specifically, alpha-hemolytic streptococci have been show to protect host mucosal membranes as these species compete with other organisms in their environment. An allergic condition, such as asthma, can be seen as a disturbance to the normal flora that is found in the upper respiratory tract. Therefore, it was hypothesized that there would be a less abundant and less diverse microbial population in the upper respiratory tract of asthmatic children. It was also suggested that there would be a lower prevalence of alpha-hemolytic streptococcus species.

To investigate the hypotheses, throat swab samples were collected from asthmatic and non-asthmatic children at Connecticut Children's Medical Center. Terminal restriction fragment polymorphism (tRFLP) was used to analyze the abundance and diversity of 18 samples from asthmatic children and 10 samples from non-asthmatic samples. A combination of tRFLP analysis as well as a virtual digestion process was used to investigate the prevalence of alpha-

hemolytic streptococci in the samples. The analysis led to insignificant p-values. A larger sample size as well as deeper analysis is needed to further investigate this problem.

7.
EFFECTS OF ANIMAL-BASED FOOD WASTE IN COMPOST PILES: ANNUAL TRENDS IN WILDLIFE VISITATION
Ben Jaffee '15, Riley Risteen '17
Faculty Sponsor: Scott R. Smedley

Household composting is an increasingly popular practice, promoting sustainability by recycling organic waste. However, animal-based food waste has typically not been composted, as it has been claimed that including animal-based food waste would increase scavenger visitation to the compost pile, however this claim has never tested experimentally. We sought do so by setting up three compost treatments: a control pile, a typical compost pile with plant-based food waste, and an experimental compost pile with plant and animal-based food waste. The experiment was carried out in Andover, Connecticut, during 2013. Heat-in-motion camera traps were used to monitor animal visitation to the piles. We examined how animal visitation differed among three piles, as well as how visitation differed during replicates in different seasons throughout a year: winter/spring (2 Feb-5 May), summer (5 Jun-23 Aug), and fall (21 Sep-20 Dec). For each replicate, we found a significant difference overall in pile visitation, with the most visitation at the mixed pile. Also, we found different animals occurring in different rates throughout the year, with coyotes the most frequent visitors in winter/spring, opossums the most frequent in summer, and opossums and squirrels the most frequent in fall. Based on 2013, the highest frequency of visitation occurred in fall, followed by summer, then winter/spring. Thus, the addition of animal-based food waste did attract scavengers at a higher frequency, and the frequency and identity of the visitors varied throughout the year. This study has led to a greater understanding of the effects of adding animal-based food waste to compost, as well as how scavenger ecology varies throughout the seasons.

8.
ULTRASTRUCTURE AND CHEMICAL COMPOSITION OF CORN SNAKE EGGSHELLS
Glory Kim '17, Kathryn Powers '17, Cionna Rosenthal '17
Faculty Sponsors: Daniel G. Blackburn, Ms. Yunming Hu

Corn snakes are oviparous and lecithotrophic species; they lay eggs and use a yolk sac to provide nutrients to their developing offspring. Corn snakes serve as valuable models for studies that track the development of embryos with scanning electron microscopy (SEM). SEM relies on the use of secondary electrons, scanning the surface of a sample by releasing electrons, causing them to scatter upon impact with the surface of the sample. These electrons are then collected by the machine and used to produce detailed, three dimensional images of the sample's surface and composition. Energy-dispersive X-ray spectroscopy (EDS) is another feature of SEM. In our preliminary studies, we have utilized this feature in order to obtain graphs depicting the elemental characteristics of calcium levels and distribution in corn snake eggshells. We have

discovered differences in the amount of calcium from the outer and inner regions. These disparities raise questions about how calcium is provided to the developing embryo. Eggshell studies contribute to an understanding of the evolutionary history of reptiles as they help reveal the specializations in viviparous species and ancestral patterns from which viviparity has evolved (Blackburn, Johnson, and Petzold, 2003).

9.
THE ECOLOGY OF FEAR: DOES THE POTENTIAL OF PREDATION AFFECT SQUIRREL CACHING BEHAVIOR?
Heidi Pi '14
Faculty Sponsor: Scott Smedley

Residential composting is becoming more popular as a method of disposing food waste. A long-held view associated with composting is that the addition of animal-based kitchen scraps will increase scavenger visitation. However, this has never been tested experimentally. Beginning in 2008, a compost experiment has been conducted to observe the effects that composting may have on scavenger ecology. Three compost pile treatments were used: control (no food scraps), vegetable (vegetable-based scraps), and mix (vegetable and animal-based scraps). Analysis of data from the initial year showed an increase in visitation during autumn at the control pile. This increase contradicts the typical observed pattern of greatest visitation at the mix pile, followed by the vegetable pile, and with the control pile encountering the least number of scavengers. Further investigation showed an increase in squirrel activity at the control pile during the fall. This raises the question of the ecology of fear possibly playing a role in scavenger visitation. The ecology of fear involves the indirect effects that predators may have on prey, resulting in behavioral changes. These non-lethal effects on prey may in turn have large-scale effects on ecosystems. Many of the scavengers encountered in the compost experiment are potential squirrel predators, including canids that frequently scent mark (urinate) on piles. We hypothesized that squirrels may avoid piles based on predator scent, and prefer to cache nuts in the pile with the least predator visitation (the control pile). Analysis of five years of data suggested that squirrel activity peaks in the fall, specifically at the control pile. To investigate potential effects of the ecology of fear further, experimental testing of the influence of heterospecific urine on squirrel caching behavior will be conducted.

10.
ANALYSIS OF INVERTEBRATE VISITATION TO COMPOST PILES WITH VARIED CONTENTS THROUGH TULLGREN FUNNEL SAMPLING
Bridget Tevnan '15
Faculty Sponsor: Scott Smedley

Composting is a common, environmentally sustainable method of organic waste disposal. Many composters add only vegetable-based scraps to their piles, believing that adding animal-based scraps will increase wildlife visitation. Surprisingly, no experimental data exist to examine this claim. Beginning in February 2008 in Andover, Connecticut, seasonal replicates have been conducted in which three types of compost piles (vegetable products only – VEG, vegetable and

animal product mix – MIX, and control – CON) have been monitored using heat-motion sensitive cameras to record wildlife visitors. Compost piles also offer resources and habitat to invertebrates. Subsequently, an invertebrate survey was conducted during the summer of 2009. Every ten days, samples were collected from the straw and leaf mulch substrates of the three piles. Tullgren funnels were used to extract and preserve the specimens. Specimens were sorted, often to the order level, and their frequency among pile substrates was analyzed using chi-square (goodness-of-fit) tests. Sixteen invertebrate taxa were identified, twelve of which had sufficient sample sizes ($n \geq 5$) for statistical analysis. Preference for pile type (VEG, MIX, or CON) within the two substrate types varied among taxa. Seven taxa, including adult ant, beetle, diptera, earthworm, larva, potworm, and rove beetle, showed a significant preference in both the leaf mulch and straw substrates. One taxon, millipede, showed a significant pile type preference in the mulch substrate, while one taxon, pseudoscorpion, showed a significant pile type preference in the straw substrate. Three taxa, feather-winged beetle, isopod, and spider, showed no pile type preference in either substrate. We speculate that invertebrates may preferentially inhabit pile types and substrates due to scavenging habits and predation-prey relations. Pile location and microclimate may also influence visitation. Identification of beetles (order Coleoptera), to the family and species level will be conducted to further examine how pile content influences that community.

11.
THE EFFECTS OF CAFFEINE ON THE FRESHWATER DIATOM TABELLARIA FLOCCULOSA (TABELLARIACEAE, FRAGILARIOPHYCEAE)
Nikolaus E. Schultz '14
Faculty Sponsor: Craig W. Schneider

The final effluents of sewage and water treatment facilities are known to contain pharmaceuticals not regulated by environmental protection agencies. Non-organic caffeine is one such compound and is designed to induce biological responses in humans at very low doses. Some aquatic biota are affected by the compound, yet at present very few studies have been performed to observe their effects on phytoplankton. An earlier experiment determined the minimum growth inhibitory concentration of caffeine began at 30 ppm for a coral's symbiotic dinoflagellate. Few, if any algal growth studies have been performed using freshwater species, species native to where water treatment facilities are stationed. In this study, the effects of varying levels of caffeine were investigated on the freshwater diatom, *Tabellaria flocculosa*. A unialgal culture isolated from Clough Brook, Tolland, Connecticut was grown using Bold's basal medium at 20°C and was used for experimentation. *T. flocculosa* was subjected to five different caffeine treatments (10, 30, 50, 100 and 200 ppm) in triplicate cultures and incubated at 20°C with a 16:8 L:D cycle. Growth within each treatment was measured through chlorophyll a absorbance every 24 hours, for 7 days. At the end of the experiment all cultures with caffeine treatment resulted in cell death.

12.

A MORPHOLOGICAL AND MOLECULAR STUDY OF THE GENUS *LOBOPHORA* (DICTYOTALES, PHAEOPHYCEAE) IN THE WESTERN ATLANTIC, INCLUDING A CLARIFICATION OF *L. VARIEGATA* (J.V. Lamour.) EX E.C. Oliveira

Nikolaus E. Schultz '14, Dylan S. Spagnuolo '17, Phong K. Quach '17
Faculty Sponsors: Craig W. Schneider, Christopher E. Lane (Department of Biological Sciences, University of Rhode Island), Line Le Gall Florence Rousseau (Institut de Systematique, Evolution, Biodiversite, Museum National d'Histoire Naturelle), Bruno de Reviers ((Institut de Systematique, Evolution, Biodiversite, Museum National d'Histoire Naturelle)

In the western Atlantic Ocean, the brown algal genus *Lobophora* is currently represented by a single species, *L. variegata,* with a type locality given by Lamouroux as 'Antilles.' In this study, we use molecular-assisted alpha taxonomy (MAAT) to assess species diversity of *Lobophora* in Bermuda, the Florida Keys and Guadeloupe (Lesser Antilles). Using COI-5P sequences as a genetic marker, at least four genetic species of *Lobophora* have been identified from these areas, all being identified in the past as forms of *L. variegata*. Our morphological and habitat studies have revealed unique characters for each of these genetic species, including cellular arrangements, as well as different depth ranges for some species. Finally, we have been able to utilize Lamouroux's holotype of *Dictyota variegata* to reassess a detailed anatomy for this species and align this early taxon to one of our genetic species from the western Atlantic.

13.
THE EFFECT ON THE NORMAL FLORA OF THE UPPER RESPIRATORY OF CHILDREN IN CERTAIN AGE GROUPS WITH ASTHMA

Abigail Whalen, '15, Catherine Guariglia '14
Faculty Sponsor: Lisa-Anne Foster

Normal flora is the diverse microbiota that inhabits the human body: it can be found across mucosal membranes and the skin. Normal flora is quite important to the human body because it acts as a protectant to external pathogens. It forms layers across mucosal membranes, creating protection so that incoming pathogens cannot pass into the epithelial cell layers. The normal flora also has seen to play a role in the modulation of inflammation, where a relationship forms in which the greater diversity and abundance of the normal flora causes less inflammation. It is interesting to study the normal flora of the upper respiratory tract because it is often the first site where inhaled external pathogens come in contact with the body.

Asthma is a chronic inflammatory disease that affects the upper respiratory tract significantly. Asthma causes inflammation and restriction of the bronchial tubes, which causes shortness of breath, wheezing, and chest tightness. Asthma affects people of all ages, but most often begins in early childhood and is also quite prevalent in urban areas.

This study was conducted to see if there were any differences in the normal flora of the upper respiratory tract in children with asthma compared to healthy children. Throat swabs were collected at Connecticut Children's Medical Center in Hartford, Connecticut. Eighteen asthmatic and nine non-asthmatic patients, ages 5 to 17, were interviewed and a physician collected a throat swab sample. The samples were analyzed using 16s rRNA gene amplification, digested with restriction enzymes (HaeIII and MnlI) and separated by capillary electrophoresis. tRFLP

chromatographs were analyzed to determine the abundance and diversity of the microbes in the samples.

Analysis of the data suggests that children with asthma have significant changes to the normal flora of the upper respiratory tract when diagnosed with severe persistent asthma in the later age group of 11 to 17 years of age.

14.
THE ANNOTATION OF MYCOBACTERIOPHAGES FUNSTON AND WHABIGAIL7
Sara Bunker '17, Elizabeth Craig '17, Sasha DiNitto '17, Haley Rafferty '17
Faculty Sponsor: Kathleen Archer

We annotated mycobacteriophages Funston and Whabigail7 to determine gene location and function. This information adds to the current database for SEA-Phages, and can be utilized for future research on *Mycobacterium tuberculosis.* We used DNA Master to facilitate the annotation. Phamerator, HHpred, Aragorn, NCBI, and DNA Master Blasts provided more detailed information about gene functions as compared to other A cluster phages. Approximately half of each genome was composed of reverse genes, similar to other annotated A cluster phages. It was interesting how similar these A cluster phages matched with other phages in their respective subclusters.

15.
EXPLORING THE FUNCTIONS OF A CLUSTER C1 BACTERIOPHAGE
Melindy Dorcin '17, Laura Nee '17, Luke Maynard '17
Faculty Sponsor: Kathleen Archer

Although numerous unique phage genomes have been sequenced, little is known about the relationship between the mycobacteriophages in each cluster or about the proteins coded for by their DNA. The goals of this research endeavor were to isolate genes exclusive to cluster C1 phages, to determine functions for C1 phage Tortoise16 gene products that had not yet been identified, and to test the theory that "sets" of genes close to each other on a genome may code for complementary proteins that contribute to a larger function. Potential exclusive C1 genes were located via comparison of Phamerator genome maps of numerous phages, and verified using protein BLAST software to ensure exclusivity. Unknown gene functions were determined by cross-referencing amino acid sequence analysis results returned from several open-source bioinformatics programs. We found two possible candidates for exclusive C1 phage genes and determined functions for three Tortoise16 gene products, two of which exist in a 'set', having related functions and located within close proximity of each other on the genome. A more comprehensive collection of known gene functions helps to better our understanding of C1 mycobacteriophages and the biological mechanisms through which they interact with their hosts and reproduce themselves.

16.
TIME OF DIVERGENCE

Maura Griffith '17, Glory Kim '17, Elliot Pollack '17
Faculty Sponsor: Kathleen Archer

The evolutionary history of cluster C phages has been unknown; however, such information can show how related different phages are to each other. The average relatedness score of fully annotated C phages, based on the alignment score of portal and major capsid proteins, was determined by using the program CLUSTALW. The C2 phage Myrna was most distantly related, with an average relatedness score of 79.375, the C1 phage Pio had the next lowest score of 88.958. All other phages were within the range of 93 - 98. From the relatedness of cluster C phages, we determined which phage was the most closely related to the recently discovered C1 phage Tortoise16. The result of our findings was that fellow C1 phage ArcherS7 is Tortoise16's closest relative. Sequence alignment and molecular analysis was then utilized to establish the evolutionary relationship between these two cluster C1 mycobacteriophages. The data from two unique mathematical tests suggested that Tortoise16 and ArcherS7 diverged relatively recently from a common ancestor approximately 1,741-4,258 years ago.

17.
PUTATIVE INTEIN IDENTIFICATION IN C1 MYCOBACTERIOPHAGE TORTOISE16

Peter Jung '17
Faculty Sponsor: Kathleen Archer

Protein splicing is a posttranslational process that involves the self-excision of an internal protein segment called an intein. Interest in the biotechnological implications of using inteins to selectively modify proteins has led to the discovery of over 500 unique inteins across all three domains of life. In this study, I searched for putative inteins and intein alleles within the C1 mycobacteriophage Tortoise16. Based on the high prevalence of previously identified inteins located in the genomes of C1 phage, Tortoise16 is a very likely candidate for an intein. Pre-spliced gene products in Tortoise16 were compared to their intein-containing homologues in other C1 phage, using the basic local alignment search tool (BLAST) of the National Center for Biotechnology Information protein database. Three putative intein-containing gene products were found in Tortoise16, but none of them exhibited close alignments with their known intein-containing homologues. Further analysis of the amino acid sequences for intein motifs proved inconclusive. Notably, all three of the putative intein-containing gene products had sequences less than 300 residues. Thus, if Tortoise16 does in fact contain an intein, it must be a "mini-intein" (no homing endonuclease domain).

18.

**THE RELATIONSHIP BETWEEN CODON BIAS IN CLUSTER C1
MYCOBACTERIOPHAGE AND VARIOUS *MYCOBACTERIUM* SPECIES**
Tom McNamara '17
Faculty Sponsor: Kathleen Archer

Codon bias, or the tendency of an organism or virus to use certain synonymous codon at higher frequencies than others, differs significantly between biological entities. Viruses are unique in that they frequently exhibit codon bias similar to that of their host, most likely due to the dependence of viruses on their hosts for DNA synthesis and translation. This property suggests that if a virus has a similar codon bias to another host, it may be possible for the virus to also infect this other host. In this study, I investigated whether there were any cluster C1 mycobacteriophage that violated the tendency towards the codon bias of their host, *Mycobacterium smegmatis*, and had codon bias more similar to another member of the genus *Mycobacterium*. The relative synonymous codon usage of several *Mycobacterium* species and twenty-five C1 phage was calculated and analyzed to determine if significant differences existed between the codon biases of *Mycobacterium smegmatis* and cluster C1 phage. The similarity in codon bias of C1 phage to other *Mycobacterium* species was also examined. For a few amino acids, such as serine, there was a sizable difference between the codon bias of C1 phage and *Mycobacterium smegmatis*. However, for the majority of amino acids, the results showed that the difference between the codon biases of *M. smegmatis* and C1 phage was not significant (P>0.05). It was also determined that the difference in codon bias between other *Mycobacterium* species and C1 phage was significant (P<0.05). The data collected does not allow us to conclude with confidence that it is possible for a C1 phage to infect a *Mycobacterial* species other than *M. smegmatis*.

19.
**STRUCTURAL AND FUNCTIONAL DIFFERENCES IN C-CLUSTER PHAGES WITH
CONTRACTILE TAILS**
Christopher Mulhern '17, Josh Knopf '17, Scott Buchanan '17
Faculty Sponsor: Kathleen Archer

C cluster phage are unique among bacteriophage because they have contractile tails. This distinction lead us to question whether their tails have structural elements unique from those that are common in other mycobacteriophage. To investigate, three different tail-associated proteins, lysozyme, tapemeasure, and D-ala D-ala Carboxypeptidase, were studied to find differences of their structure in C1 phages. Software programs used were: NCBI BLAST, Phamerator, HHPred, and PredictProtein. They enabled researchers to study the structure, locations, applications and origins of the three proteins, often comparing the results from C phages to non-C phages. There were no lysozyme domains found within the tape measure protein because the lysozyme protein was found to be a completely separate gene from the tape measure protein which is consistent with all other C-cluster phages but no other clusters. There were several significant structural differences between tape measure protein structure and sequence in C phages when compared to non-C phages shown by BLAST results and PredictProtein structures. Nucleotide sequences and the amino acid sequences of the D-ala D-ala Carboxypeptidase gene were determined and BLAST was used to compare against a database of other viral and bacterial genes. This yielded a

group of matches with high similarity to the gene in Tortoise 16. The BLAST results of the D-ala D-ala Carboxypeptidase gene yielded a group of matches with high similarity to the gene in Tortoise 16. These results were then analyzed to draw conclusions about the origin of the gene, as well as the application in phage. These results suggest that there are significant differences in tail-associated proteins in C cluster phages.

20.
SUBCLUSTER C1 MYCOBACTERIOPHAGES: DETECTING ADAPTIVE EVOLUTION BY EXAMINING AMINO ACID REPLACEMENT IN NRDC-ENCODING GENE AND A PHAMILY 565-ENCODING GENE
Kathy Rodogiannis '17
Faculty Sponsor: Kathleen Archer

Adaptive evolution in viral genomes was investigated. In the last half century there has been debate as to whether evolutionary changes at the molecular level are largely driven by natural selection or random genetic drift. The selection on the NrdC-encoding gene and a Phamily 565-encoding gene in three C1 cluster phages: Tortoise16, Bxz1, and ArcherS7 was explored. In order to search for evidence of mutations that alter the function of a protein, and thus affect the phenotype of the organism, the Yang and Swanson analytical method comparing the number of nonsynonymous base pair substitutions (dN) to the number of synonymous substitutions (dS) was implemented. Nonsynonymous base pair substitutions can be advantageous or deleterious to the organism, while synonymous substitutions (dS) often do not result in an altered phenotype in the organism and are assumed to be neutral. For the NrdC gene, there is no significant difference between the dN and dS (dN/dS=1.024, Z= 0.23, P=0.8181). For the gene that codes for a Phamily 565 protein, there is no significant difference between the dN and dS (dN/dS = 0.99, Z= -0.113, P=0.91). Adaptive evolution does not appear to be the mechanism driving the evolution of these genes. These results suggest that both the NrdC encoding gene and the structural-protein encoding gene undergo neutral selection, possibly indicating that the genes are conserved.

<u>CHEMISTRY</u>

21.
ALKYNYL β-SHEET PEPTIDOMIMETICS RETAIN THEIR ANTI-PARALLEL SHEET CONFORMATION WHEN CORDINATED TO TUNGSTEN
Adam N. Boynton '12, Shawna M. Berk '13, Elena-Marie C. Pedro '17
Faculty Sponsor: Timothy P. Curran

β-sheet proteins are widespread in the body, however the structural features that stabilize or destabilize a β-sheet are not yet fully understood. Aggregations of β-sheet proteins are possible causative agents in neurodegenerative diseases such as Alzheimer's disease. Therefore, understanding the stabilization or destabilization of β-sheet proteins might provide knowledge about these diseases. The research objective was to determine if peptide derivatives of 2-amino-2'-carboxydiphenylacetylene maintained their β-sheet conformation when the alkyne bond in the

diphenylacetylene was coordinated to the transition metal tungsten. Previous work by the co-authors Adam N. Boynton and Shawna M. Berk revealed that the peptide portions of the mono-alkyne complexes synthesized maintained their β-sheet conformation. Consequently, these compounds were re-synthesized to confirm their structure and purity. Following the re-synthesis of the compounds, the authenticity was determined through purification by flash chromatography, and then characterization by mass spectrometry and ^{1}H NMR spectroscopy. These results proved that the compounds previously studied by Adam N. Boynton and Shawna M. Berk were the proposed compounds. Future work will entail displacing a CO ligand from these monoalkyne complexes and replacing it with a ligand (for example an alkynylcarbohydrate) that would make the anti-parallel β-sheet soluble in aqueous solutions.

22.
CONSTRUCTING A SYSTEM FOR MICROCHIP ELECTROPHORESIS LASER-INDUCED FLUORESCENCE (LIF)
Eleanor Clerc '17
Faculty Sponsor: Michelle L. Kovarik

Microchip electrophoresis laser-induced fluorescence (LIF) is an effective method for the analysis of single cells. The microchip allows for precise fluid control, as well as a confined space in which to analyze small volume samples such as lysed single cells. Once the sample has been loaded into the microchip, electrophoresis is an efficient method to separate the contents of the cell. Electrophoresis uses voltages applied to the chip to separate the contents of the cell based on their charge and size. Since the sample volume is limited, a sensitive detection method, such as LIF is required to analyze the sample. In order to make the microchips, a master was made through photolithography with the design of the channels for the chip raised on its surface. Soft lithography was then used to create the microchip itself, which was made of polydimethylsiloxane (PDMS) cast against the master, siloxane reservoirs to hold the samples and buffers, and a glass coverslip bonded together using an oxygen plasma. In order to apply the desired voltages at the appropriate time intervals for electrophoretic separations, a LabView program was written to program the power supply to perform a single injection or multiple injections. Additionally, four high voltage leads were soldered to platinum wire electrodes for electrophoresis. The detector for the LIF, a photomultiplier tube, needed an adaptor plate in order to be attached to the microscope. This adaptor plate was designed using the SolidWorks software and sent to an off-campus machine shop to be fabricated. Ongoing work includes alignment of the detection optics necessary for LIF detection. The next step in this experiment will be to run chips using fluorescein standards to determine the limit of detection of this system. In the future, this newly-built system will be used to conduct enzymatic assays of lysed single cells containing a fluorescent reporter peptide.

23.

DISCOVERY OF A DIMERIC BY-PRODUCT IN THE PREPARATION OF A TUNGSTEN BIS-ALKYNYLPEPTIDE COMPLEX
Lauren Davidson '16
Faculty Sponsor: Timothy P. Curran

Forming tungsten bis-alkynylpeptide complexes involves attaching two alkynylpeptides to a tungsten center. In order to create a metallacyclicpeptide two alkynes in the same molecule are attached to the tungsten center. The alkyne component, in this work Boc-Phe-NHCH$_2$CCH, is reacted with the tungsten complex, W(CO)$_3$(dmtc)$_2$, under reflux. In order to analyze the products for purity, thin layer chromatography, flash chromatography, NMR spectroscopy, and mass spectrometry were utilized. In previous years, these reactions were conducted in refluxing methanol. However, reactions in methanol were yielding small amounts of the bis-alkyne product W(dmtc)$_2$(Boc-Phe-NHCH$_2$CCH)$_2$, or failing. This research originally sought to answer the question of whether tungsten bis-alkyne complexes could be better prepared in a solvent other than methanol, but methanol produced higher yields and purer product than toluene and chloroform. The reactions in methanol also produced an interesting and novel side product, a dipeptide (Boc-Phe-Phe-NHCH$_2$CCH) formed from condensation of two molecules of Boc-Phe-NHCH$_2$CCH. Formation of the dipeptide likely occurred as a result of an intramolecular reaction following the coordination of either one or two the Boc-Phe-NHCH$_2$CCH molecules. The production of this dipeptide could explain the low yields in synthesizing tungsten metallacyclicpeptides. The structure of the dipeptide was confirmed by NMR spectroscopy and mass spectrometry, and results have been replicated in multiple reactions with Boc-Phe-NHCH$_2$CCH. Reactions with other alkynes (Boc-Ala-NHCH$_2$CCH and Boc-Phe-Ala-NHCH$_2$CCH to date) have yielded neither the tungsten complex nor a dipeptide. Research is now directed toward probing the mechanism that creates the dipeptide, which might have applications in peptide synthesis, and whether different alkynylpeptides will form dipeptide by-products when coordinated to tungsten. In order to efficiently separate and analyze the products of the reactions, looking for evidence of dipeptide by-products, an LCMS assay will be developed.

24.
SYNTHESIS OF A PHOSPHONAMIDITE FOR FUTURE SOLID-PHASE OLIGONUCLEOTIDE SYNTHESIS
Florence Dou '16
Faculty Sponsor: Richard Prigodich

Organic and inorganic cations bind to the anionic phosphate groups of nucleotides, oligonucleotides and nucleic acids. In fact, an increase in metal cation concentration can induce the right-handed B-DNA helix to change conformation into a left-handed Z-DNA helix. This cation-DNA interaction can be studied by monitoring the ^{31}P NMR chemical shifts. However more detailed information can be obtained if at a single site on the oligonucleotide, the 3'-O of the ribose ring is changed to a methylene group. This will produce a distinct, unique signal in the ^{31}P NMR spectrum that can be used to monitor cation binding at that site in the oligonucleotide. In order to make this change, a phosphonamidite will be synthesized by a seven-step reaction sequence. The phosphonamidite can then be used in standard oligonucleotide solid-phase synthesis. In the first step, the 5'-hydroxyl group of thymidine was protected with tert-

butyldiphenylsilyl chloride. In the second step, the 3'-hydroxyl group was substituted by an iodine atom. The third step will be a Grignard reaction to displace the iodine atom with a vinyl group.

25.
THE DEVELOPMENT OF A SYNTHETIC ROUTE FOR A DI-SUBSITITUTED DIPHENYLACETYLENE AND ITS CONFORMATIONAL CHARACTERISTICS UPON COORDINATION TO TUNGSTEN: A PROSPECT FOR BETA-SHEET STUDIES
Francis Herman '14
Faculty Sponsor: Timothy P. Curran

The study β-sheet mimetics represents an important step in understanding the structural and function of β-sheets. The purpose of this report was to develop a β-sheet mimetic through a diphenylacetylene backbone, coordinate the complex to tungsten and determine the structural and conformational characteristics of the complex. In order to characterize the different compounds ESI-MS, ^{1}HNMR, COSY NMR, NOESY NMR, and ROESY NMR were employed. The diphenylacetylene backbone contained two phenyl substituents with a peptide chain of two amino acids. The β-sheet mimetic **1** was successfully synthesized utilizing peptide coupling reactions and a Sonagashira coupling reaction. Previous research by the Curran group has illustrated the ability of alkynylpeptides and dialkynylpeptides to be constrained to specific conformational arrangements upon coordination to tungsten. Compound **1** was successfully coordinated to tungsten and the conformational characteristics of the complex are currently under review. The thesis will detail the synthetic steps taken to create compound **1** and **15** and study the structural characteristics of the β-sheet mimetic.

26.
ANALYSIS OF SYNTHESIZING CAROLACTON
Hamilton Herr '14
Faculty Sponsor: Cheyenne Brindle

Dental caries, or tooth decay, is a bacterial infection that degrades the hard tissues of the teeth. Carolacton is a macrolide ketocarbonic acid that can reduce this biofilm formation. A synthesis of carolacton was reported by Michal S. Hallside, Richard S. Brzozowski, William M. Wuest, and Andrew J. Phillips. Some important reactions used are Steglich esterification, Leighton crotylation, and the enolization of an Evans β-ketoimide aldol. The following report analyzes the mechanisms behind these key reactions.

27.
TOTAL SYNTHESIS OF MICROTUBULE-STABILIZING AGENT CERATAMINE A

Woojung Ji '15
Faculty Sponsor: Cheyenne Brindle

The Organic Chemistry paper reported the total synthesis of ceratamine A, a natural microtubule-stabilizing agent with unusual cellular effects. In this paper, Ceratamine A was synthesized starting from 5-methoxybenzimidazole in 10 steps in an overall yield of 12.7 %. The key steps in the synthesis involved the Schmidt rearrangement to construct the azepine ring, the alkylation of lactam to introduce the C-5 benzylic side chain, and the highly economical S_NAr reaction to install the C-2 methylamine residue. The details of this work will be presented.

28.
PROBING RIDITY IN CYCLIC TUNGSTEN-FERROCENE DIALKYNYLAMIDE COMPLEXES
Woojung Ji '15
Faculty Sponsor: Timothy P. Curran

The goal of this research was to investigate the fluxionality of a cyclic tungsten-ferrocene dialkynylamide complex, and to discover whether there was any intramolecular hydrogen bonding between the amide NH on one chain and the amide C=O on the other chain. The cyclic tungsten-ferrocene dialkynylamide was prepared as followed. First, the ferrocene dialkynylamide was synthesized by reacting 1,1'-ferrocenedicarboxylic acid and 4-butyn-1-amine using 1-ethyl-3-(3-dimethylaminopropyl)carbodiimide (EDC coupling reagent); and second, structures of the ferrocene dialkynylamide and cyclic tungsten-ferrocene dialkynylamide complex were obtained using ^{1}H NMR spectroscopy and positive ion electrospray mass spectrometry. The terminal alkyne hydrogens in tungsten-bisalkyne complexes are observed around 11 ppm, making them an excellent diagnostic tool for examining fluxionality. The ^{1}H NMR spectrum of the complex showed multiple singlets for the two alkyne hydrogens. This indicated that the complex is flexible and exists as a complex mixture of conformational isomers that differ in the orientation of the ligands around the tungsten metal center. Then, the validity of intramolecular hydrogen bonding of the tungsten complex was examined by performing DMSO titration on the amide NH protons in the complex. The results from the DMSO titration showed that the NH protons were not involved in intramolecular hydrogen bonding. These results, coupled with other results from our laboratory, show that rigidity in tungsten-alkyne complexes is determined by the size of the ring.

29.
THE CONTINUED SYNTHESIS OF TRIARYLMETHYL CATIONS
Mazin Khalil '15
Faculty Sponsor: Cheyenne Brindle

This research is a continuation of the project that was done the previous semester to find an effective method to synthesize the precursors of the triarylmethyl cation and the cation itself, which is the end result of our research. The original starting reagent used was the 3-fluoro-2-bromotoluene because the methyl group provides steric hinderance about the aromatic central

carbon bond, while the fluorine group increases rotational barrier electronically. Throughout this semester, several different starting materials for reactions were used, such as the carboxylic acid compound that was synthesized by the reaction of 3-bromo-2-flourotoluene with THF and CO_2 gas, and the acyl chloride compound that was made from the resulting reaction using the carboxylic acid compound with oxalyl chloride in DCM and DMF. Various solvents were used including THF, and DCM. We were able to successfully synthesize the carboxylic acid compound and the acyl chloride compounding, with both being reaffirmed via comparison to literature values and ^{1}H NMR.

30.
THE TOTAL SYNTHESIS OF BREVISAMIDE
Mazin Khalil '15
Faculty Sponsor: Cheyenne Brindle

Olugbeminiyi O. Fadeyi and Craig W. Lindsley

After Satake, Tachibana and Wright were able to synthesize brevisamide, a compound made by a special type of algae called *Karenia brevis,* in 28 steps with a longest linear sequence being 21 steps and a 0.23% yield, Fadeyi and Lindsley sought to simplify the synthesis. In this article, Fadeyi and Linsley explain their synthesis of brevisamide using three key steps, the Horner-Wadsworth-Emmons Reaction, the Curtis Rearrangement, and SmI_2 Reductive cyclization to give a total yield of 5.2% in 21 steps.

31.
THE APPLICATION OF DIRECT ANALYSIS IN REAL TIME – TIME OF FLIGHT MASS SPECTROMETRY IN THE DETECTION AND CHARACTERIZATION OF SYNTHETIC CATHINONES
Heather S. Loring '15
Faculty Sponsor: Janet F. Morrison

Cathinones are an emerging class of designer drugs that are often sold as "bath salts." These illicit drugs are similar to amphetamines and cocaine in that they produce euphoric and stimulant like effects. Recent work in our laboratory has focused on the development of methods based on headspace solid phase microextraction (HS-SPME) coupled with gas chromatography-mass spectrometry (GC-MS) for the detection of cathinones in saliva. A limitation of this work has been the difficulty of analyzing both secondary and tertiary amine cathinones in a single run. The recent acquisition of a Direct Analysis in Real Time/time of flight mass spectrometer (DART/TOFMS) in our department makes possible the detection and characterization of a wide range of cathinones, including both secondary and tertiary amines, in a single analytical step. With the development of the revolutionary DART ion source, samples can be analyzed in real time in the open air with no sample preparation. DART is used in conjunction with a time of flight mass spectrometer, in which the ion velocities and times of arrival at the detector are correlated with their mass-to-charge ratios. The TOFMS allows for exact mass measurement, enabling accurate detection and characterization of synthetic drugs without the necessity of prior

chromatographic separation. Initial results for the DART-TOFMS analysis of mixed aqueous solutions of cathinones from glass dip tubes and cotton swabs will be presented.

32.
EFFECT OF SAMPLE PRE-TREATMENTS ON THE SOLID PHASE MICROEXTRACTION OF DESIGNER DRUGS FROM AQUEOUS SOLUTIONS
Matthew Lucas '17, Sarah Talcott '17
Faculty Sponsor: Janet F. Morrison

The past decade has seen an eruption of abuse across the world of designer drugs such as synthetic cathinones and synthetic piperazines. These drugs have become popular "legal highs" because they are designed specifically to bypass DEA legislation; therefore, authorities have peaked their interest in developing rapid and reliable analytical methods to detect and characterize these synthetic drugs so that they can ultimately halt their production. This research project focuses on optimizing the performance of one of these trending methods of analysis called Solid Phase Microextraction (SPME). SPME extracts the analytes from an oral fluid sample and injects them into the coupled gas chromatography-mass spectrometry (GC-MS) system to obtain a chromatogram portraying the ions present in the drug sample. The optimization of SPME includes various derivatization schemes with alkyl chloroformate reagents, such as ethyl chloroformate (ECF), as well as multiple types of sample pretreatments. These sample pretreatments include different combinations of base and salt in effort to determine which combination increases analyte volatility and extractability to the highest degree. The primary amine analytes were detected in the presence of ECF, but without fragmentation into multiple ions. Additionally, it was determined that tertiary amine analytes were converted to salts in the presence of ECF; thus, the MS was unable to detect these compounds because of their decreased volatility. Lastly, in the presence of ECF a piperazine was not detected by the MS. Further investigations are necessary to determine the most effective combinations of pretreatments and/or derivatizing reagents in order to optimize sample detection by the method of SPME coupled with GC/MS.

33.
OXIDATION OF TURBOMYCIN SUBSTITUTED COMPOUNDS
Brooke Moore '15
Faculty Sponsor: Cheyenne Brindle

This project focused on the oxidation of previously synthesized turbomycin analogues precursors. These analogues will be tested on various strains of bacteria, and analyzed for their anti-cellular proliferation activity. Oxidation was achieved by reacting each precursor with dichlorodicyanoquinone (DDQ) in ethanol. The products were purified and analyzed by ^{1}H NMR in order to determine the success of the oxidation reaction. Unfortunately, successful oxidation of the central carbon proved challenging. Unexpected results were obtained for the oxidation of an alkyl-substituted analogue derived from valeraldehyde. Promising results have been achieved with a methoxy-substituted aryl analogue, suggesting that the oxidation process is highly

substrate dependent. In the future, these analogues will be tested on bacterial colonies in collaboration with Professor Foster's lab.

34.

SYNTHESIS AND STUDY OF A CYCLIC TUNGSTEN BIS-ALKYNE COMPLEX DERIVED FROM A 1,1'-FERRPCENEDOALKYNYL ESTER
Niranjana Pokharel '15
Faculty Sponsor: Timothy P. Curran
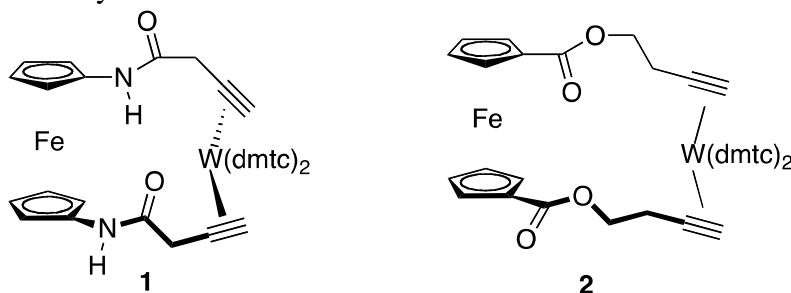
In prior work in our laboratory, dialkynylpeptides were complexed to tungsten, forming novel metallacyclicpeptides featuring a cyclic tungsten bis-alkyne complex. The conformational behavior of these metallacyclicpeptides was studied using NMR spectroscopy. It was found, in every case studied, that the complexes were flexible about the tungsten-alkyne bonds, and that the complexes equilibrated between the different orientations of the two alkyne ligands. This posed the question of whether all cyclic tungsten bis-alkyne complexes would be flexible. In recent work in our laboratory, a rigid, cyclic tungsten bis-alkyne complex (**1**) was discovered. This complex incorporated a ferrocene moiety and two dialkynylamides. It adopts one solution conformation and that there is an intramolecular hydrogen bond between one of the amide NH protons and the C=O of the other amide. To uncover the reasons for the rigid behavior of **1**, derivatives of **1** are being prepared and examined. In the present work, the synthesis and study of **2** is being undertaken. Complex **2** has a larger ring size than **1**, and with the two esters there is no possibility for an intramolecular hydrogen bond. The ferrocene dialkynyl ester was prepared in two steps. First, 1,1'-ferrocenedicarboxylic acid was reacted with oxalyl chloride to yield red crystals of ferrocenedicarbonyl chloride. Then, the purified 1,1'-ferrocenedicarbonyl chloride was reacted with 3-butyn-1-ol to produce the dialkynylester. Coordination of this dialkynylester with tungsten by reaction with $W(dmtc)_2(CO)_3$ to produce **2** is under investigation. Results from this work will be presented.

35.

COMPARING MEASUREMENTS OF THE FORMIC ACID, WATER, AND SODIUM CHLORIDE LIQUID-VAPOR INTERFACE

Jeff Pruyne '15

Faculty Sponsors: Maria Krisch, Matthew A. Brown (Institute for Chemical and Bioengineering, ETH Zürich, CH-8093 Zurich, Switzerland), Ming-Tao Lee, Markus Ammann (Paul Scherrer Institute, CH-5232 Villigen PSI, Switzerland)

The liquid-vapor interface has experienced renewed interest from physical chemists in the last two decades as techniques to study it have become more accessible and reliable. We compare two different methods of examining the liquid-vapor interface for a ternary (water, formic acid, and sodium chloride) system. An important property of the interface is the surface excess of a compound relative to its concentration in the bulk solution. Wilhelmy plate surface tension measurements from which the surface excess can be derived were compared with ambient pressure x-ray photoelectron spectroscopy (AP-XPS) measurements of the composition of a surface layer of the solution. We found that sodium chloride acts as a weak salting out agent for the formic acid with a very small concentration dependence of surface excess on salt concentration. Our data are consistent with the surface tension measurements accessing a more surface selective region than XPS spectra. A simple model of the XPS experiment allowed us to replicate the XPS results under the assumption that the top nanometer of solution contributed most of the experimental signal.

36.
INVESTIGATION OF THE COMPOSITION OF ALKALI METAL HALIDES' CRYSTAL

Phong Kim Quach '17

Faculty Sponsor: Ralph Moyer Jr.

Two alkali metal halides, NaCl and KBr, were dissolved in water giving one molar solution each. The solution then was left to completely evaporate in air and solid crystals were collected. Under the optical microscope, the product showed nice crystal structures. A small sample of the product was heated in the Muffle furnace at 803ºC for 15 minutes to create fused crystals. A control experiment was concurrently conducted by dissolving NaCl, KBr, NaBr and KCl each in separate beakers with one molar concentration. The control solutions were also left to evaporate in air and the product crystals were retrieved. Follow up experiments will use powder X-ray diffraction to ascertain the chemical composition of the residue product and the fused crystal form at 803ºC.

37.

SYNTHESIS OF TURBOMYCIN ANALOGUES FOR THE DEVELOPMENT OF NEW ANTIBIOTICS: VARIATION OF THE INDOLE COMPONENT
Christine Reavis '15, Phong Kim Quach '17, Abigail Whalen '15
Faculty Sponsors: Cheyenne Brindle, Lisa-Anne Foster

The world has recently entered an antibiotic crisis due to increased bacterial resistance. This necessitates the development of novel antibiotics. Turbomycin B is a naturally occurring compound that has been isolated from microorganisms found in soil and has shown antibiotic effects. Our research focuses on altering the structure of turbomycin B, specifically the indole portion to determine the consequences of such changes. Thus far, we have synthesized N-methyl and allyl derivatives precursors. We are currently optimizing the oxidation of these substrates to improve their solubility properties for application to our biological model systems. In the future, we plan to further alter the indole portion with tosyl, acetyl group and other substituents.

38.
TOTAL SYNTHESIS OF (-)-PRZEWALSKIN B
Alex Shea '14
Faculty Sponsor: Cheyenne Brindle

Przewalskin B is a novel terpenoid found in *Salvia przewalskii*, a plant commonly used in traditional Chinese medicine. It was first isolated in 2007 by Zhao *et al*., and has since been found to exhibit mild antiviral activity, specifically towards the HIV-1 virus[1]. In this paper, Zheng *et al*. discuss their total synthesis of (-)-Przewalskin B from starting material 4,4-dimethyl-2-cyclohexenone. Key steps in the synthesis include the intramolecular nucleophilic acyl substitution (INAS) reaction performed on 4, the intramolecular aldol condensation of 13, and the lactonization of 15. Using ^{1}H NMR (and ^{13}C NMR) to confirm the final structure, it was ultimately concluded that (-)-Przewalskin B was synthesized in 8.1% overall yield. In my presentation of this paper, I will be examining this synthesis of (-)-Przewalskin B, focusing on the mechanisms of the key reactions.

39.
CHARACTERIZATION OF THE STABILITY OF SUPPORTED BILAYER MEMBRANES IN POLYDIMETHYLSILOXANE MICROFLUIDIC DEVICES
Livia Shehaj '15
Faculty Sponsor: Michelle L. Kovarik

Microfluidic devices consist of a system of channels with dimensions from 5-500 µm. Their small size makes them an optimal tool in studying individual cells; therefore they are promising tools for biomedical research. One of the main obstacles in using microfluidic devices in biological and biomedical applications is the tendency of biological molecules (especially proteins and DNA) to adhere to the walls of the channels. The accumulation of these molecules over time can clog the channels, making the collected data inconsistent and the devices unusable. One way to overcome this obstacle is to coat the channels with self-assembling lipid bilayer

membranes. These lipid coatings are very similar to cell membranes; therefore they prevent proteins and DNA from adsorbing to the surface. However no study has been done on the stability of these membranes. To characterize the stability of these lipid coatings, we prepared hybrid microfluidic devices containing straight, 3 cm long channels through photolithography and soft lithography. For coated devices, the channels were filled with small unilamellar vesicles (SUVs), which self-assemble into supported bilayers. Conductivity measurements of the electroosmotic flow were used to characterize the presence and stability of the supported bilayer membranes. These conductivity measurements were performed and recorded using a custom LabView program and high voltage power supply. To validate the experimental set-up, measurements were conducted on a bare (uncoated) channel, and the results confirmed the literature value known for μ_{eo} of plasma-treated PDMS. Additionally, preliminary results showed that, as expected, the application of a phosphatidylcholine bilayer coating lowered the EOF, meaning that the coating was successfully formed in the device. For future goals we will use these established techniques to characterize the stability of the supported bilayer membranes as a function of time, composition, and electric field strength.

40.
THE PATH TOWARDS A CYCLIC TUNGSTEN BIS-ALKYNE COMPLEX DERIVED FROM m-XYLENEDIAMINE
Edgar Soto '15
Faculty Sponsor: Timothy P. Curran

In prior work, this lab has demonstrated an ongoing interest in the formation of constrained tungsten-bis(alkyne) complexes (Lawrence, 2010) formed from the coordination of dialkynylamides to tungsten. In an effort to generate constrained analogs the conformational rigidity of alkynes derived from m-xylenediamine where probed. (. The dialkynylamide derivatives of m-xylenediamine were formed via acylation of propargylchloroformate or 4-pentynoic acid. The dialkynylamide was then reacted with $W(CO)_3(dmtc)_2$ in order to try and form a bis(alkyne) complex. NMR spectroscopy experiments indicate that the propargylchloroformate dialkyne derivative of m-xylenediamine does not form the bis(alkyne) complex. To investigate this further the results of the propargylchloroformate derived m-xylenediamine were contrasted with the 4-pentynoic acid dialkyne derivative of the m-xylenediamine. In this presentation details about this work will be discussed.

41.
SYNTHESIS OF ASPARTIC ACID AND GLUTAMIC ACID DIPEPTIDES AND COORDINATION TO TUNGSTEN VIA ACYLATED SIDE CHAINS
John Stiller '14
Faculty Sponsor: Timothy P. Curran

Two amino acids, aspartic acid and glutamic acid were used as foundation for the creation of dialkyne dipeptides with acylated side chains. Synthesis was done with the intent of coordinating the dialkyne molecules to tungsten to form bisalkyne complexes and analyze the overall complex's flexibility. The derivatized Glu-Glu molecule was formed and successful coordinated

to tungsten. H-NMR was used to determine the flexibility of said complex. Synthesis of the derivatized Asp-Asp complex was unsuccessful due to intramolecular cyclization problems.

42.
HS-SPME/GC-MS METHOD DEVELOPMENT FOR THE ANALYSIS OF PIPERAZINES IN ORAL FLUID: *On-Fiber vs. In-Matrix Derivatization*
Alexandre X. Zhang '14, Matthew Lucas '17
Faculty Sponsor: Janet F. Morrison

Piperazines are a class of synthetic drugs which are often marketed as a legal alternative to 3,4-methylenedioxymethamphetamine (MDMA or 'Ecstasy'). At low doses many piperazines have very similar stimulant effects to MDMA, while hallucinogenic effects may be experienced at higher doses. For this reason 1-benzylpiperazine (BZP) has already been classified as a Schedule I controlled substance by the Drug Enforcement Agency under the Federal Controlled Substances Act. Despite their prevalence, there is a lack of analytical data for the piperazines, which has made detection and identification of these compounds difficult.

The overall goal of this research project is to develop an analytical method based on headspace solid-phase microextraction (HS-SPME) and GC-MS for the detection and quantification of BZP, 1-(3-trifluoromethylphenyl)-piperazine (TFMPP), and *meta*-chlorophenylpiperazine (mCPP) in oral fluid. Previous work in our laboratory has focused on characterizing the mass spectrometric fragmentation of these piperazines using liquid injection gas chromatography-mass spectrometry (GC-MS). This semester on-fiber and in-matrix derivatization methods were investigated for improving chromatographic performance and mass spectrometric selectivity.

GC-MS data for on-fiber and in-matrix derivatization of synthetic piperazines with ethylchloroformate (ECF) and on-fiber derivatization with n-methyl-n-(trimethylsilyl) trifluoroacetamide (MSTFA) will be presented. Preliminary results indicate that derivatization with both reagents show improved chromatographic characteristics compared to underivatized analytes. In-matrix derivatization only allowed for the extraction of TFMPP and mCPP, while on-fiber derivatization resulted in the extraction of all three piperazine analytes.

COMPUTER SCIENCE

43.
DEVELOPMENT OF A MACHINE LEARNING ALGORITHM TO PREDICT NATIONAL HOCKEY LEAGUE GAME WINNERS
Alexandre X. Zhang '14
Faculty Sponsor: Takunari Miyazaki

Over the last few decades sabermetrics and statistics have infiltrated into the world of professional sports. Many baseball organizations have begun employing mathematicians to analyze their team data in order to increase their chance of winning games. The most notable example is Moneyball: the art of winning an unfair game by Michael Lewis. This project focuses

on the analysis of hockey statistics because there has been a limited amount of advanced statistical research done and the statistics which are currently talked about are usually ignored when piecing a team together.

The overall goal of this senior project was to develop a model using a support vector machine and to use this model to successfully predict more than 50% of NHL game winners. This was accomplished using two key resources, Web Scraper, a Google Chrome extension, and *libsvm*, a support vector machine library package. The overall architecture of this project begins with data collection using the Web Scraper extension from NHL.com, followed by data preprocessing to alter the data into values acceptable by *libsvm*. The majority of the data set is then used to train a model, through which the rest of the data will be tested to determine the accuracy of the model.

The results of different models will be presented. The model based on goals per game and goals against per game was determined to be the best at 68% accurate, 18 percentage points greater than the target value.

44.
ACQUIRE ONLINE
Marin Abernethy '14
Faculty Sponsor: John V.E. Ridgway

Acquire Online cohesively incorporates the economic strategy of the classic board game, Acquire, in a web based multiplayer version of the game. As a authenticated user, one can enjoy as many games with as many friends as desired. Acquire was designed by Sid Sackson and first published by 3M in 1962. The objective of the game is to earn the most money by developing and merging corporations. When a larger corporation acquires a corporation in which a player owns stock, players earn money based on the size of the acquired corporation. At the end of the game, all players liquidate their stock in order to determine which player has the most money. This economic simulation game is consistently rated one of the best economics board games, however, people these days turn to their technological devices for entertainment rather than sitting around a game board. This projects aims to convert the fun of the board game to the Internet. While there are two notable, existing online versions of this game – NetAcquire and Game Table's Acquire – they require the user to download their software or pay a fee to play others. Acquire Online requires neither and allows the user to play from their local web browser. This application is built in Ruby on Rails, a server-side web framework, alongside front-end web languages such as HAML (HTML Abstracted Markup language), and SASS (CSS Compiler). Additionally, Ember.js, a client-side JavaScript framework helps to make the game dynamic, with its Handlebars templates that update automatically when the underlying data changes. The design is simple so that gameplay is easy and enjoyable.

45.

CONSTRUCTION ALGORITHMS FOR EXPANDER GRAPHS
Vlad Burca '14
Faculty Sponsor: Takunari Miyazaki

Graphs are mathematical objects that are comprised of nodes and edges that connect them. In computer science they are used to model concepts that exhibit network behaviors, such as social networks, communication paths or computer networks. In practice, it is desired that these graphs retain two main properties: sparseness and high connectivity. This is equivalent to having relatively short distances between two nodes but with an overall small number of edges. These graphs are called *expander graphs* and the main motivation behind studying them is the efficient network structure that they can produce due to their properties. We are specifically interested in the study of *k-regular expander graphs*, which are expander graphs whose nodes are each connected to exactly *k* other nodes. The goal of this project is to compare explicit and random methods of generating expander graphs based on the quality of the graphs they produce. This is done by analyzing the graphs' spectral property, which is an algebraic method of comparing expander graphs. The explicit methods we are considering are due to G. A. Margulis (for 5-regular graphs) and D. Angluin (for 3-regular graphs) and they are algebraic ways of generating expander graphs through a series of rules that connect initially disjoint nodes. The authors proved that these explicit methods would construct expander graphs. Moreover, the random methods generate random graphs that, experimentally, are proven to be just as good expanders as the ones constructed by these explicit methods. This project's approach to the random methods was influenced by a paper of K. Chang where the author evaluated the quality of 3 and 7-regular expander graphs resulted from random methods by using their spectral property. Therefore, our project implements these methods and provides a unified, experimental comparison between 3 and 5-regular expander graphs generated through explicit and random methods, by evaluating their spectral property. We conclude that even though the explicit methods produce better expanders for graphs with a small number of nodes, they stop producing them as we increase the number of nodes, while the random methods still generate reasonably good expander graphs.

46.
SYM A DYNAMIC APPROACH TO THE 0-1 KNAPSACK PROBLEM USING THE DISCRETE SHUFFLED FROG LEAPING ALGORITHM
Rahul Chandrashekhar '17
Faculty Sponsor: Peter A. Yoon

The Knapsack Problem is a popular combinatorial optimization problem which is of the type NP-hard. It assumes a case where there is a knapsack which can hold a maximum weight W and there is a set of items N provided from which each item n_i has a certain weight w_i and a value v_i. The task is to pack the knapsack with the maximum possible value while staying under the weight limit of W. The 0-1 Knapsack Problem is a unique case of the classic Knapsack Problem in which each item from the set either goes in or out of the knapsack in entirety. Fractional portions of items are not allowed. The conventional method to tackle the problem is the brute force method in which all the subsets of the set N which equals to 2^n are compared from which the one with the highest value under the weight limit W is considered the optimal solution. But as n increases, the number of subsets also increases exponentially making this conventional

approach computationally impractical. We use the Discrete Shuffled Frog Leaping Algorithm to solve this problem which employs the use of dividing the problem into multiple sub-problems hence making it more suitable for parallel computation. The dynamic approach is theoretically a much more efficient alternative for a large scale implementation of the Knapsack Problem. We further aim to undertake a GPU based approach to this algorithm using CUDA, a parallel computing platform by NVIDIA.

47.
METRIC TRIDIAGONAL EIGENVALUE PROBLEM ON MULTI-GPU SYSTEMS
Hyunsu Cho '15
Faculty Sponsor: Peter A.Yoon

Divide-and-conquer algorithm is a numerically stable and efficient algorithm that computes the eigenvalues and eigenvectors of a **symmetric tridiagonal matrix**. A major challenge in implementing the algorithm on multiple GPUs is the **low compute intensity** at the bottom of the divide-and-conquer tree, where the subproblem size is small. Conventional implementations on multi-GPU systems fall short of addressing this issue, leaving GPUs idle much of the time. We overcome the problem by merging multiple pairs of subproblems in parallel. Preliminary runs show promising results. Our implementation running on 4 GPUs shows a 12x speedup over the sequential counterpart. Furthermore, it exhibits a meaningful degree of scaling with respect to the number of GPUs, running 2x as fast on 4 GPUs as on 1 GPU.

48.
NOTEWORKS – TAKE NOTES BETTER
Liam Doran '14
Faculty Sponsor: John V.E. Ridgway

Note-taking is an incredibly common practice that, for many people, hasn't changed much since the advent of personal computing. Physical notes are severely limited by their medium, and for the most part, digital notes suffer many of the same weaknesses. As a result, they can be difficult to maintain, and even more difficult to study from. To resolve this, I created Noteworks, a web application designed to let users take cleaner, better organized, and more usable notes. The application works by allowing a user to type in notes with a simple markup language I designed. The backend then parses these notes, breaks them down, and allows the frontend to present the user with a graph of their data, which is generated by a force-directed graph drawing algorithm. The user is able to interact with this graph by moving its elements around as necessary, and can update it in real time by simply modifying the notes that they've taken. The computation for the app was written in Ruby (with the Ruby on Rails web framework) on the backend and JavaScript on the frontend. Noteworks works, turning notes that may have otherwise been unusable into an easy to engage with, dynamic, and well organized network of information.

49.

USING DECISION TREES WITH FINANCIAL MOMENTUM TO CLASSIFY COMPANIES' FUTURE GROWTHS

Zach Freedman '14
Faculty Sponsor: Takunari Miyazaki

The goal of this software package is to predict companies' future performances based off of current momentum factors. Our goal is to look at a company's growth over the past yearlong period, and based on that growth, project how the company's share price will be valued one year from our current date of examination. The predictive classifiers chosen for this machine learning task are decision trees, which perform attribute tests on data objects to classify the objects into predefined classes. To complete this task, the project was broken up into three distinct modules: data scraping performed through Python using BeautifulSoup, data preprocessing written in R, and, also programmed in R, decision tree growth and model valuation. First, financial statement data and pricing history are scraped from NASDAQ and Yahoo Finance, respectively, into .csv files indexed by the companies' ticker symbols. Once data is collected and organized, the .csv files are read into the data preprocessing module, where key attributes can be analyzed, refined, and selected for dimensionality reduction. After choosing the key attributes that truly define financial growth and momentum, data is rewritten to .csv files to be fed into the predictive model for decision tree growth, testing, and valuation of predictive classification accuracy. The predictive model produces a 60% predictive accuracy for a binary classification of Buy and Sell, and a 40% predictive accuracy for a ternary classification of Strong Buy, Buy, and Sell.

50.

GROUP STEINER PROBLEM ON THE GPU USING CUDA IMPLEMENTATION

Basileal Imana '17, Suhas Maringanti '17
Faculty Sponsor: Peter Yoon

Previous literature on VLSI routing and wiring estimation typically assumes a one-to-one correspondence between terminals and ports. In practice, however, each terminal consists of a large collection of electrically equivalent ports, a fact that is not accounted for in layout steps such as wiring estimation. In this research, we address the general problem of such minimum-cost routing tree construction in the presence of multi-port terminals, which gives rise to the Group Steiner problem (GSP). The minimal tree problem states that given a weighted undirected graph G, a minimum spanning tree is a sub-tree that contains all the vertices in G and minimizes the sum of the weight of the edges. Our research focuses on an extension of the problem where we are allowed to introduce special Steiner nodes with zero weight as junctions in order to minimize the cost of the tree. Common approach to the Group Steiner problem, known as the strong connectivity version, allows all the nodes of a group to be implicitly connected with each other which allows the solution to the problem to be a forest. However, the version of the problem that we are working on involves weak connectivity whose solution must strictly be a tree. The problem of interconnecting a net with multi-port terminals is a direct generalization of the NP-hard Steiner problem, and is therefore itself NP-hard which means that, theoretically, it cannot be solved in polynomial time. To that end, our research will be focused on developing an efficient algorithm of the GSP on the GPU (Graphical Processing Unit) using CUDA programming and compare the results with the serial implementation of the GSP on the CPU.

51.
MUSICIAN'S TOOLBOX
Christina Lipson '14
Faculty Sponsor: John V.E. Ridgway

As a longtime musician, I have accumulated a list of tools that I believe would help me in my musical endeavors. For the culmination of my studies in Computer Science and Music at Trinity College, I wanted to make these tools a reality. The web application I have developed provides a space with a cohesive set of tools for users to train themselves in various musical skills, create their own music, analyze music, and reference musical information. These four components (Train, Create, Analyze, Reference) act as categories and each contain different musical functions. The "Train" category improves the user's musical brain by letting them practice interval training, pitch training and sight singing. The "Create" category provides the user with a creative outlet through the "note playground", which contains a grid of music that they can design. The "Analyze" category gives the user the ability to turn live audio input into a musical score. The "Reference" category contains chord chart generation and a musical dictionary to help the user with musical diagrams and terminology. The application was built using Ruby on Rails and other assisting web development languages. Since most of the application consists of temporary audio and visual generation, much of my coding was done in the front-end, with back-end storage used in cases such as storing musical terms as objects in the database. I utilized open source code for the sound and visual components of my application in order to move quickly and effectively through all of the material I wanted to cover. Using a real-time audio JavaScript library and a music notation rendering API as my building blocks, I created algorithms for advanced chord generation, interval generation/classification, live audio analysis, and optimal audio-visual connection. The resulting application is a space with musical functions that incorporate the visual and auditory components of music.

52.
SOCIALMINIMAP
Nathaniel Maynard '14
Faculty Sponsor: John V.E. Ridgway

Event advertisement is difficult on college campuses, the main media being Facebook and flyers. These can often be ineffective with people not stopping to read the flyers or ignoring the event requests component of Facebook. The goal of the SocialMiniMap is to be a tool that students can use as a public posting board for events. The project uses the open source web application framework Ruby on Rails in combination with the Google Maps JavaScript API v3 to display upcoming events, your location and the location of your peers on a map that helps the user gain a better perspective. Ruby on Rails uses a Model-Views-Controller software pattern that allows for the creation of many different objects that add functionality to the map. Users will log in and be able to manage their connections to friends and send messages along with all the Google Maps functionality. Three of the major components in this project are the Users, Events and Locations on the map. These Ruby models work with the JavaScript via Embedded Ruby where Ruby

expressions can be inserted in to the JavaScript. User and Event models store information such as names and location data that are used with the Google Maps API to help display the information that the user is looking for. Location models hold data used to create Google Maps latitude and longitude bounds objects. These are then used with click listeners that notify the user when a new event location is in the area of a predefined building or dorm.

53.
NULI XUEXI: A MOBILE PHONE APPLICATION FOR STUDYING CHINESE
Tanya D. Nongera '14
Faculty Sponsor: Ralph Morelli

Mobile phone quiz apps are commonly being used as a studying tool by students, and their use as language learning tools is no exception to this trend. Hence, the mobile phone application proposed, to help students grasp the Chinese language, specifically by improving their vocabulary recall. *Nuli Xuexi* permits a user to create multiple quizzes, and retrieve them if and when they want to test their knowledge of learned vocabulary. The ultimate goal is to aid them in committing the new vocabulary to long term memory in an attempt to obtain a better grasp on the language. With the use of App Inventor, a database created that stores this information for each user, and due to the importance of communication when learning or studying a language, *Nuli Xuexi* incorporated features that allow communication between users via email or text. Additionally, it contains a voice recognition tool that provides a platform for users to practice their intonation of different words as they work through the quiz; an extremely useful tool for mastering the Chinese language, as the meaning of a word can change if incorrectly pronounced.

54.
WHATSON: A MOVIE RECOMMENDATION SYSTEM FOR MOVIES ON REDBOX AND IN THEATRES
Jamie Recas '14
Faculty Sponsor: John V.E. Ridgway

WhatsOn, a web application built with Ruby on Rails, that seeks to answer the question of "what's on" by suggesting movies on redbox and in theaters based on the users calculated preferences. It accomplishes this using a popular unsupervised learning technique, collaborative filtering. The type of collaborative filtering used was user-user collaborative filtering also known as K-NN collaborative filtering. K-NN collaborative filtering is a straightforward algorithmic interpretation of the core premise of collaborative filtering, which is the grouping of similar users and using their average ratings for a particular item as an indicator of the expected rating for other similar users. K-NN collaborative filtering was implemented by creating a vector for each user that corresponds to their ratings of an ordered set of movies. Using this vector as a position in space, the K-Means algorithm then clusters users together according to Euclidean distance. To generate a movie rating for a user j and movie k the recommendation algorithm is run. This searches within the cluster that j belongs to and finds all the users that have rated movie k. The algorithm then uses a weighted average (weighted on similarity) of all the ratings of movie k,

within the cluster, as the projected rating for user j. WhatsOn manages to predict, with reasonable accuracy, the expected ratings for users of the application. It does, however, suffer from the "cold starting" problem that plagues many collaborative filtering applications and the K-Means algorithm needs to be optimized. On the other hand, these problems diminish as the number of users of the application increase.

55.
A CALENDAR WEBSITE FOR ROWERS TO TRACK PROGRESS
Lauren Yianilos '14
Faculty Sponsor: John V.E. Ridgway

For my senior project I've created a website for athletes, more specifically rowers, to document their workouts and track their progress. Athletes will be able to join their team (example: Trinity College Women's Rowing Team) and record their workouts. There are two places where a user can record information – on the team page and on their personal page. The team calendar will consist of workouts that its teammates have deemed, 'public.' If a user chooses to make a workout 'private' it will only be visible on his/her personal calendar. In other words, a public workout will be visible on both calendars, whereas a private workout will only show up on the user's personal calendar. Users can choose to be notified by text, email, or both about certain information. My project is implemented using Ruby on Rails. The two main models in my project are 'Exercise' and 'Calendar.' To update the calendar, the user can pick from a list of exercises. The user inputs information about their workout in these tables and the information is displayed on a calendar with the help of the ruby gem, 'event_calendar.' To track progress, the user can compare a current workout to one completed a week, month, or year ago.

ENGINEERING

56.
SUTURE GRASPER FOR LAPORASCOPIC PORT SITE CLOSURE
Meredith Apfelbaum '14, Shea Kusiak '14, Mark Yanagisawa '14
Faculty Sponsors: Joseph Palladino, Scott Prior, Jaroslaw Malkowski, Covidien

Covidien, a biomedical instrumentation company, needed to develop a port site closure suture grasper. This device is used to drop off (pass) and pick up (grasp) a suture through the incisions (ports) made during laparoscopic surgery to ensure complete closure of the tissue layers. Current devices on the market risk port site herniation, have inconsistent capture of tissue layers, are difficult to use and expensive. A team consisting of three engineering students and two sponsors from Covidien was formed to develop a device capable of delivering optimal performance while minimizing cost relative to the current competitive devices. Covidien has defined the following specifications: effectiveness, low cost, ergonomics and safety. After researching current devices and methods of closure, a design process was executed to create a working model that was tested to evaluate its efficacy. This senior design project enhanced the current design of port site closure devices in the market ensuring effective closure and safe use at a competitive price.

57.
APPLICATION OF HIGH-LIFT WINGS FOR R/C MODEL AIRCRAFT
Sydney Doolittle '17, Tristan Peirce '17, Catherine Poirier '17, Phillip Winser '17
Faculty Sponsor: Joseph Palladino

The impact of new engineering technologies can be studied by examining their intersection with the hobby of remote controlled (R/C) aircrafts. Technologies such as wind tunnels, computer-aided design programs, and 3D printers can be used to study these aircraft and the fundamental physics of how they fly. Aerodynamics, or the study of flow and motion of air, is a particular area of interest, as the motion of air is directly altered when it encounters solid objects such as modern aircrafts. R/C models typically have basic airfoils (wing cross-sections). Two airfoils - the Whitcomb-il and Selig-1223 - were specifically analyzed to apply high lift wings to a modern aircraft. These airfoils were fabricated in a Computer Aided Design (CAD) software called SolidWorks. Then, these prototypes were printed using the Stratasys uPrintSE 3D Fused Deposition Modelling (FDM) printer. The aerodynamic properties of these wings were measured using an Aerolab Educational Wind Tunnel (EWT). In this subsonic wind tunnel, the two airfoils were analyzed at 100 mph by measuring the lift force at different angles of attack and calculating the nondimensional lift coefficient. Data collected was analyzed to determine the optimal angle of attack for the higher lift airfoil. According to the results, the integration of this airfoil in R/C models will hypothetically yield a higher lift force for lower speeds, and an increase in maximum payload.

58.
EARTHQUAKE SIMULATOR DESIGN AND SEISMIC ISOLATION TESTING
Marco R. Eberth '14
Faculty Sponsor: Joseph Palladino

During the first semester the team [Marco Eberth & Claire Anderson] designed and constructed a shaker table for earthquake simulation. Prior to construction, the team consulted articles and Trinity's own earthquake enthusiast, Professor Geiss, and determined that horizontal ground motion was only necessary for testing the failure of buildings. The team determined a jigsaw would be sufficient in the driving mechanism of the shaker table, and at lowest speeds the finished shaker table was able to create a 2g earthquake. This was determined sufficient in testing considering a 1.24g earthquake typically results in "very heavy" damage. During the second semester Marco worked independently and constructed a seismic isolator: a system below the super structure of a building that creates a barrier between the ground movement and the movement the building experiences. Through dimensional analysis it was determined that the building and table were not dynamically similar; meaning that the earthquake was unrealistically violent for a light-weight scaled building. An accelerometer was utilized to determine the efficiency in performance of the seismic isolator. Using bearings as isolators, the top floor acceleration of the building was measured while the ground acceleration was measured simultaneously. There was an average of a 75% decrease in acceleration experienced by the building in comparison to the ground acceleration during the same simulated earthquake.

59.
ROBOBOAT
John Fasano '14, Bach Nguyen '14, Alexa Pujol '14, Jonathan Rothendler '14,
Arbaaz Tanveer '14
Faculty Sponsor: David J. Ahlgren

As we progress further in to the 21st century, an increasing amount of tasks and actions, which were previously controlled by humans, are now being done so by sophisticated robots in conjunction with software and clever engineering. Our project explored the aspects and possibilities of an autonomous boat capable of traveling to destinations and avoid obstacles without any human input. The boat was designed around the guidelines for the AUVSI foundation and ONR's 7th annual international RoboBoat competition held in Virginia Beach. These guidelines included tasks such as obstacle avoidance, speed testing, and autonomous travel. The competition guidelines also included strict rules on boat manufacturing, putting the design teams into constraints that truly test the team's ingenuity. Our team decided to go with a pontoon design with two parallel motors. The software and electrical parts are all controlled by an Arduino Uno microprocessor. Along with the autonomous control, we also installed a Bluetooth remote control per competition guidelines, as well as a webcam complete with image processing for detecting obstacles. Although our boat does not reflect a competition-winning craft, we believe that it is a solid work of labor given our time and budget constraints. We hope that our boat will be built upon by future engineering students, helping to instill the creativity and drive that we as engineers felt during this past year.

60.
ROTATIONAL FIXTURE DESIGN FOR FRONT FUSELAGE OF THE F4U-4 CORSAIR AIRCRAFT
Elizabeth Gerber '14, Renzo Hidalgo '14, Lucas Knight '14
Faculty Sponsors: John Mertens, Craig McBurney, Connecticut Corsair, Connecticut Corsair, Sikorsky Aircraft, Pratt & Whitney, Trumpf, Stratasys, Bolton Works LLC, CAPINC Environmental Tectonics Corporation (ETC), Reno Machine Company, Connecticut Innovations, Service Steel Aerospace Corporation

Connecticut Corsair is restoring to flight-condition a Chance Vought F4U-4 Corsair. In partnership with this organization, our Trinity College Capstone Design team seeks to design the fixture that will be used to construct the F4U-4 Corsair front fuselage. The fixture must be a rigid structure that can withstand the weight of the front fuselage throughout its assembly and have a rotational feature about the plane's roll-axis. It must also maximize the operator's productivity and safety, while minimizing their fatigue and discomfort. In order to complete this task, we must first reverse-engineer the bulkheads at the front and rear ends of the front fuselage (Bulkheads 91¾ and 186) and model the necessary skeleton of the front fuselage in SolidWorks. Then, we will identify the attachment points for the fixture, and where these points are located on the two bulkheads. We would also have to keep in mind the eventual detachment of the front fuselage from the fixture. Our team will study the design of existing F4U-4 Corsair fixtures, both rotating and static systems, to come up with the most suitable

hybrid solution. All research, progress reports, pictures, and documents are to be recorded on Connecticut Corsair's organizational portal at CTiHub.com.

Building this rotating fixture will provide future hands-on design opportunities for student-interns at Connecticut Corsair who will join and contribute to this project. By reviving this historic plane, our Capstone project will help contribute to research opportunities for prospective mechanical and aerospace engineers.

61.
DIGITAL IMAGE PROCESSING FOR DIAGNOSTICS OF MIDDLE EAR INFLAMMATION
Jessica L'Heureux '14, Georgia McAdams '14, Joanna Wycech '14
Faculty Sponsor: Lin Cheng

Otitis Media, a common ear infection present in children, is one of the most commonly misdiagnosed infections in the country; a large contributing factor to this is the use of otoscopes with the naked eye for diagnosis. Recently, digital otoscopes have been created that give the doctor the option of taking digital images that can then be examined more closely and in greater detail. The objective of this senior design project was to develop a program in MATLAB using already existing image processing kernels and techniques, which would determine if an infection is present and whether it is Acute Otitis Media or Otitis Media with Effusion. This will provide a reliable second opinion for a physician to make his diagnosis. Images taken by Dr. Tulio Valdez from Hartford Children's Hospital with digital video otoscopy devices were used in this project. Filtering techniques, segmentation, light levels, analyzing several biological landmarks that are characteristic of this infection were all used to create a final product that can detect Otitis Media with reasonable accuracy.

62.
DESIGN OF DATA COMPRESSION EMBEDDED SYSTEM USING DISCRETE-WAVELET TRANSFORM (DWT)
Jin Feng Liu '14
Faculty Sponsor: Lin Cheng

Data storage is becoming more of a concern as huge data begin to accumulate in various applications. This capstone project used a novel approach that combines data acquisition and compression into a single embedded system. The project can be divided into three major parts. First, it involves data acquisition system with signal conditioning circuit design that matches the application requirement for target transducers. Secondly, data compression algorithm using DWT and Huffman and Run-Length Effect (RLE) coding algorithms must be developed with proved performance. Lastly, the developed algorithm will be implemented using a 32-bit ARM-Cortex microprocessor development board.

63.
DYNAMIC STRESS REDUCTION SYSTEM

Junius Santoso '14, Stacy Sodergren '14, Erik Quiñonez '14
Faculty Sponsors: John Mertens, NASA and Travelers Companies

By utilizing a piezoelectric device as the actuator system in a feedback control loop we demonstrate a reduction of stress concentration on a cantilever beam with a k value of 1.24. The stress reduced is shown to be in the order of 24 MPa for an aluminum beam using strain measuring techniques. The piezoelectric actuator and its capability to reduce stress concentration provide evidence to support its potential use as an actuator system to regulate stress in a dynamically loaded member. Finite Element Analysis models were used to predict the response of the beam to the inverse piezoelectric effect from the actuator. These models show promising results in predicting the effects of piezoelectric actuator on structural members. We compare the performance of various types of controllers such as a proportional integral derivative (PID) and proportional integral (PI).

64.
DEVELOPMENT OF AN ELECTROLARYNX CAPABLE OF SUPPORTING TONAL DISTINCTIONS IN MANDARIN

Bicky Shakya '14, Vishal Bharam '14, Alexander Merchen '14
Faculty Sponsors: David J. Ahlgren, Dr. James Heaton (Massachusetts General Hospital), Mark Robertson (Griffin Laboratories, California)

Tone distinction is a vital part of languages such as Mandarin, where the same words said in different tones could mean vastly different things. For people who have lost their voice box, usually due to the cancer of the larynx, making this tone distinction becomes impossible with currently available Electrolarynxes which are limited to monotones. Further, due to a lack of tone distinction, the resulting voice sounds 'robotic' and unnatural. Wan et. al recently developed an electrolarynx capable of tonal control using a trackball, and TruTone® from Griffin Laboratories is another EL that features tone modulation via capacitive buttons. These designs feature user-interfaces which make it hard for pitch-changing during speaking, especially for tonal languages. This senior design project focuses on developing an Electrolarynx-based system capable of modulating vocal frequencies so that tonal distinctions can be made for Mandarin. We have developed a novel user interface using a gyroscope so that an electrolarynx user might be able to select and produce the tones necessary to converse in Mandarin. The gyroscope is embedded into a custom-made electrolarynx body along with a microcontroller (ATMEGA328) and additional circuitry for digital-to-analog conversion, voltage-controlled oscillation and amplification. Our system is capable of accurately reproducing the four tones in Mandarin, along with the fifth 'non-tone' as well as taking care of tone transition rules in Mandarin. Initial results have shown as much as 90% accuracy in the identification of the four individual tones produced by our Electrolarynx system and understandable speech with multiple syllables.

65.
A ROUTING PROTOCOL DESIGN AND IMPLEMENTATION FOR VEHICULAR AD-HOC NETWORKS (VANETS)

Hokchhay Tann '14, Peter Burrows '14
Faculty Sponsors: Lin Cheng, NASA CT Space Grant Consortium

Vehicular Ad-Hoc Networks (VANETs) rely on routing protocols to disseminate traffic information efficiently and effectively throughout the network. In this study, we examine the performance of the Subzone routing protocol using realistic traffic models and empirical highway traffic data. We develop and use probability models to test parameter settings within the protocol. Based on the results, we construct a model that optimizes the Subzone protocol for different circumstances. Following the optimization process, we introduce our implementation of the protocol, which begins with the design of a software framework capable of carrying out the basic logical operations of the protocol. Finally, we test the framework using a network of transceiving nodes.

ENVIRONMENTAL SCIENCE

66.
MEASURING VEGETATION GROUND COVER: VISUAL ESTIMATES VERSUS ANLAYSIS OF DIGITAL IMAGERY
Jacob Ammon '17
Faculty Sponsor: Cameron Douglass

Vegetation cover is a measurement of the percentage of the ground covered by plants. This quantity can be assessed as overall cover of vegetation, or on an individual species basis. Vegetation cover is important in the analysis of ecosystem health because it describes vegetation density, and can be used to quantitatively measure changes in plant community composition over time. In order to estimate vegetation cover, visual estimates are normally made of the proportion of a given area. In an effort to avoid the observer bias that frequently influences visual estimations, we experimented with quantifying vegetation ground cover in digital photographs. Digital images of six vegetation sampling plots at Knox Preserve (Mystic, CT) were taken over 8 days in September 2013. Images were imported individually into ImageJ, a free NIH-developed program. Selecting different hue and brightness threshold levels allowed for the selection of particular color ranges in the imagery, in this case, that of plant leaves. Images were then processed and the area consisting of green leaves measured.

Mean vegetation cover from visual estimates of the plots was 79.75%, and mean cover from digital imagery analysis was 80.19%. Variability was lower in digital imagery analysis data (± 1.66%) than in visual estimate data (± 2.99%). Two plots - both photographed by the same observer - had significantly higher discrepancies between digital imagery analysis and visual cover estimates. Overall variability among plot-level digital cover data was very low, except for two subplots from a single plot that had very high grass cover. Overall, digital and visual estimates agreed very well, but digital estimates were much less variable. The limitation of this technology proved to be for plots with mixed grass and broadleaf plant covers, which digital analysis was unable to assess without unacceptably large variability. Finally, our findings suggest that better training and calibration of observers in both visual estimates and techniques for acquiring digital plot images are called for.

67.

THE EFFECT OF CLEAR CUTTING ON SUB-ALPINE FOREST SOIL NUTRIENT CONCENTRATIONS OF ALUMINIUM AND CALCIUM WITHIN THE WHITE MOUNTAIN NATIONAL FOREST, NEW HAMPSHIRE

Justin Beslity '15, Lauren Tierney '16, Jack Agosta '17
Faculty Sponsors: Jonathan Gourley, Robert A. Colter (Soil scientist from USDA Forest Service, White Mountain National Forest)

Clear-cutting is the most popular and economically profitable method of logging and has been in use for centuries to provide lumber. However, there are several negative side effects which may lead to an increase in soil erosion and nutrient loss. Aluminum and calcium have been found to be critical nutrients for forest ecosystems. Aluminum is an important nutrient for plant growth, especially for trees, and calcium plays a large role in the construction of the cell wall. Collaborating with the USDA Forest Service, three small timber sales were selected for a long term study, which would be sampled for measurements of aluminum and calcium in the O and B layers of soil. Samples were collected prior to the cutting of the timber sales to measure the baseline soil nutrient content of the three plots in the summer of 2013, and the next samples will be collected several months after each plot is cut. The Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES), is used to measure the concentrations of aluminum and calcium in the soil and GIS to provide an interpolated map of each timber sale. In order to confirm the accuracy of results and to compare future nutrient concentrations, samples with high deviations or concentrations observed to be orders of magnitude higher or lower than expected, were reprocessed. The reanalyzed samples were then selected based off of precision and accuracy.

68.

ANALYSIS OF MAGNETIC SEDIMENTS AT OTSEGO LAKE, NY

Matt D'Andrea '17, Hadley Merrill '17, Celeste Popitz '17, TJ Sherman '17
Faculty Sponsor: Christoph Geiss

In this study, variations in magnetic susceptibility were measured on sediment cores from Otsego Lake, New York (42.7564° N, 74.8961° W), in order to reconstruct prehistoric sequences of large storm events. Large storms are known to erode massive amounts of sediments from inland areas into the lake. The carbonate sediments, found in the inner part of the lake, are less magnetic than the shale, found in the lake's watershed. Consequently, a period of numerous large storm events can be characterized by a greater amount of magnetic material (i.e. more shale eroded into the lake), and therefor a larger susceptibility value. Because magnetic susceptibility reflects the amount of magnetic material in the lake sediment, we propose that periods with high storm frequency will be characterized by high values of magnetic susceptibility (X). 21 meters of sediment were analyzed for variations in magnetic susceptibility, using an Agico KL44 Kappabridge susceptibility metter. Five radiocarbon dates established that the first 5 meters of sediment core corresponded to approximately 10,000 years. Our data show that there were periods of high values of K, and therefor storm frequency, approximately 2,000 years ago, 6,000

years ago, and 8,00 years ago. Comparison of our data to a similar study (Noren et al., 2002) shows significant correspondence in the dating of periods of high storm frequency.

69.
SOIL CARBON GRADIENTS AT KNOX PRESERVE, MYSTIC, CONNECTICUT
Jordan Fisk '17, Tracy Keza '17
Faculty Sponsor: Cameron Douglass

Invasive plants are known to cause widespread ecological disturbances that lead to reductions in biodiversity and also change soil properties. For example, invasive plants frequently alter soil carbon-nitrogen ratios due to their abundant biomass production and tissue chemistries. This project focused on the analysis of soil carbon gradients across an early successional field at Knox Preserve, near Mystic, CT. The field represents gradients of several relevant environmental parameters - including elevation and physical disturbance - in addition to varying invasive plant densities. In fall 2013 soil samples were collected every 2.5 meters along four 100 meter transects following the prevailing elevation and disturbance gradients. Samples were analyzed in the laboratory for carbon content using the loss-on-ignition method, in which sub-samples are burned at precise high temperatures for prescribed periods of time to determine carbon content. The distinct ignition temperatures of organic and inorganic carbon in the soils allowed us to determine the amount of each compound in each sample. Soil moisture and organic carbon content appeared to be somewhat correlated, so that samples at lower elevations closer to the pond generally had slightly higher levels of organic carbon. However, this relationship was inconsistent, and overall the predictors we measured in this study – in particular soil moisture – do not by themselves appear to strongly determine soil carbon content. The driving factor is more likely to be plant community type, which would better explain organic inputs into the sampled soils, and will be characterized in further studies to be carried out this coming summer.

70.
SOIL SALINITY GRADIENTS AT KNOX PRESERVE, MYSTIC, CONNECTICUT
Kate Furgueson '15
Faculty Sponsor: Cameron Douglass

Open grasslands are rarely found in coastal areas of New England, and are therefore a conservation priority. These types of habitats are vulnerable to plant invasions and environmental stressors, such as salt spray from seawater and periodic flooding. To study the interaction of soil salinity and invasive species, we sampled transects in an old field at Knox Preserve – on the shores of Long Island Sound - in Mystic, Connecticut. In October 2012, Hurricane Sandy inundated roughly 70% of the area. Due to this flood, and the presence of a perennial marsh at the northern edge of the project area, we expected that the soils closest to the marsh would have higher salinity levels than those at higher elevations. During the summer of 2013, we collected soil samples every 2.5 meters along four transects that bisected the field to characterize soil salinity along an elevational gradient. Wet field soil was combined with deionized water in a 1:5 ratio (vol:vol) and stirred thoroughly. The samples were left to sit for an hour to allow the soil to settle to the bottom. Following this resting period, the conductivity of

each soil was measured and recorded three separate times. The average salinity concentration across the sampled area was 430 μS/cm, with a range of 26 μS/cm - 6.5mS/cm. Soil salinity concentrations were greater at high moisture and low elevation plots closer to the marsh. These data will be used to characterize how soil salinity affects vegetation, and specifically whether successional trajectories in the old field have been altered by elevated salinity levels.

71.
ASSESSING TRACE METAL CONCENTRATIONS UNDER BRIDGES IN THE PARK RIVER WATERSHED, CT
Linnea Gotberg '14, Bridget Kitchen '15, Simona Fried '16
Faculty Sponsor: Jonathan Gourley

The Park River watershed is a tributary to the Connecticut River. The watershed has been affected by urbanization including pollution of trace metals due to runoff, deposition, point sources and industrial companies. The focus of this study is to analyze how runoff from bridges may be polluting the underlying rivers. Our study quantified the concentrations of lead, zinc, chromium and copper in the stream and bank sediments at four sample sites. Samples of fine-grained sediments were taken upstream of the bridge, under the bridge, and downstream of the bridge.   Results from each location were compared to determine if sediment concentrations increased downstream of the bridge. The concentrations were also compared to sediment quality guidelines and probable effect concentrations to determine if the trace metals have a negative impact on the rivers. Lead and copper had elevated concentrations at two of the locations. Preliminary results suggest that more analysis of the location of the bridge must be done in order to determine the source of pollution.

72.
THE EFFECT OF CLEAR CUTTING ON SUB-ALPINE FOREST SOIL MERCURY (Hg) AND ORGANIC MATERIAL WITHIN THE WHITE MOUNTAIN NATIONAL FOREST, NEW HAMPSHIRE
Daniel Hong '15, Lupita Barajas '17
Faculty Sponsors: Jonathan Gourley, Robert A. Colter (Soil scientist from USDA Forest Service, White Mountain National Forest)

Clear-cutting has been practiced for centuries to provide lumber for our societal need. It is the most economically profitable method and proven to be renewable when practiced responsibly. However, clear-cutting vast parcels of land can have adverse effects on the quality of the soils, which involve increased likelihood of erosions, loss of nutrients due to rapid runoff, disruption of habitats and wildlife, and the cost of aesthetic values. Moreover, with large parcels of trees cut, the soils are more exposed to direct airborne fallout of trace metals such as mercury (Hg). Hg, which comes from the burning of coal, is found throughout the northeast as winds carry airborne Hg eastward from the coal burning power plants of the upper mid-west. In the summer of 2013 with a collaboration of Andy A. Colter from USDA Forest Service, soil samples were collected at three pre-determined sites prior to clear-cut in order to obtain the baseline concentrations of Hg and organic material. The three sites were Millbrook (ME), Douglas Brook (NH), and

Hogsback (NH). A positive correlation between Hg and organic material from our baseline data was observed due to the particulate organic matter fraction accumulating more Hg per unit of organic carbon. In the fall of 2014, we will return to these sites to collect soil samples after the clear-cut. The purpose of this six-year-long study is to observe and analyze the effect of clear-cutting on Hg, organic material, and the relationship between the two in the soils before and after the clear-cut. Milestone's Direct Mercury Analyzer (DMA-80) will be used to quantify the concentrations of mercury, Loss on Ignition to calculate the percentages of organic material, and ArcGIS to map out the distributions of mercury and organic material in the soils.

73.
ANALYSIS OF GROUND TEMPERATURE DATA ON THE TRINITY COLLEGE CAMPUS
Lia Howard '15
Faculty Sponsor: Jonathan Gourley

Global temperature has been rising for the past 150 years. These increasing temperatures have begun to affect earth's delicately balanced climate and ecosystems. To determine if these global trends have begun to alter the local environment, Trinity College's ground temperature data was analyzed in this study. Beneath the soccer fields on campus there are six temperature probes that measure ground temperature. Since June 2007 these probes have recorded the temperature, at six different depths, every hour of every day. Graphs of the average monthly temperature and the maximum and minimum monthly temperature display a slightly increasing linear trend over the past seven years. Graphs of the averages of the first and last quartiles of temperature data per month have also shown increasing trends. The trend lines of the average monthly temperature and monthly minimum temperature steepen with the increasing depths of the probes. These results suggest that the changing global climate has had an increasing, warming effect on local ground temperature. Through graphing and analyzing this data, I have begun to measure climate change on campus.

74.
EDUCATIONAL SIGN PROJECT, KNOX PRESERVE, MYSTIC, CONNECTICUT
Eunice Kimm '14
Faculty Sponsor: Cameron Douglass

The Avalonia Land Conservancy's Knox Preserve near Mystic (CT) has a number of critically important ecological habitats that have fluctuated in condition over time, affecting the numbers and composition of bird populations there. Many visitors come to the preserve to walk or watch birds, but many are unaware of underlying ecological issues at the site. If visitors were more thoroughly educated about these concerns, and the value of the site's bio-diversity, they may become more invested in Avalonia's volunteer land stewardship efforts at Knox. Therefore, the objective of this project was to design, illustrate and install permanent educational signage at the Knox Preserve.

The signs will inform the visiting public about specific habitats at the site, the changes that have occurred there, and the value of protecting these resources. Signs will focus on grassland, salt marsh, and forest/shrubland habitats, as well as also discussing ongoing habitat and invasive plant management activities. Signs will contain carefully researched written material that will inform visitors about common plant and insect species in each of these specific habitats, and discuss bird species that rely on the habitat. These bird species descriptions will be accompanied by one or two original, color ink drawings.

Additionally, bird-banding data collected by Avalonia and volunteers since 1990 were analyzed to identify whether bird species demographics have changed over the years in response to fluctuations in habitat type and quality. Species richness remained constant over the banding years, but species abundance (number of individuals) varied considerably, with peaks found in 1992, 2005 and 2010. Overall, species diversity was relatively consistent, but analysis of species evenness suggested that there were significant changes in bird species demographics over time at Knox Preserve. It appears that dominant species shifted over the banding period, and our next step is to identify possible environmental explanations for these population changes.

75.
MAGNETIC PERSISTENCE SINGNAL IN SOIL
Helen Samuels '16, Kyaw San Min'17
Faculty Sponsor: Christoph Geiss

Soil contains iron minerals that make soils slightly magnetic, and the resulting soil magnetic properties can reflect the environmental conditions during pedogenesis. One possible element to change the magnetic properties of soil is fire. An earlier study of prairie soils discovered that the fires do have effects on soil magnetic properties by increasing the abundance of very fine iron-oxide particles in the topsoil. (Roman et al., 2013). However, it is unknown whether these changes in magnetic properties persist through time. This study looks at the persistence of these magnetic particles over time by analyzing samples of soil from the same sites collected over 6 months apart. We measured low-field magnetic susceptibility, frequency-dependent magnetic susceptibility and Anhysteretic Remnant Magnetization (ARM). Our preliminary results are mixed. Some of the magnetic properties within the grains in the soil samples remain over time, while the abundance of ultra-fine particles, as characterized through frequency-dependent susceptibility decreases within the studied time period.

76.
ACID RAIN AND STORM TRACKING AT TRINITY COLLEGE, HARTFORD, CT
Paula Shea '14, Dan Pidgeon '16

Faculty Sponsor: Jonathan Gourley

Acid rain has been a serious environmental problem in recent history with the increased use of fossil fuels because combustion emits sulfur dioxide and nitrogen oxides. These gases react with water molecules in the atmosphere to form sulfuric acid and nitric acid. Acid rain destroys trees, breaks down building materials and acidifies lakes and streams, which makes them uninhabitable for organisms. Rain samples were collected during Fall 2013 and Spring 2014 from the rain bucket in the Clement Tower at Trinity College. The storms' paths were tracked using a radar tracking application from wunderground.com. Each sample was tested with a pH meter and a Digital Titrator to determine it's acid strength. The samples were analyzed using Ion Chromatography (IC) to measure anion concentrations. The anions found in the samples were chloride, nitrate, and sulfate.

Typically, the pH of rainwater is between 5.0 and 5.5. Most of our rain samples fell slightly below this range. The lowest pH sampled was 3.55 from a storm that occurred on 10/31/13-11/1/13. The highest pH sampled was 5.55 from a rainstorm on 10/7/13. The radar data indicated the low pH storm traveled across the southern Midwest. The storm would have absorbed emissions from the factories it traveled over. The high pH storm traveled across the Great Lakes. We interpret these high pH values to be the result of dilution of atmospheric conditions from evaporation from the Great Lakes. The 10/31/13-11/1/13 storm had the highest concentrations of Nitrate and Sulfate out of all the samples, which made the rain acidic. The 10/7/13 storm had the second lowest concentrations of Nitrate and Sulfate out of all the samples so their concentrations were not sufficient to acidify the rain.

77.
AFFECTS ON SUMMER SOLAR RADIATION LEVELS FROM 2008-2010 IN HARTFORD CT
Tori Shea '15
Faculty Sponsor: Jonathan Gourley

Solar radiation data recorded by the Trinity College weather instruments was analyzed for yearly, monthly, and daily trends. The data of interest was radiation levels in the summer, which was defined as May 1st through August 31st of the years 2008, 2009, and 2010. The raw numbers were recorded in TXT files and were then translated into Excel files. The results overall indicate that the summer solar radiation levels of 2010 were the most intense of the three years. Of 132 days, 48 kWh/m^2/day values were highest in 2010(40% of all days). Weekly averages were also taken, and 2010 had 60% of the highest weekly values. The highest monthly average kWh/m^2/day values for May, June, and July were all in 2010. My report makes suggestions as to why the solar radiation was the most intense in 2010, taking into account weather conditions, air pollution and particulates, and the 11-year solar cycle. I also specifically analyze August of 2010 for these aforementioned characteristics that likely contributed to the month's lower solar radiation levels.

78.
AN INVESTIGATION OF THE SUBSURFACE OF TRINITY COLLEGE USING GROUND PENETRATING RADAR

Jessica Smith '14
Faculty Sponsor: Christoph Geiss

Ground penetrating radar (GPR) is a rapid, high-resolution tool that sends microwave radiation into the ground and records the waves as they return to the surface, and is a cost-effective method for imaging the subsurface. In this study, I used GPR to image some of Trinity's main upper and lower quad in order to look at the geology of the subsurface, and view any man-made features that may be placed there. Trinity College exists on some unique geologic features, next to a ridge likely caused by vertical vault slips, as well as shaping of the hill between the upper and lower campus possibly by glacier movement.

79.
TRINITY COLLEGE (TCCT) SEISMOGRAPH ANALYSIS
Renee Swetz '14, Sakile Broomes '16
Faculty Sponsor: Jonathan Gourley

The Trinity College Seismograph (TCCT) records seismograms from activity around the world, including some of the strongest quakes in Japan, South America, the United States, and Indonesia. While some seismic activity falls in TCCT's Shadow Zone, an area where seismic waves cannot pass through the earth's liquid core, some of the most significant seismic activity is within TCCT's reach.

A caustic point is a location 144.2° to 145.6° degrees away from a seismograph where the seismic waves meet and interfere constructively. As a result the magnitude appears much larger than it otherwise would. It is not often that a caustic point coincides with such an active location, such as TCCT's caustic point in the Indonesian region. Because of this unique location, TCCT's data works to discover information on the patterns of the earth's interior. Those patterns may point to the reason TCCT records some events within the shadow zone, while missing others.

Seismic Analysis Code (SAC) is software that can be used to analyze the data recorded by a seismograph. At TCCT, SAC is being used to interpret the data recorded. SAC is capable of producing information that can otherwise not be seen such as PKP wave arrival times, activity length, magnitude, and depth. Using SAC and Incorporated Research Institutions for Seismology (IRIS), an online seismic database, we've compared earthquakes of similar magnitudes but varying epicenters. Current research is geared towards the completion of an SAC manual that, in the future, can be used to guide caustic point data analysis.

HEALTH FELLOWS

80.

PILOT STUDY TO DEVELOP AN INTERVIEW REGARDING PEDIATRIC BIOREPOSITORY PARTICIPATION & COLLECTION OF SAMPLES: PARENTAL OPINIONS & FACTORS INFLUENCING PARENTAL PERMISSION

Emily Aiken '15
Faculty Sponsors: Sarah Raskin, Maryann McGuire, RN, MPH, Francis DiMario, MD, Connecticut Children's medical Center

A biospecimen is defined as a sample (urine, blood, tissue, cells, DNA, RNA, protein, etc.) collected from a human, animal or plant that is stored within a biorepository for the purposes of laboratory research (Collyar, 2011). Biorepositories hold a collection of these samples that serve as a way to compile health information from various populations and countries. Biorepositories aid in discovering a new means of diagnosing, preventing and treating various diseases and providing a means for genetic analysis to eventually individualize medical treatments (Beskow & Dean, 2008). Pediatric biobanking is of special importance in identifying genetic factors that lead to medical disorders that are often masked until later in a person's life, however that are numerous ethical questions surrounding pediatric participation in biobanking that make it quite difficult to purpose an accurate way of increasing the number of child participants. This study pilot tested an interview script that will be used for a future study that has an overall goal of understanding the limitations and opinions that parents and guardians have pertaining to providing consent for their children's participation in biospecimen collection and research. Interviews were administered to eligible parents and guardians in private conference rooms in the physical and occupational therapy department at Connecticut Children's Medical Center. Participant responses were analyzed with thematic analyses and an assessment of effectiveness in order to examine interview question clarity and ability to elicit appropriate participant responses. At the completion of the pilot study, necessary edits will be made to the interview question to ensure clarity and a low non-response rate in future studies.

81.
PARENTAL ASSESSMENT OF SYMPTOM SEVERITY TO DETERMINE NONURGENT EMERGENCY DEPARTMENT UTILIZATION

Alexis Benedetto '15, Tasmerisk Haught '15
Faculty Sponsors: Sarah Raskin, Maryann McGuire RN, MPH, Karen Rubin MD, Catherine Wiley MD, Jesse Sturm MD, MPH, Erin Cornell MPH, Connecticut Children's Medical Center

Overutilization of the Emergency Department (ED) by children with nonurgent concerns has become a functional problem leading to overcrowding and decreased quality of care in pediatric hospitals (Moskop, 2010). Nonurgent cases in an ED setting are based on a triage scale, which identifies patients with mild fever, cough, cold, vomiting/diarrhea and ear pain as nonurgent (Berry et al., 2008). Parents do not have a similar system of identification and often overestimate severity and worry for their child's symptoms and take them to the ED when they could wait for an appointment with a Primary Care Physician (Moskop, 2010). This study looks to further understand parents' perceptions of severity and worry for their child's symptoms in relation to the chosen treatment facility. Parents and guardians at Connecticut Children's Medical Center (CCMC) in both the ED and Primary Care Center (PCC) will be interviewed for a pilot study between March and May of 2014. The interview results will aid in understanding of the frequency of use of the ED and PCC in relation to perception of severity and worry for

symptoms in the current sample and will also be used to develop a larger scale study of nonurgent ED use.

82.

HEALTH LITERACY EFFECTS ON NONURGENT UTILIZATION OF THE EMERGENCY DEPARTMENT
Tasmerisk Haught '15
Faculty Sponsors: Sarah Raskin, Maryann McGuire, RN, MPH, Karen Rubin, MD, Jesse Sturm, MD, MPH, Catherine Wiley, MD, Erin Cornell, MPH, Connecticut Children's Medical Center, Alexis Benedetto '15

The aim of this study is to develop a methodology for an interview measure that will be used to investigate the factors that influence the choice of parents to use the Emergency Department (ED) or Primary Care Center (PCC) for nonurgent concerns at Connecticut Children's Medical Center (CCMC). The Parent Health Literacy Activities Test (PHLAT-8), a validated literacy and numeracy test, was administered, in conjunction with a semi-structured interview, to ten eligible English-speaking participants in the PCC and one eligible participant in the ED. Eligible participants found in the PCC received an average score of 5.3 ± 2.0 out of 8 on the PHLAT-8. The one ED participant scored 4. Ten out of eleven participants got the first question on the PHLAT-8 correct while only one out of eleven got the second question correct. The PHLAT-8 will be administered to at least nine additional participants eligible in the ED. Once the additional interviews are administered, the results will be analyzed in order to gain a better understanding of the role that health literacy plays in the continuous care of patients at CCMC.

83.

AN EVALUATION OF METHODS USED TO IMPROVE PEDIATRIC CRANIOCERVICAL MEASUREMENT FIDELITY
Ryan Geelan '15
Faculty Sponsor: Sarah Raskin, Maryann McGuire, RN, MPH, Jonathan Martin MD, Connecticut Children's Medical Center

Radiologists use various measurements that demonstrate the distances between skeletal landmarks to diagnose abnormalities in the craniocervical junction (CVJ). The ability to properly make these clinical measurements on a plain radiograph can greatly influence a diagnosis. Previous research has demonstrated a low level of fidelity in these clinical measurements. This pilot study evaluated various attempts to improve the fidelity of three clinical measurements, the atlantodental interval (ADI), the neural canal width (NCW), and the basion-axial interval (BAI). Three raters were asked take these measurements on twenty radiographs of 8-16 year old patients. The raters were given standardized definitions of the measurements, and a rotational quality measurement (RQM) that was developed in order to eliminate poor quality radiographs. In comparison with average intraclass correlation coefficients from previous research, both the standardization method and the rotational quality measurement demonstrated significant improvement. The findings indicate that both attempts at improving the

fidelity of clinical craniocervical junction measurements were successful enough to warrant consideration of a full-scale study.

84.
AN OVERVIEW OF THE SYNTHESIS OF ORGANIC NANOCARS AS ORIGINALLY DESCRIBED BY SHIRAI et al.
Ryan Geelan '15
Faculty Sponsor: Cheyenne Brindle

Original Synthesis Described in the Article "Directional Control in Thermally Driven Single-Molecule Nanocars"

The original article aimed to develop a type of nanocar that would exhibit rolling motion, as opposed to previous versions of the molecular vehicle that relied on stick-slip or sliding translation to move. These researchers relied on fullerene-based wheels and alkyne axles to allow the vehicle to roll instead of slide. The synthetic process by which this new version of nanocar was produced is presented, along with ^{1}H NMR and ^{13}C data to support the proposed structure.

85.
AN INVESTIGATION OF THE RELATIONSHIP BETWEEN ANTIBIOTIC RESISTANT GRAM-NEGATIVE BACTERIA AND PATIENT RISK FACTORS AT CONNECTICUT CHILDREN'S MEDICAL CENTER (CCMC)
Sara Khalil '15
Faculty Sponsors: Sarah Raskin, Maryann McGuire RN, MPH, Nicholas Bennett MBBChir, PhD, Connecticut Children's Medical Center

Bacteria are found in great abundance throughout the body and can be harmless, beneficial or pathogenic. The pathogenic role of bacteria has been exacerbated through antibiotic resistance and presents major threats to healthcare. Antibiotics inhibit enzymes that catalyze specific metabolic processes in bacteria, targeting ribosomal functions and nucleic acid, cell wall, or folate syntheses. However, bacteria have acquired specific biological mechanisms that render these antibiotics ineffective.

 The prevalence of multidrug resistant Gram-negative bacteria continues to increase globally, such that infections with these bacteria, specifically E.coli, Pseudomonas, Enterobacter and Klebsiella, have become a leading cause of mortality and morbidity worldwide. The major resistance mechanisms in Gram-negative bacteria are extended-spectrum β-lactamases (ESBLs), ampC β-lactamases and carbapenemases. To manage this problem, microbiology laboratories isolate and characterize bacterial pathogens and identify these resistance mechanisms.

Connecticut Children's Medical Center (CCMC) lacks data that correlate specific patient social and medical risk factors to bacterial resistance. As a result, the aim of this study was to describe the population of children presenting to CCMC who have drug-resistant Gram-negative infections, in terms of medical history and other patient factors.

We obtained historical culture results for isolates of the four Gram-negative bacterial strains E.coli, Pseudomonas aureuginsoa, Enterobacter spp. and Klebsiella spp. from the microbiology laboratory computer system and identified them for significant beta-lactam resistance. The data was then filtered according to information on the bacterial species and risk factors. Relative risk of acquiring resistance based on the various risk factors was calculated using the population, with non-resistant infections used as a control. Statistical analysis was then done using the chi-square test in order to assess significance rates. Multi-variant analysis was also performed in order to control for confounding variables and population characteristics.

Focusing on drug-resistant Gram-negative infections and looking at relationships between risk factors and antibiotic resistance patterns will hopefully encourage physicians to be more cautious in prescribing treatment for their patients.

86.
QUALITY IMPROVEMENT PLAN FOR INFLUENZA VACCINE ADMINISTERED TO HUMAN IMMUNODEFICIENCY VIRUS (HIV) PATIENTS
Lorena Lazo de la Vega '14
Faculty Sponsors: Sarah Raskin, Maryann McGuire RN, MPH , Jack Ross, MD, Moneca Liz
Hartford Hospital

Patients infected with the human immunodeficiency virus (HIV) need to be screened by the Health Resources and Services Administration's HIV/ acquired immune deficiency syndrome (AIDS) guidelines. One of the guidelines is to administer the influenza vaccine because these patients have a low T-cell count. However, the preliminary chart review showed that 194 out of the 453 total patients in the sample had not received the influenza vaccine during the flu season (October 1st to March 1st). The following information on these patients was gathered: gender, ethnicity/race, age, reason for not getting the vaccine, and information concerning patient visits during the flu season such as the name of the provider. Results indicated that 12% had gotten the vaccine; 9% were given the opportunity but either declined or deferred; 28% did not visit the hospital during flu season and the remaining 51% did not receive the flu vaccine even though they had visited the hospital. 12% of the patients had incorrectly documented records because they had received the vaccine. The advanced practice registered nurses (APRN) had seen 21 of the 23 patients with these records. Therefore, the APRNs should focus on documenting the vaccine under the immunization section of the chart. The chi-squared test was performed to determine whether the sample population would rather decline the vaccine or have it administered. Therefore, it was shown that Hispanic males would rather decline the vaccine. More specifically, 41-60 year old African American female patients would rather decline the flu vaccine. If the patient chooses to decline, the declination section of the amended immunization consent form should be signed. To address patients who did not visit the hospital during the flu season, the staff will help with reminding patients the flu season is coming up and if they want to schedule an appointment during the season. For the patients who did not get the vaccine, a logbook will be implemented to make sure there is no shortage of vaccines. The front desk staff will also be required to ask the patient checking in for an appointment if they had gotten a flu shot. The higher the number of visits to the hospital, the fewer patients the providers missed to vaccinate. However, the providers need to decrease the number of patients who are left unvaccinated. This quality improvement plan was developed by examining the breakdown of the

patients who did not get the influenza vaccine. Therefore, if this plan increases the percent of patients who get the flu vaccine, the hospital will be able to say that the care given to each patient has not only the best interest of the patient but also addresses safety for the community.

87.
LOADING PEPTIDES INTO *DICTYOSTELIUM DISCOIDEUM* USING PINOCYTOSIS, ELECTROPORATION, MYRISTOYLATION, AND CELL PENETRATING PEPTIDES
Lorena Lazo de la Vega '14
Faculty Sponsor: Michelle L. Kovarik

The phospholipid bilayer of the cell is fluid and allows transport of small, hydrophobic compounds across the membrane. However, larger molecules such as peptides cannot cross the bilayer as easily. Our goal is to identify and optimize a method for loading exogenous peptides, such as reporters, hormones, or drugs, through the cell membrane. For these studies, we are using *Dictyostelium discoideum* as a model organism to test four peptide loading methods: pinocytosis, electroporation, myristoylation, and cell-penetrating peptides. Pinocytosis uses changes in osmotic pressure to load the peptides through vesicles. The cells were exposed to a hypertonic solution for 10 min, 30 min, 1 hour, 4 hours, 17 hours, or 21 hours to load the peptide. Electroporation uses an electric field to create pores in the cell membrane that allows the diffusion of the peptide into the cell. The three different buffers used were H-50, HEPES and a sucrose phosphate buffer which were tested at electric field strengths of 8.50, 1.25 or 3.13 kV/cm, respectively. To follow up on promising initial results, the HEPES and sucrose phosphate buffers were additionally tested at 0.50, 0.63, 0.88, or 1.0 kV/cm. Myristoylation takes advantage of the cell membrane fluidity; the myristoylated peptide inserts itself into the membrane to allow the peptide to flip into the inside of the cell. Similarly, the cell penetrating peptide helps transport cargo into the cell through endocytosis or direct penetration. Both methods are ongoing projects, however, the incubation times in the loading solutions will range from 10 minutes to 1 hour. These methods were tested for cell viability and highest percent of fluorescent peptide loading, which was measured under fluorescence microscopy. Pinocytosis stresses the cell through the varying osmotic pressure, and loading was very slow. Although, electroporation showed efficient loading, this method disturbs the cell membrane and stresses the cells. We expect that the methods using the myristoylated peptide or the cell penetrating peptides will load the peptides more gently but with comparable effectiveness. Once we have an optimized method for loading peptides, we will use labeled substrate peptides as reporters to learn more about enzymatic activity and better understand signaling pathways implicated in disease.

88.
CORRELATING BODY MASS INDEX WITH FACTORS DESCRIBING CHRONIC PAIN IN THE PEDIATRIC POPULATION AT THE CCMC CHRONIC PAIN CLINIC

Taylor Murtaugh '14
Faculty Sponsors: Sarah Raskin, Maryann McGuire RN, MPH, Jessica Guite, Ph.D., William Zempsky, MD., MPH., Ashley Panteleao, BA., James Santanelli, MPH, Connecticut Children's Medical Center

The research goal was to study the relationship between obesity and factors describing chronic pain in the pediatric population at the chronic pain clinic at Connecticut Children's Medical Center. The factors of interest included pain severity, pain frequency, pain burden, disability and catastrophizing and their correlation with obesity described through body mass index (BMI) percentiles. A retrospective chart review was done on 130 patients between the ages of 8-18 years old who received a multidisciplinary team evaluation between January 1st and December 31st of 2013. Data including demographic information, height/weight/BMI/BMI percentiles, past medical history, sleep disturbance, school attendance, diagnosis, medical recommendations, and questionnaire scores was collected. Basic descriptive statistics were done in order to describe the sample population and correlations were investigated between BMI and BMI percentiles and patient's scores on questionnaires including the Pain Frequency-Severity Duration Scale (PFSDS), the Functional Disability Inventory (FDI), the Pain Catastrophizing Scale (PCS), and the Pain Burden Interview (PBI). The most common patient being seen at the pain clinic at CCMC can be described as a white adolescent female with less than one year of pain. Most patients at the clinic were experiencing head, abdominal/pelvic/flank, and back pain with 20.6% of the population experiencing widespread pain. The average BMI percentile for the population was 71.6 with 43.0% and 20.6% of the population falling greater than the 85th and 95th percentile respectively. No correlations were found between BMI percentile and the pain questionnaire scores. Significant correlations were found between patients above the 85th percentile and males and the Adolescent Pain Catastrophizing Scale (APCS) (0.310 $p<0.05$, n=46; 0.376 $p<0.05$ n=35). The percent of obese patients (20.6%) at the CCMC pain clinic was seen to be slightly elevated in comparison to the national average (18%). It was concluded that being overweight and obese or a male in the chronic pain pediatric population may put one at risk for increased catastrophizing and clinical attention may need to be considered for this specific subset of patients in regards to catastrophizing.

89.
SYNTHESIS OF DIBARRELANE: THE THREE MAJOR SYNTHETIC STEPS
Taylor Murtaugh '14
Faculty Sponsor: Cheyenne Brindle

The focus is presenting the three major synthetic steps in synthesizing dibarrelane, work done by the Suzuki group in 2014. The synthesis of dibarrelane is of interest due to its highly symmetric cage similar to dodecahedrane and fullerene. In addition, dibarrelane can be used later to form other polycyclic hydrocarbons with D$_{5h}$-symmetry and axial chirality. The first synthetic step forms the dibarrelane skeleton through an intramolecular reverse-electron-demand Diels-Alder (REDDA) reaction of a masked o-benzoquinone (MOB). After the skeleton is formed, a Clemmensen reduction is performed to from hydrocarbons from carbonyls. Lastly, a Barton decarboxylation is done in order to remove the primary alcohol, forming the final product of dibarrelane. The structure of dibarrelane was verified using its precursor due to the crystals of

dibarrelane not being suitable for x-ray analysis. Dibarrelane was determined to have a twisted skeleton due to diminished hydrogen diaxial interaction resulting in C_2 symmetry rather than the expected C_{2v} symmetry. Overall, the Suzuki group was able to successful synthesize dibarrelane in three major synthetic steps in an overall scheme of eleven steps.

90.
IMPLEMENTATION OF ELECTRONIC HEALTH RECORDS' AFFECT ON PEDIATRIC RESIDENTS' LEARNING EXPERIENCE
Selena Patel '15
Faculty Sponsors: Sarah Raskin, Maryann McGuire RN, MPH, Dr. Keri Wallace, MD, Rich Uluski, MD, Connecticut Children's Medical Center

The Electronic Health Record (EHR) is a technological advancement that is currently altering the delivery of healthcare worldwide. The implementation of EHR affords many benefits to both medical professionals and patients alike: EHR organizes, systematizes, and streamlines patient care. Many studies have looked at the impact that EHR has on delivery of patient care, patient satisfaction, quality and improvement in medicine; however few have looked at the impact that EHR has on the resident educational experience. The purpose of this study is to describe the impact that implementation of EHR had on the medical education of pediatric residents in the ambulatory setting.

Pediatric resident evaluations of their educational rotations are collected anonymously using the program, My Evaluations. Residents' evaluations are used that evaluate medical education and teaching of the rotations, during May 7, 2012 to October 22, 2012 (Pre-implementation Period), October 22, 2012 to April 5, 2013 (Implementation Period), or April 6, 2013 to September 22, 2013 (Post-implementation Period). Data obtained includes the responses from the following rotation evaluation questions: 1) Clinical teaching was provided by the supervising resident. 2) I was appropriately supervised by the attending. Two one-way analysis of variance (ANOVA) tests were run, for Question 1 and Question 2, to determine if there were any significant differences between the three time Periods. For Question 1's results, there was no significantly statistical difference of the resident's learning experience between the time Periods ($F(2,133) = 0.1835$, p = 0.83); for Question 2's results, there was also no significant statistical difference of the learning experiences between the time Periods ($F(2, 133) = 0.8592$, p = 0.43). The reasons for insignificant changes between the Periods could be due to the small population size used and the narrow-valued scale used. Future studies should look abstract the residents' subjective "Additional Comments" (free text) for a descriptive analysis to report on more insight of their experience.

91.
EPIDEMIOLOGY OF PEDIATRIC AND ADOLESCENT CONCUSSION IN AN OUTPATIENT YOUTH SPORTS MEDICINE CLINIC

Nick Pettinelli '15
Faculty Sponsors: Sarah Raskin, Maryann McGuire RN, MPH, Matthew Solomito, Connecticut Children's Medical Center

A large number of concussions, about 3.8 million, are estimated to occur in the U.S. alone from sport-related activities ranging from every experience level. While an expansive amount of literature exists regarding the nature of concussion in adults, comparably little has been done to research how these mild traumatic brain injuries manifest themselves in pediatric and adolescent athletes. This retrospective study examined 122 athletes ages 11-18 from the Elite Sport database who had received concussions from 2010-2012 playing football, hockey, lacrosse, soccer, and basketball. After comparing each sport to one another based on the symptoms present, the results suggest that youth lacrosse athletes express more difficulty with memory than soccer and hockey, while hockey players exhibited more irritability to stimuli than soccer players. Soccer players were also found to have a higher chance of developing headache symptoms post-concussion more than any other sport. These findings reveal more information about what is known of child and adolescent concussions, and may change the perspective of parents and medical professionals alike about the risks associated with select youth contact sports.

92.

CONNECTICUT TEEN MOTOR VEHICLE FATALITIES AND GRADUATED DRIVER LICENSING LAW NONCOMPLIANCE

William Schreiber-Stainthorp '15
Faculty Sponsors: Sarah Raskin, Maryann McGuire RN, MPH, Brendan T. Campbell, MD, MPH, Connecticut Children's Medical Center

Motor vehicle accidents are the leading cause of death for American teenagers. The introduction of graduated driver licensing (GDL) laws has lowered fatal crash rates for teens, but thousands of teen drivers and their passengers die every year. The purpose of this study is to investigate whether, and to what extent, breaking graduated licensing laws increases the likelihood of driving fatalities for teenage drivers. Our hypothesis is that the majority of fatal crashes occur when GDL laws are broken.

We retrospectively analyzed data from all Connecticut motor vehicle deaths involving a teenage driver in the time period between August 2008 and December 2012. A master crash file was assembled based on information from the Department of Transportation, which provided the dates of fatal accidents as well as the dates of birth of those involved. In order to obtain supplementary information, records from the Office of the Chief Medical Examiner were obtained and studied in conjunction with news accounts and personal directories. Identifying information will be sent to the Department of Motor Vehicles (DMV), which in return will provide data on the licensing status of each teen driver involved in a fatal crash. Based the licensing data we obtain from the DMV, we will determine which drivers were in violation of GDL laws, which will allow us to calculate the fraction of teenage drivers subject to GDL laws who exhibited noncompliance at the time of their fatal crash.

93.
PARENTAL OPINION ABOUT PEDIATRIC BIOSPECIMEN PERMISSION
Julia M. Vresilovic '14
Faculty Sponsors: Alison J. Draper, Francis J. DiMario, Jr., M.D.; Pediatric Neurology, Division Chief Emeritus; Connecticut Children's Medical Center

Background: Patients' opinions about the informed consent process for biobank research has had limited review to determine when and how consent should be obtained from donors. The available literature has opinions predominantly from adults about their own biospecimens. This study focused on expanding the current consent opinion from a parental permission point of view. Our aim was to find whether or not one-general consent would be preferred over specific itemized permission decisions, and whether factors such as gender, race, or prior experience with consent would influence participants' opinions about obtaining biobank specimens for research. *Methods:* After IRB approval a prospective survey was completed of parents with children being treated at CT Children's Medical Center. The survey of 18 multiple choice and Likert scale questions was administered between the months of March to May of 2013, compiled and analyzed. *Results:* A convenience sample of 147 English comprehending parents volunteered to complete the survey. The majority of parents wanted to know who (79%), what (76%), where (73%), and how (74%) the sample was processed and further wanted to know to whom their child's medical history would be provided (84%). While 65% allowed general research on a blood sample, only 43% agreed to it for other tissue research, 35% for genetic-based research and 28% for stem cell research. Only half of those surveyed would allow unrestricted future research. While parent gender did not affect the consenting process both race and prior experience did. The white population compared to non-white was more likely to allow research (82% vs. 45%, $p < 0.0001$), but both groups had similar concern for knowing who, what, where, and how the sample was processed. Consent for research in those who had previously given parental permission for research was 81% compared to 59% to those who had not ($p < 0.003$). *Conclusion:* While the majority of surveyed parents would allow for blood samples to be taken for research, the large majority of parents would prefer a more detailed consent noting what disease would be studied, who would do the research, where it would be done, and for how long the sample would be used. The survey showed both a population and experience bias. *Additional Work:* The survey of 18 multiple choice and Likert scale questions was translated into a Spanish equivalent. After IRB approval, it was administered to Spanish comprehending parents between the months of April and May of 2014. This additional data will help to target the large population of native Spanish speakers in the Hartford area. Since there was a found significance between the opinions of Hispanic and non-Hispanic parents in allowing general research (46% vs. 76%) this new data will allow for further racial comparison.

MATHEMATICS

94.

PRE-STORM ESTIMATION OF POWER OUTAGES USING STATISTICAL MODELS
Pranav Bhandari '17, Subekshya Bidari '17
Faculty Sponsor: Alexandar G. Baldenko

Power outages are a major problem during the occurrence of a storm. Locations in Connecticut have experienced power outages of up to 11 days during past storms. During the power outages, the power company: Connecticut Light and Power (CL& P), has to make sure that the areas with power outages get the power back as soon as possible. For this they want to estimate the number of outages, Pre-estimation helps utility company to be prepared and maintain resources adequate for the restoration of power immediately after the storm and also finding the probability of damage to poles at some area help to relocate the poles to some other safer area. Mathematical model using regression techniques and past data can be used to predict the outages. First, a model was created to analyze the data, two different models generalized linear model and generalized additive models can be used with Poisson regression. The models were created using programming language 'R', where the accuracy of the model to analyze the data can be tested using its AIC (Akaike Information Criterion) value, which is a measure of the relative quality of the statistical model to see how accurately the model fits the data. A model with lowest AIC value was selected and used to predict the outages by dividing the data into train and test sets. The model was then developed on the train data set was used to predict and the number of outages for the test data set. The accuracy of prediction was tested using MSE (Mean Squared Error), where MSE $=\sum$(actual outcome – predicted outcome)^2. This testing is also called the k-fold test where the data set is divided into k parts and each part is tested and average MSE is calculated. The model for which the average MSE is lowest is our preferred model for prediction.

NEUROSCIENCE

95.
THE EFFECTS OF ALCOHOL CONSUMPTION ON PROSPECTIVE MEMORY IN COLLEGE STUDENTS
Sharmy Dhaliwal '16
Faculty Sponsor: Sarah Raskin

Prospective memory is the ability to remember to perform an action at a designated time in the future. This study examines the effects of alcohol use on prospective memory in college students by looking at the correlation between alcohol consumption and students' performance on the Memory for Intentions Test (MIST). Participants answered questions regarding the frequency of consumption, the number of drinks consumed, the effects consumption may have had, and other substances used. They were also asked to provide a daily breakdown of how much was consumed to determine if they were binge drinkers and what their maximum and minimum levels of consumption were. Following these two tasks, participants completed the MIST, where they were asked to perform certain tasks at designated times. The MIST tested for their responses using time intervals, event-based cues, time-based cues, action-based cues, and verbal-based cues. Depending on the results, methods for improving prospective memory in college students may be developed and consumption levels which cause impairment may be determined.

96.
SEX-DEPENDENT EFFECTS OF THE KETOGENIC DIET IN THE EL MOUSE MODEL OF AUTISM AND EPILEPSY
Jessica Fortin '14
Faculty Sponsors: Susan Masino, David Ruskin

BACKGROUND: Autism spectrum disorder (ASD) is a developmental disorder that affects at least 1 in 88 children. The disorder is characterized by behaviors such as deficits in sociability, communication, and increased self-repetitive behavior. Children with autism often have seizures, making epilepsy a common comorbidity with autism. The ketogenic diet (KD) is a metabolic therapy high in fats and low in carbohydrates and proteins that is used in the treatment of childhood epilepsy, and previous studies of a strict KD in animal models of autism or epilepsy have elucidated beneficial effects of the diet. The effect of a KD on behavioral characteristics of autism has never been tested before in EL mice, which was recently discovered to be a model of combined autism and epilepsy. The goal of the current study was to evaluate the effect of a strict KD on weight and blood markers as well as autistic behaviors of both sexes in the EL mouse model of autism.

METHODS: We investigated the effect of a strict KD on weight and blood markers as well as autistic behaviors in male and female EL mice and a control strain of mice. We obtained weight and blood data before dietary treatment and after three weeks on the KD or control diet (CD). When the mice reached eight weeks of age we used an established battery of tests aimed at analyzing sociability (three-chamber time and social approach), communication (social transmission of food preference), and self-repetitive behavior (single and three-chamber grooming). Student t-tests and ANOVA with post-hoc analyses were used where appropriate.

RESULTS: Sex differences in blood chemistry and behavior were noted in EL mice. Both male and female EL KD-fed mice had increased ketone levels compared to their EL CD-fed counterparts. EL KD-fed females exhibited decreased glucose levels compared to EL CD-fed females but this effect was not seen in males. Female mice displayed beneficial behavioral effects of the KD in some tests, but no effects were seen in EL KD-fed males.

CONCLUSION: Our study suggests that behavioral differences in the EL strain on a strict KD could be due to sex differences in blood glucose and ketone levels. The EL mice also produced mixed results on behavioral characteristics of autism as assessed by the current battery of tests. Further study is necessary to characterize this mouse model and the effect of the KD. Other rodent behavioral studies should also take care to analyze sex differences in their data.

97.
OBJECTIVE CLASSIFICATIONS OF THE DRINKING BEHAVIOR OF COLLEGE AGED STUDENTS
Sarah Isaac '14

Faculty Sponsors: Alexander Baldenko, Sarah Raskin

The purpose of the Brain Alcohol Research in College Students study is to evaluate drinking trends, memory and cognition in young adults, 18 to 25 years of age. As part of this study more than 1000 first year college students were tested using a battery of computerized cognitive and memory tasks. Each of these participants were retested their junior year using exactly the same battery of tests. Previously, students were categorized into subjective groups based on drinking behavior, and analyses were performed in order to determine meaningful differences between groups. In this study, a zero-inflated Poisson generalized linear model as part of the R package crimCV objectively classified individuals into new groups, which were the subject of analyses. It was determined that these groups showed significant differences on measures of impulsivity. This may be useful in determining the underlying causes of problematic drinking behavior and help to target specific groups for intervention.

98.
RELATIONSHIP BETWEEN PHYSIOLOGICAL AND CLINICALNMEASURE OF PROSPECTIVE MEMORY IN INDIVIDUALS WITH TRAUMATIC BRAIN INJURY AND HEALTHY ADULTS
Navneet Kaur '12, Consuelo Pedro '15, Erin Aisenberg '16, Tessa Bloomquist '16
Faculty Sponsor: Sarah Raskin

Prospective memory (PM) requires the ability to form and later realize intentions that are delayed over time (Einstein & McDaniel, 1990). The purpose of this experiment was to examine the underlying brain activity related to PM using an event-related potential paradigm (West & Ross-Munroe, 2002) compared to a clinical measure, the Memory for Intentions Screening Test (MIST) (Raskin, Buckheit, & Sherrod, 2011) in both healthy adults (HA) and individuals with traumatic brain injury (TBI). Results revealed that individuals with TBI performed significantly worse than HA on all variables of the MIST and also showed reduced amplitude on ERPs that have been associated with intention formation and intention retrieval when compared to HA. In addition, total score on the MIST was related to variables associated with attention retrieval. Overall, these findings suggest that individuals with TBI have deficits in PM compared to HA and that the MIST may be a valid measure of underlying brain processes in PM.

99.
THE MEMORY FOR INTENTIONS SCREENING TEST
Constance Ky '17, Rey Llena '15, Jennifer Reavis '17
Faculty Sponsor: Sarah Raskin

The Memory for Intentions Screening Test (MIST) is a 24 minute long test, designed to be a clinical measure of prospective memory. It has been proven effective in discerning differences among subjects with various neurological conditions, such as traumatic brain injury and multiple sclerosis. It is able to test prospective memory through time versus event cues and action versus verbal responses. For some instances, as in a hospital clinic, 24 minutes is too long to spend on one test. Therefore, the goal of this research was to shorten the MIST in a way that was still

effective in measuring prospective memory. The new version places a greater emphasis on comparing time versus event cues because action versus verbal responses tended to give similar results. The shortened test is twelve minutes in length, and shows promise in giving accurate prospective memory results compared to the results from the original, 24 minute long MIST.

100.
ANALYZING THE EFFECTS OF WILD-TYPE GLIAL CONDITIONED MEDIA MOLECULAR WEIGHTS ON SH-SY5Y CELLS
Francesca Marino '16
Faculty Sponsor: William H. Church

Various studies have concluded that there are direct correlations between neuronal degradation and rates of neurodegenerative disorders; Parkinson's Disease is a primary example of such a disorder. Recently, astrocytes have been shown to produce a protein secretion that has been strongly associated with increased rates of neuronal apoptosis. In an effort to enhance understanding of the molecular basis of this secretion, Amicon Ultra Centrifugal Filters were used to separate the astrocyte conditioned media (ACM) based on molecular weight. The ACM was separated into fractions that contained substances less than 50 kilo-daltons (kD_A), and less than 100 kD_A. SH-SY5Y human neuroblastoma cells were treated with either regular cell culture media, ACM, ACM ($<50kD_A$), or ACM ($<100kD_A$) for 24 hours. The cells were stained with a live cell/dead cell assay to establish cell viability. Cells were counted using the images observed under the Nikon light microscope. The average dead to total cell ratios were calculated for each treatment level and compared using statistical t-tests. Results showed a significant difference between the regular media, as well as the wild-type glial cell media, and the $<100kD_A$ treatment. This suggested that the apoptosis-inducing factor in the astrocyte secretion has a molecular weight of less than $100kD_A$, but more than $50kD_A$. At this point, further studies are recommended to determine the implications of these results in Parkinson's Disease.

101.
ANALYZING THE POLY-(I:C) MOUSE MODEL OF AUTISM
Michelle Murphy '14
Faculty Sponsors: Susan Masino, David Ruskin

Autism spectrum disorder (ASD), commonly referred to as autism, is a neurological disorder that is characterized by the core symptoms of impairments in sociability and communication, as well as restricted and repetitive behavior. Autism-like symptoms are seen in the poly-(I:C) mouse model, developed based on epidemiological observations that immune challenges during pregnancy increases the risk of autism in offspring. Poly-(I:C) is a synthetic analog of double stranded RNA that acts as a viral mimic to induce an immune response without an active infection. When a pregnant mouse is exposed to poly-(I:C), it causes maternal immune activation (MIA) which releases pro-inflammatory factors and activates immune cells in the decidua. These changes, along with other alterations in maternal endocrine factors, alter fetal development resulting in adult offspring demonstrating the core symptoms of autism. This study attempted to reproduce the MIA model in mice for use in dietary anti-ASD treatments. Timed pregnancies in

C57Bl/6 mice were determined by the presence of a vaginal plug. The pregnant mouse was left undisturbed until E9-10, when pregnancy was confirmed by weight gain. Pregnant mice were injected with 5mg/kg of either poly-(I:C) or saline on E10.5, E12.5, and E14.5. Behavioral testing on MIA (n=11) and control (n=3) offspring was conducted at eight weeks of age. MIA offspring were not social and had high self-directed behavior, although they performed well in a communication test. Comparisons with control mice were hampered due to the small number of subjects. Experiments will proceed with some future MIA offspring receiving experimental diets.

102.
THE EFFICACY OF VARIOUS WELL PLATE COATINGS IN CULTURING, TREATING, AND STAINING HUMAN NEUROBLASTOMA CELLS

Sheila Njau '17, Thomas Naragon '17
Faculty Sponsor: William H. Church

A significant aspect of successful cell culture is choosing the optimum substrate onto which the cells adhere during the course of the experiment. The purpose of present experiment is to determine which type of substrate coating was most effective for culturing SH-SY5Y cells. SH-SY5Y cells (human neuroblastoma cells) were grown on Nunclon delta-coated or poly-D-lysine coated 24 well plates as well as a 6 well Biocote-coated plates. Cells were then treated with hydrogen peroxide for twenty four hours. Cell viability was determined using two different fluorescent staining methods: an ethidium bromide/calcien AM live cell/dead cell assay or the Hoechst 33342 assay. Cells were counted from three images per well from photographs taken using a fluorescence microscope and the average number of the cells was used to determine cell death ratios. Coatings were evaluated based on reproducibility of the hydrogen peroxide data as well as overall morphological of the cells at the end of the treatment period.

103.
PURINE DETERMINATION BY HPLC

Jake Rubin '15, Amina Kureshi '16
Faculty Sponsor: William H. Church

Purine neurochemistry had been implicated in the therapeutic effect of the ketogenic diet (KD). A high performance liquid chromatography (HPLC) method for determination of purine compounds in discrete brain regions was developed. Separation parameters were optimized for the quantification of adenosine, guanine, hypoxanthine, inosine, uric acid (UA). The HPLC method was evaluated based on limits of detection, sensitivity, and reproducibility. Representative samples from a KD brain sample and a control sample are presented. Knowledge of the effect of the ketogenic diet on purines levels in the brain will be used to further investigate the mechanism of the anticonvulsant effects of KD in the brain.

104.
THE EFFECTS OF EVEN- AND ODD-NUMBERED MEDIUM CHAIN TRIGLYCERIDE KETOGENIC DIETS ON AUTISTIC BEHAVIORS IN A MOUSE MODEL

Lisa Saa '14
Faculty Sponsors: Susan Masino, David Ruskin

A ketogenic diet (KD), which has restricted carbohydrates, sufficient protein, and a very high fat content, causes the body to switch from a glucose-based metabolism to a ketone-based metabolism. The KD has been effective at reducing seizures in epileptic patients. Autism is comorbid with epilepsy and characterized by restricted and repetitive behaviors, low sociability, and deficits in communication. A strict version of the long-chain triglyceride (LCT) KD has been effective at reducing autistic symptoms in BTBR T+tf/J, an autistic model of mice. However, a more moderate and clinically relevant version of the LCT KD has been shown to be ineffective in this model. Recent studies suggest that a KD derived primarily from medium chain triglycerides (MCTs) will effectively reduce the severity of autistic symptoms. A MCT KD may cause an increase in ketone bodies, acetyl-CoA, ATP, and level of ketosis similar to a LCT KD. However, MCTs are hydrolyzed faster than LCTs and provide more kilocalories per gram of fat, allowing it to maintain clinical relevancy. Furthermore, only odd-numbered MCTs are anaplerotic substances, meaning that the metabolites of the Krebs cycle are refilled. Thus, the goal of the study was to determine a) the role of anaplerosis on ketosis and the KD and b) if either even- or odd-numbered MCTs can result in a beneficial alleviation of autistic symptoms in mice.

BTBR T+tf/J mice were given one of the following metabolic treatments for three weeks: pellet chow (control), pellet chow balanced with 17% cellulose, 17% heptanoic acid KD (odd-numbered MCTs), and 17% octanoic acid (even-numbered MCTs). A battery of behavioral tests was given in order to quantify the core symptoms of autism, including deficits in sociability, communication, and motor control as well as self-directed repetitive behaviors. Furthermore, glucose and ketone blood analysis were conducted in order to elucidate the mechanisms of the diet.

The mice in the pellet control group did not clearly exhibit autistic behaviors as expected, primarily in the three-chamber test for sociability and self-directed repetitive behavior. However, the heptanoic and octanoic treatment groups spent significantly more time engaged in frontal contact than the cellulose control.

The results of the current study are conflicting and inconclusive. The effect of even- and odd-numbered MCT KDs should be investigated and expanded further in order to understand the impact of this metabolic treatment on alleviating autistic symptoms.

PHYSICS

105.
THE RADIO SKY

Chris Buesser '14
Faculty Sponsor: Barbara Walden

We examine a number of objects in the sky with a 2.3 meter radio telescope in the 1420MHz range. We will look at emission spectra of a number of strong radio emitters in the sky and look for anything out of the ordinary. We examine the sun, Andromeda, a number of pulsars, and a number of messier objects.

106.
VERY LOW FREQUENCY RADIO ASTRONOMY
Derek DeCagna '14
Faculty Sponsor: Barbra Walden

Very Low Frequency (VLF) radio astronomy was explored throughout the course of this semester in an attempt to monitor solar flare activity. Our investigation began with the construction of a VLF antenna through which we were able to observe and record emitted radio signals. Methodology included Fast Fourier Transform (FFT) signal analysis through both a complex signal analyzer and standard computer sound card. Consequently, the detection limits of our VLF antenna are now known, we have tested and acquired too distinct methods of sampling and analyzing data, and have gained insight into the field of radio astronomy for future research.

107.
SOLAR ENERGY DIFFUSION AND EFFECTS ON CLIMATE CHANGE
Bobby Tella '17
Faculty Sponsor: Mark P. Silverman

Compared to the past couple of millennia, the Earth's mean surface temperature has been exceptionally high in the 20th and 21st centuries. Much of this is due to the fact that there has been an absurd escalation of greenhouse gases in the atmosphere that trap heat energy within Earth. By studying measurements of solar energy diffusion, the trends of climate change can be viewed and analyzed. It is not useful information to just know that the average temperature is rising in a given area, therefore many directions of data analysis are taken in different regions of the world (urban and rural).   The changes in both mean surface temperature and maximum surface temperature over the months and years are analyzed through line graphs and histograms. The results based on New York City data have shown that the mean surface temperature per month has, in fact, increased at a steady rate of about 0.169 degrees Celsius per year after the year 1900. In the past seven years (2007-2013) graphs showed that it has increased at an even higher rate, of about 0.360 degrees Celsius per year. The maximum surface temperature of each month in New York increased at a similar rate of about 0.179 degrees Celsius per year from 1900 to 2013. Also, many urban temperatures of large cities proved to experience larger maximum temperatures than rural areas. The data concludes that the Earth will most likely continue to warm up enough to create some severe physical geographical changes by the end of the century, but what is of the most immediate concern are the cities, which are basically oversized crucibles

with large towers, pavement and overpopulation. Immense heat waves and health concerns are expected to rise in cities and cause deaths within the next decade.

PSYCHOLOGY

108.
LEARN 2 LEARN: A METACOGNITIVE INTERVENTION
Taylor Godfrey '14, Melva Lopez '14
Faculty Sponsors: Dina Anselmi, David Reuman, Hartford Magnet Trinity College Academy (HMTCA)

Self-regulated learning is comprised of motivation, cognition, and metacognition. This study aimed to improve eighth grade social studies students' self-regulated learning and academic performance through the implementation of an intervention into their social studies curriculum. The intervention centered on exposing students to the different dimensions of metacognition (i.e., comprehending and being able to control one's own cognitive processes) based on research findings that showed a link between metacognition and academic performance (Dignath & Büttner, 2008; Kistner et al., 2010). The intervention was designed to foster the students' knowledge and use of metacognitive strategies through group work and cognitive discussions based on the research by Paris & Paris (2001). Four eighth-grade history sections taught by one teacher and two sections taught by a second teacher participated in the study. Three sections were randomly assigned to the intervention group and the other three to the control group. All students completed pre- and post-testing qualitative and quantitative measures of metacognition. In addition, student performance was evaluated in terms of overall changes in grades from the first to third marking period. As predicted, the experimental group showed an increase in metacognition assessed through qualitative and quantitative measures. There was no effect of the intervention on student performance; however, both the qualitative and quantitative measures of metacognition were positively correlated with course grades.

109.
THE CULTURAL CHANGE IN COLLEGE STUDENT LANGUAGE
Louise Balsmeyer '14, Taylor Godfrey '14, Connor Proctor '14, Annie Scalambrino '14
Faculty Sponsor: Dina Anselmi

Research has shown that language can define and separate subcultural groups within a single culture. Research shows that the use of language among American college students differs between social and academic terms. This study investigated the Trinity College students to see if their use of language regarding social and academic terms differed from that of Trinity College faculty. We hypothesized that students and faculty would use similar language for academic terms and different language for social terms. We surveyed 205 students and 41 faculty members about their language use and found that student and faculty language is most similar for academic terms and most different for social terms. We believe the reason there is less difference for academic terms is that faculty and students interact in a setting where those terms form a

common bond. On the other hand, the greater difference in social terms can be attributed to the lack of social interactions that would lead to similar knowledge of a "Trinity social vocabulary".

110.
SECOND AND FIFTH GRADE CHILDREN'S ATTITUDES TOWARDS AUTISM SPECTRUM DISORDERS (ASD)
Louise Balsmeyer '14
Faculty Sponsor: Dina Anselmi

Since the implementation of the Individuals with Disabilities Education Act (IDEA) in 2004, students diagnosed with mental disabilities have been mainstreamed into classrooms with non-disabled students. Research has shown that children who are diagnosed with mental disorders are subject to high rates of stigmatization and bullying. This study examined attitudes of 2nd and 5th grade students about autism spectrum disorders (ASD). The aim of this study was to reduce the stigma associated with autism by conducting an educational program that addressed mental health, mental disorders, and ASD. Seventy-two children enrolled in two 2nd grade (35) and two 5th grade classrooms (37) from an elementary school in Hartford, CT participated in the study. All classrooms were shown a 4-minute video depicting a child exhibiting positive and negative ASD behaviors. Once participants viewed the video, they completed three measures: the Adjective Checklist (AC), Friendship Activity Scale (FAS), and the Bryant Empathy Index (BEI). Two days later, one classroom of each grade level received an educational program about autism, while the other two classrooms maintained their normal schedules. After the educational program was presented, all classrooms were again tested on these measures. Students exposed to the educational program were found to have more positive attitudes towards children with autism than the students who did not receive the program.

111.
THE EFFECTS OF EXERCISE ON STATE AND TRAIT ANXIETY
Lauren Blau '14
Faculty Sponsor: Randolph Lee

Exercise has been shown to have a significant impact on mood, anxiety, and stress as well as overall health in adults. The present study sought to determine the impact of aerobic physical activity on state versus trait anxiety in college students. Using Spielberger's State-Trait Anxiety Inventory as a measure, 18 college-aged students enrolled in the Fitness I courses at Trinity College were measured at three points in the Spring 2014 semester. The expectation was that physical activity would have a greater impact on reducing levels of state anxiety than trait anxiety, compared to a control group. The results of this study suggested that there were no significant differences in levels state versus trait anxiety over the course of the 8-week period. There was also no significant reduction in overall levels of anxiety over the 8-weeks. There was, however, a significant reduction in overall anxiety levels after one exercise session. Possible reasons for these findings and implications for future research are discussed.

112.
COLLEGE STUDENTS' PERCEIVED RISKS OF ECSTASY USE AND THE STATE OF

ECSTASY PREVENTION
Maria Young '14
Faculty Sponsor: Laura Holt

National statistics reveal a startling trend concerning ecstasy use among high school students, with over 5% of 10th graders and 8% of 12th graders reporting lifetime use (Dennis & Ballard, 2002). Ecstasy use among college students is even higher, with some studies reporting rates up to 10% (Boyd et al., 2003). Although previous research has documented the prevalence and predictors of ecstasy use, there is a limited understanding of how college students' perceptions of risk related to ecstasy use are formed. A focus group was conducted using a sample of Trinity College students. In addition, a brief online survey was administered to high school health educators across Connecticut. Findings revealed that participants' perceptions of the risks of ecstasy were limited, nonspecific and largely shaped by their peers and media, as opposed to previous health education. In addition, only a subset of drug prevention programs taught in high schools across Connecticut addressed ecstasy and most health educators did not endorse using nationally recognized evidence based programs.

113.
THE EFFECT OF PARENT RELATIONSHIPS ON INIMATE RELATIONSHIPS IN COLLEGE STUDENTS
Midge Daniel '14, Maria Young '14, Polly Maroni '15, Melody Fulton '15,
Ashley Ravesloot '15
Faculty Sponsor: Dina Anselmi

Parent and child relationships have long-term implications that may affect various aspects of a child's life. Research suggests that this relationship is one indicator of how well children are able to connect with others later in life. The nature of the parent-child relationship can effectively shape children's views of what constitutes a healthy intimate relationship. The current study examined students' relationships with their parents and how the nature of that relationship influences students' romantic relationships. Students were surveyed from all four classes at Trinity College. We hypothesized that those who have a more positive relationship with their parents (both mom and dad) would have a more positive view on romantic relationships. There was a positive correlation between the student's perceptions of their relationship with mom and their relationship with dad, but mom and student relationships were more positive than dad and student relationships. Students whose parents weren't divorced had higher MSIS scores than those whose parents were divorced, and additionally for those whose parents were divorced, dad and student relationships were significantly more negative.

114.
THE CONTENT AND MALLEABILITY OF COLLEGE STUDENTS' PERCEPTIONS OF NON-PRESCRIPTION STIMULANT USE

Henry Eff '14
Faculty Sponsor: Laura Holt

There has been an increase in non-prescription stimulant use (NPSU) among college students over the last ten years, with prevalence rates as high as 35% in some samples (Looby et al., 2013). Despite the prevalence of NPSU on college campuses, no studies have explored students' attitudes about prescription stimulants in a qualitative manner, so as to understand students' spontaneous associations with these substances. Moreover, no previous research has explored the extent to which participating in a survey about potential negative consequences of NPSU might change students' perceptions of, and their behavioral intentions towards NPSU. 241 students (66% female) participated in our confidential, online survey. 37% of the sample endorsed NPSU; as hypothesized, this subset of the sample reported more positive associations (and fewer negative associations) with prescription stimulants compared to the rest of the sample. Although participants did not evidence more overall negative imagery for prescription stimulants at the end of the survey as hypothesized, there was a significant increase in the number of specific negative health consequences identified at the end of the survey as compared to the beginning. Future research should explore whether the identification of more specific negative consequences related to NPSU is associated with lower risk for eventual NPSU or cessation of NPSU.

115.
ROMANTIC RELATIONSHIPS AND CULTURAL IDENTITY
Moe Khine '15, Daniel Luke '14, Malcolm Williams '14
Faculty Sponsor: Dina Anselmi

The purpose of this study was to investigate the associations between cultural identity and the perception of parental influence on romantic relationships. Our sample was 110 Trinity College students (25 male, 81 female, and 4 no response). Ninety-seven participants were American and 16 were non-American. Our first hypothesis predicted that individuals categorized as collectivist would report higher parental influence on romantic relationships than those who were categorized as individualist. Our second hypothesis predicted that the scores of the communal orientation scale (a measure of individual's beliefs of the importance of other peoples' needs and feelings), would be positively correlated with the perception of parental influence on romantic relationships. Our third hypothesis predicted that parents would influence the romantic life females more than males. Our fourth hypothesis predicted that non-American participants would have a higher parental influence than American participants. We found a positive correlation between communal orientation and parental influence, confirming our second hypothesis. There was no significant correlation between an individual's parental influence on romantic relationships and their cultural orientation (individualism/collectivism rating), between gender, or between nationality (American/non-American). The confirmation of our second hypothesis suggests that participants who are communally oriented (take into consideration needs and feelings of others) have a high degree of parental influence on their romantic relationships.

116.
MINDFULNESS AND ITS ABILITY TO ALLEVIATE STATE AND TRAIT ANXIETY IN COLLEGE STUDENTS

Kaity Mascioli '14
Faculty Sponsor: Randolph Lee

Society today puts extreme pressure on individuals to take on a magnitude of daily responsibilities in order to be successful. We are pushed beyond our limits both mentally and physically, which results in heightened state and trait anxiety. Adopting the theory of mindfulness teaches us to live in the present moment and not criticize our thoughts (Bormann et. al, 2013). The current study tests the effects of daily mindfulness meditation on state and trait anxiety as measured by the State-Trait Anxiety Inventory. Participants were Trinity College students that engaged in formal meditation sessions twice a week, but maintained the practice on their own every day. Students completed the State-Trait Anxiety Inventory before the first session began and after their sixth session. The inventory was also given before and after the fourth session. Based on past research, it was hypothesized that the participants that engaged in daily mindfulness meditation for six weeks would have a reduction in trait anxiety when compared to the control group. It was also hypothesized that the participants would see a reduction in state anxiety when measured before and after the meditation session. If mindfulness meditation is proved to be a significant reduction method for state and trait anxiety, this easy to learn lifestyle can be an effective alternative to medication.

117.
PSYCHOLOGICAL AND DEMOGRAPHIC PREDICTORS OF NON-PRESCRIPTION STIMULANT EXPECTANCIES AND MISUSE IN COLLEGE STUDENTS

Constance Minot '14
Faculty Sponsor: Laura Holt

Rates of non-prescription stimulant use (e.g., Adderall, Ritalin, Concerta) among college students are increasing. Accordingly, researchers have begun to identify psychological characteristics (e.g., depression, anxiety, stress, internal restlessness, expectancies) and demographic characteristics (e.g., gender, SES, Greek life participation) that place some students at greater risk for stimulant misuse. The current study aimed to add to the existing literature by replicating previous findings showing links between certain demographic and psychological factors and non-prescription stimulant use (NPSU). We also explored a possible relation between perceived peer norms around NPSU and participants' NPSU. Two hundred and forty five college students (63% female, 80% White/non-Hispanic) completed the online survey. Results showed a positive correlation between cognitive enhancement expectancies and anxiety and arousal expectancies and NPSU. Anxiety symptoms, but not depressive symptoms or stress, were a significant predictor of NPSU. Although internal restlessness did not predict NPSU, it did predict positive expectancies (i.e., cognitive and social enhancement), suggesting that internal restlessness might be a useful construct in predicting who is at risk for NPSU. Finally, students' reported percentages of how many students they believe to be using stimulants recreationally was positively correlated not only with their positive expectancies, but also with a higher frequency of NPSU.

118.
DO STATISTICS COURSES AFFECT CRITICAL THINKING ABILITY AND USE OF HEURISTICS AND BIASES?

Mitchell Mirtil '14
Faculty Sponsor: David Reuman

Research demonstrates that critical thinking ability is associated with the tendency to use heuristic and biases (West, Toplak & Stanovich, 2008). Given that performance in a statistics course has been found to improve critical thinking ability (Kooker, 1971; Fong, Krantz & Nisbett, 1986), I expect that statistics courses will also improve use of heuristics and biases. In study one, a random sample of 400 Trinity College students were invited to participate in an online survey that included measures of syllogistic reasoning (the Belief Bias test), the Cognitive Reflection Test, and multiple problems testing use of heuristics and biases. Of these students, responses were grouped for those who had completed a statistics course and those who had not. In study two, a group of students enrolled in an introductory statistics course were sent the same online survey, either at the end of the academic semester, or at the beginning and end of the semester. When observing pooled samples, scores on all cognitive measures were associated with one another; supporting that there is a relationship between critical thinking ability and use of heuristics and biases. There were not any significant differences in scores on cognitive measures when comparing groups of students who had taken, had not taken, or were enrolled in a statistics course; invalidating my hypothesis. Scores on the Belief Bias test and the Cognitive Reflection Test were positively associated with class year, suggesting that the general features of a liberal arts education improve critical thinking ability.

119.
EFFECT OF GENDER AND TYPE OF GAMING ON AGGRESSIVE AND PROSOCIAL BEHAVIOR
Valerie Scelsa '14, Nikita Singhal '14
Faculty Sponsor: Dina Anselmi

The relationship between different types of video games and male and female adolescent behavior has been widely speculated in the recent past. Research has suggested that violent video games may increase aggressive behavior, and prosocial video games may influence altruistic behavior (Adachi, Good and Willoughby, 2012; Brauer, Greitemeyer and Osswald, 2010). In terms of gender, Barthalow and Anderson (2002) explained that men may be more influenced by violent video games than women. Interestingly, past research on prosocial video games has not found any gender differences (Gentile et al, 2009). The current study examined the effect of gender on aggressive and prosocial behavior with gaming technology. Participants were given the Buss-Perry Aggression Questionnaire and Self-Report Altruism Scale and randomly assigned to one of the following three games: Monster Shooter 2, Ants or Monkey Ball 2 (control game). After playing the designated game, participants engaged in a Prisoner's Dilemma task in order to determine the game's influence on their competitive or helping behaviors. A total of forty undergraduate students at Trinity College participated in this research. It was hypothesized that students assigned to Monster Shooter II would display more aggressive behavior in the Prisoner's Dilemma task and students assigned to Ants would exhibit more prosocial behavior. We predicted that men would generally display more aggression than women and specifically that men would be more aggressive than women after violent game exposure. Additionally, we predicted that there would be no gender difference after altruistic game exposure. Results indicated that there was no significant relationship between game type or gender on behavior.

120.
BICULTURALISM AND PSYCHOLOGICAL ADJUSTMENT IN COLLEGE STUDENTS
Nikita Singhal '14, Valerie Scelsa '14, Sara Bess '14
Faculty Sponsor: Dina Anselmi

Our research project sought to answer two research questions. Does bicultural competence and identity conflict predict psychological adjustment for bicultural students? Secondly, do factors such as quality of life and psychological adjustment differ between bicultural and monocultural students? We hypothesized that bicultural students with more cultural competence and less identity conflict would be better adjusted than bicultural students who lack these characteristics. Additionally, we hypothesized that bicultural students would have a better quality of life, lower rates of depression and better psychological adjustment than those who identify as monocultural. We distributed an online survey to a random sample of 400 Trinity students (100 from each class) that included: the Bicultural Self-Efficacy Scale (David, Okazaki & Saw, 2009), the Ethno-Cultural Identity Scale (Ward, Stuart & Kus, 2010), the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977) and the Quality of Life Scale (Flanagan, 1979). Results from 53 students indicated that there was no significant difference between bicultural and monocultural participants. There was, however, a significant correlation between a participant's bicultural self-efficacy score and reduced ethno-cultural conflict, and quality of life.

121.
GENDER DIFFERENCES AMONG COLLEGE STUDENTS WITH RESPECT TO WORK-PARENTING BALANCE
Sara Bess '14
Faculty Sponsor: David Reuman

Do gender differences exist among Trinity students with respect to career and parenting expectations? Do gender differences also exist with respect to hostile versus benevolent sexism (Glick & Fiske, 1996)? Is sexism associated with career and parenting expectations for oneself? From these questions, I hypothesized that women would be more likely to hold career and parenting expectations that are mutually dependent; men would be more likely to hold career expectations that are independent of parenting expectations. More sexist women would hold more dependent expectations; more sexist men would hold more independent expectations. An online survey was fielded to a stratified random sample of 200 Trinity women and 400 Trinity men. This survey included the Life Role Salience Scales (Amatea, Cross, Clark, & Bobby, 1986) and the Ambivalent Sexism Inventory (Glick & Fiske, 1996). In a Trinity College sample of 40 women and 35 men, men scored significantly higher than women with respect to occupational role commitment, but women scored marginally significantly higher on parental role commitments; there was no gender difference in marital role commitments. Trinity men scored higher than women in hostile sexism, but there was no gender difference in benevolent sexism. Results also showed that for women overall (those who demonstrated both high and low hostile sexism), occupational and parental role commitments were negatively correlated. Additionally,

occupational and marital role commitments were negatively correlated for women. For men who were high in hostile sexism, these roles were also negatively correlated – but for men low in hostile sexism, these roles were positively correlated with one another. The findings suggest that Trinity women believe families and careers require a trade-off, while Trinity men are split: more sexist men hold beliefs similar to women's, while less sexist men believe the role commitments are compatible.

122.

AN EXPLORATORY STUDY OF COLLEGE STUDENTS' ATTITUDES ABOUT ECSTASY

Rachel Reingold '14
Faculty Sponsor: Laura Holt

In a recent survey of 18-35 year olds, 15% reported using ecstasy (Businelle et al., 2009) and many emerging adults view it as "safer" than other illicit drugs, with limited negative consequences (Bahora et al., 2009). Although numerous quantitative studies have explored the topic of ecstasy use in college students, there is limited qualitative research, most of it limited to users. Thus, in the current study, we used a focus group methodology to better understand users' and nonusers' knowledge, expectations, and perceived risk of ecstasy use, for the purpose of informing prevention efforts on college campuses. 24 Trinity College students participated in 3 focus groups. Results of a thematic analysis suggested that both users and nonusers of ecstasy hold specific, positive expectations related to the effects of ecstasy; this supported the first hypothesis that college students' attitudes about ecstasy would be characterized by more positive rather than negative effects. Compared to nonusers, users identified more positive and negative effects, as well as risks associated with ecstasy use. This partially supported the second hypothesis that users would view ecstasy more positively than non users; however, users also reported more negative effects and risks than non users. Results of the quantitative portion of the study showed that students regarded ecstasy to be just as risky as cocaine, but more risky than both alcohol and marijuana; interestingly, there was no significant difference in perceived risk of ecstasy between users and non users.

123.

GENDER ROLES AND CAREGIVING PRACTICES IN TRINITY COLLEGE FACULTY

Berkley Singer '15, Rachel Reingold '14, Nikita Wadhwa '15, Alexis Deschenes '15
Faculty Sponsor: Dina Anselmi

Deckard & Scarr (1996) studied parenting stress among dual-earner mothers and fathers and found that women in the workforce feel more parenting stress than men. A recent study examining the shift in traditional gender roles found that in dual earning households, men were less involved in routine child care compared to their spouses and less competent than their spouses in childcare tasks (Kyong-Ah, Suejung, Hyun-Joo, & Bingham, 2013). While much of the research in this area focuses on quantitative measurers of stress and amount of time spend in child-care and house related duties, fewer studies have used qualitative measures to tease out

male and female perceptions of how to balance career and home responsibilities. The purpose of the current study was to use an interview methodology to understand the perceptions of male and female faculty at Trinity College about gender roles and child rearing in today's society. Fourteen Trinity College faculty members participated in scripted interviews. We did not find a significant relationship between gender and stress levels for career nor for the relationship between gender and stress levels for daily household tasks. Transcripts were coded for both positive and negative themes and on several categories there were different perceptions between male and female faculty.

124.
CULTURAL VARIATIONS IN DISTRESS TOLERANCE: INFLUENCE ON SEEKING SOCIAL SUPPORT
Melissa Sital '14
Faculty Sponsor: Janet Chang

Past research has found that individuals with an interdependent self-construal are more likely to engage in emotion regulation than those with an independent self-construal. This difference may lead individuals with an interdependent self-construal to have a higher level of distress tolerance. Though high distress tolerance is theorized to be advantageous, those with high distress tolerance may be less likely to seek social support when distress levels are too high to cope with on one's own. Research has yet to uncover whether independent or interdependent norms regarding distress tolerance affect solicitation of social support. The objective of the current study was to examine how primed cultural values influence distress tolerance, and the association between distress tolerance and support seeking. Undergraduates were primed as either independent ($n = 26$) or interdependent ($n = 27$) before completing a manipulation check, and measures of distress tolerance, emotion regulation, social support solicitation, and demographics. Participants in the independent condition demonstrated a significant priming effect. Participants in the interdependent condition demonstrated priming in the expected direction, but this effect was not significant. High distress tolerance was not found to be significantly correlated with support seeking behaviors. However, higher emotional reappraisal was significantly correlated with higher support seeking. Implications related to the sample size of the present study, as well as suggestions for future studies, are discussed.

125.
REDUCING PROACTIVE INTERFERENCE THROUGH A SEREIES OF DISTRACTOR TASKS
Jeffrey Smullen '14
Faculty Sponsor: Elizabeth Casserly

The effects of proactive interference can be detrimental to learning when multiple sets of material are being learned and each one is highly similar to another. The purpose of this experiment was to investigate the effectiveness of varying types of distractor tasks in their ability to reduce the effects of proactive interference. Participants were given two lists of words to remember and one of three tasks to complete. The accuracy of recall was compared across all

groups. While there was not a significant difference between the different types of distractor tasks, there was some evidence that there was a reduction in interference. The results did show that on average Trinity College students to have better memories than the general population. Finding a way to reduce the effects of proactive interference will be beneficial to students and educators who must deal with interference daily.

126.

DIFFERENCES IN EMPATHY BETWEEN HIGH AND LOW SCHIZOTYPAL COLLEGE STUDENTS
Allison Cazalet '14
Faculty Sponsors: Sarah Raskin, Silvia Corbera, PhD, Institute of Living

Past research has provided support for empathy disruptions in individuals with schizophrenia and autism, but there is limited research on the relationship between empathy and schizotypal personality traits. This study explores the relationship between disruptions in empathy, schizotypal traits, and autistic traits in a population of college students. A prescreening questionnaire that consisted of a general information form and the Schizotypal Personality Questionnaire (SPQ) was sent out to the entire student body. SPQ scores of 40 and above (high schizotypy) and 12 and below (low schizotypy) were eligible to participate in the second part of the study. 25 students completed the second part of the study, consisting of an exercise in E-Prime, which analyzed participants' reactions to people in painful and neutral emotional states. Participants also completed the Beck Depression Inventory, Interpersonal Reactivity Scale, Autism Quotient, Empathy Quotient, Questionnaire of Cognitive and Affective Empathy, and the Difficulty in Emotional Regulation Scale. Overall, students in the high schizotypy group exhibited some significant deficits in empathy. Students with high schizotypal traits were also found to have an intermediate number of autistic traits.

SOCIOLOGY

127.

EXAMINING THE EFFECTS OF GENDER EQUALITY ON COUPLE SATISFACTION
Lara Abiona '16
Faculty Sponsor: Theresa Morris

The purpose of this research is to investigate how equality among partners in a heterosexual relationship affects their overall satisfaction with their relationship. I hypothesized that there is a positive correlation between gender equality and couple satisfaction. That is, partners who feel equally advantaged in their relationship are more likely to be satisfied with overall relationship, with gender equality as my independent variable and couple satisfaction as my dependent variable. To test my hypothesis, I used a secondary dataset titled *Couples and Well-Being Project, 1993-1995, Detroit Metropolitan Area* to find variables for gender equality and couple satisfaction and analyzed the relationship between them by doing crosstabs and conducting a chi-square analysis. I found that those who were in an equal relationship reported higher couple satisfaction than those in an unequal relationship. When I controlled for gender, I found that additionally, women were more likely to be dissatisfied in an unequal relationship than men.

128.
MEDIA AND SELF-ESTEEM
Missy Aja '15
Faculty Sponsor: Theresa Morris

There are a wide variety of factors that influence the construction of adolescent self-esteem. This paper focuses on the effect that images portrayed in the media have on the self-esteem of young adolescents. Using data from the 2010 'Health Behavior in School-Aged Children' survey of 10-17 year olds, found in ICPSR, the paper examines the relationship between media and self-esteem. Using symbolic interaction theory, I examine how hours of television watched affects the individual's thoughts about their body. The results demonstrate that the more exposure an adolescent gets to images in the media, the lower their self-esteem, even when controlling for gender.

129.
THE RACE TO SUCCESS: THE AFFECT OF RACE ON EDUCATIONAL ATTAINMENT
Bianca Brenz '15
Faculty Sponsor: Theresa Morris

So often studies are conducted on how far different races of students made it in education, and not often enough are there studies that explore students' aspirations or expectations on their educational attainment. This study presents the differences among distinct races of students and how far they think they will get in education. This is done by looking at different races of students, my independent variable, and taking their accounts on expectations of their own educational attainment, my dependent variable. I hypothesize that more white than non-white students believe they will make it further high school. The Education Longitudinal Study collected the data used for this study in its base year of 2002. After analyzing the responses given by different races of students I found that my hypothesis was not supported and that more Asian, Hawaiian Pacific Islanders than any other race of students expect to go further than high school in their education. I have concluded that there are many factors such as recourses or a lack thereof that affect students' expectations on educational attainment.

130.
CLASS ACTS: HOW SELF-DEFINED CLASS IDENTIFICATION IMPACTS VIEWS ON ABORTION
Victoria DaMore '16

Faculty Sponsor: Theresa Morris

This study examines the different views of abortion based on people's self defined "class". Using the variables of "Subjective Class Identification", self-defined by the respondent and "Woman Wants Abortion For Any Reason", the study looks at how class impacts one's view on abortions, and what attributes contribute to those views. Using the Symbolic Interaction theory, class relations and opinions are studied in connection to abortion. The research shows that, through Symbolic Interaction, the Lower Class and Working Class are more strongly against abortion than the Middle Class and Upper Class.

131.
SEASONS OF SUCCESS
Lauren Fitzgerald '15
Faculty Sponsor: Theresa Morris

The research topic for this study was the impact of playing a winter sport on graduation rates and how that compares to the graduation rates of athletes who play a fall or spring sport. The dependent variable in this study was the graduation rates, and the independent variable was the season in which the athlete's sport took place. The hypothesis was that winter teams will have a higher graduation rate than teams who are "in season" during different season. The data came from a 2003 study about one northeastern school. Ultimately, the findings were not statistically significant and there appeared to be no causal relationship between the variables, but there is information pointing to the possibility of a difference between men and women.

132.
THE EFFECT OF MEDIA ON BODY IMAGE
Rebecca Levy '16
Faculty Sponsor: Theresa Morris

This study examines the effect of exposure to media content has on the body image of adolescents. Media images present an ideal body type that is an inaccurate representation of what the average person looks like. This can have many negative effects on those who expose themselves to these images, such as eating disorders and self-hatred. Through the lens of the symbolic interaction theory, this study examines how the average amount of television watched daily affects how frustrated one feels about their body image. Data was obtained from the Health Behavior of School-Aged Children survey. All findings were statistically significant and hypotheses supported.

133.
A CROSS SECTIONAL STUDY: HIGH RATES OF TEENAGE PREGNANCY AMONG LOW-INCOME WOMEN
Claudia Malaga '15

Faculty Sponsor: Theresa Morris

The rate of teenage pregnancy in the United States, although declining, is still at a critically high level for a developed country. This study investigates whether teenage pregnancy is linked to income within the United States and is based on secondary data from the National Survey of Family Growth, Cycle VI 2002 – Pregnancy File. Using intersectionality theory and as well as previous studies of teenage pregnancy in the United States, my findings indicate that the higher a woman's poverty level is during her teenage years, the more likely she is to become pregnant. Furthermore, when controlling for race, my findings indicated that this trend only held for Non-Hispanic Whites and Non-Hispanic Blacks and that income bore no relation to rates of teenage pregnancy among Hispanic women. This study is important because it provides insight on the nature of income as a contributing factor to teenage pregnancy, while at the same time, challenging pre-existing understandings of how race plays a part in teenage pregnancy.

134.
HOW DIFFERENCES IN GENDER MAY AFFECT WHETHER A PERSON FINDS THE SUBJECT OF MATHEMATICS TO BE ENJOYABLE OR NOT
Molly Malloy '16
Faculty Sponsor: Theresa Morris

This study explores and analyzes how differences in gender may affect whether a person finds the subject of mathematics to be enjoyable or not. When taking into consideration how a person's gender may affect their attitude towards mathematics, researchers often hypothesize that women tend to have a more negative outlook on math then men. While agreeing with most researchers in this hypothesis, I also propose that it is not only gender that may affect this level of enjoyment, but also an individual's race. After controlling for race, it is shown that this hypothesis holds true for all attributes of race in this study except for that of the black race. It would be through further research into our education systems that we would come to see what other factors cause these discrepancies between men and women and their correlation to math.

135.
MAJORITY IN THE WORKPLACE, MINORITY IN PAY: INEQUALITY IN PAY FOR THE SAME WORK
Walter McElrath '15
Faculty Sponsor: Theresa Morris

The amount of literature that can be found about gender inequality is abundant, yet for some reason it still exists in today's society. This study will focus on that wage inequality between men and women. I used the Age and Generations Study, 2007-2008 as my data set. I find that men are more likely to be present in all the pay scales with the exception of the highest. Applying a conflict theory perspective, I suggest that this inequality exists because of the oppression placed upon women within the work place. Women are allotted less opportunity on the lower end of the pay scale in comparison to men. The data shows that while men are paid

more on a lower pay scale, women are more likely to be present on the higher end of the pay scale.

136.
THE EFFECT OF SOCIAL CLASS ON EDUCATIONAL EXPECTATIONS
Emily Meehan '16
Faculty Sponsor: Theresa Morris

Although most students may dream of pursuing high levels of education, the reality of their life situations may cause their actual educational expectations to differ from these aspirations. This study focuses on what it is that causes some students to have high educational expectations, and others to have lower educational expectations. To research this topic, I draw data from the Education Longitudinal Study 2002, and analyze how socioeconomic status affects students' educational expectations. I find that there is strong statistical significance to prove that high socioeconomic status results in high educational expectations, and low SES results in lower expectations. These results are consistent when controlling for the variable gender.

137.
HOW MUCH IS TOO MUCH: AN IN-DEPTH STUDY OF THE RELATIONSHIP BETWEEN ALCOHOL CONSUMPTION AND ACADEMIC PERFORMANCE.
Al Nejmeh '17
Faculty Sponsor: Theresa Morris

Drinking is a major part of the social life across colleges throughout the United States. This study looked to examine how this social activity, alcohol consumption, affected academic performance amongst college undergraduates. The theories of secondary socialization and young adulthood were used in relation to the research question. This study also implemented gender as the control variable. It was hypothesized that those students who have greater alcohol consumption will have a significantly lower academic performance. The data set used in this study was from the *Harvard School of Public Health Alcohol Study of 2001*. It was concluded that there was a statistically significant relationship between alcohol consumption and academic performance. It was found that there is small discrepancy in academic performance between non and moderate drinkers. Females also tended to have much a better academic performance than their male counter parts. It should also be noted that there were some difficulties operationalizing the independent variable, alcohol consumption, as the data was collected from a mailed-in questionnaire.

138.
MINIMUM WAGE: A CASE OF CLASS INTEREST
Michael G. Newkirk '14
Faculty Sponsor: Theresa Morris

The scholarly literature examining whether raising the minimum wage is a good idea is basically split down the middle. However, if one examines the data of who supports raising the minimum wage by class, race, and political affiliation, a clear trend emerges. White, conservative, rich people tend to oppose raising the minimum wage. As the short-sighted profiteers of America, raising the minimum wage goes against their own short term self-interest. However, I make the claim that raising the minimum wage may very well hurt the economy in the short term, but it will benefit humanity in the long term. This is based on the logic that if people do not have disposable income, they will not be able to purchase products and grow the economy. I will employ instrumentalist theory to reveal how the state is essentially an instrument to protect the short term interests of the capitalist class through exploring the issue of minimum wage in America.

139.
PAYING COLLEGE ATHLETES: THE ANSWER IS BLACK AND WHITE…
Kyle Pulek '16
Faculty Sponsor: Theresa Morris

This paper studies the factors that affect people's opinions on if college athletes should be paid. I hypothesize that the race of the respondent, namely those who are black, will support paying college athletes significantly more than other races. My hypothesis is grounded in Critical Race Theory and logically through the empowerment of whites in paid administrative jobs while Blacks act as the majority of the athletes in the highest revenue sports. I test my hypothesis using secondary data from a poll conducted by CBS News, 60 Minutes, and Vanity Fair. I find that Blacks are more likely than any other race to support paying college athletes, even controlling for political philosophy. Race remains significant when compared between people at lower education levels, however race is not a significant factor in predicting people's attitudes when considering only those who completed a four-year college degree or more. This finding allows for a sociological glance into a looming topic that is sure to remain headline news for years to come.

140.
INTERSECTIONAL RELATIONSHIP OF BREASTFEEDING OUTCOMES AND SOCIOECONOMIC CLASS
Olivia Reny '16
Faculty Sponsor: Theresa Morris

In this study I discussed the relationship between the independent variable of socioeconomic class and its affect on the dependent variable of breastfeeding outcomes. Breastfeeding outcomes were defined as the likelihood for mothers to breastfeed their newborns. In using the feminist theory and the theory of intersectionality I examined the relationship of class, gender, and race in comparison to breastfeeding outcomes. My hypothesis was that lower income mothers were less likely to have successful breastfeeding rates in comparison to higher income mothers. I examined secondary quantitative data from the 2004 *New York City Health and*

Nutrition Examination Survey on whether or not mothers breastfed their children and cross-referenced that information with the mother's total income. Additionally, I controlled for race to see if any further relationships would be observed. Upon completing the bivariate and multivariate analyses of the data and running a chi-square test of significance, I concluded that there was not a statistically significant relationship between breastfeeding outcomes and socioeconomic class. Therefore, I could not accept my hypothesis. But, after applying the control variable of race, I concluded that there is a statistically significant relationship between breastfeeding outcomes and socioeconomic class in mothers of Asian race.

141.
EDUCATIONAL DISPARITIES: DOES RACE INFLUENCE A SUDENT'S CHANCE OF GRADUATING FROM COLLEGE?
Malaine Thorpe '15
Faculty Sponsor: Theresa Morris

Minority individuals have long faced historical, political, economic, social, cultural, and psychological inequalities when compared to the experiences of their white counterparts. The purpose of this paper is to determine if these inequalities also exist when looking at educational attainment, more specifically, how race affects a student's chance of graduating from college. GSS data was used to compare the independent variable "race", with the dependent variable "highest degree received" in order to discover any relationships, if any, that might exist between the two variables. I hypothesize that there will be a significant relationship between race and highest degree received, with minority students receiving less college degrees than white students. After analyzing the data, it was determined that there is a significant relationship between race and a student's chance of graduating from college, and in fact white students have a greater chance of graduating from college when compared to minority students.

142.
MEDIA'S INFLUENCE ON RELATIONSHIP SATISFACTION
Tessa van der Meer '16
Faculty Sponsor: Theresa Morris

Various prior studies on relationship satisfaction have studied how respondents' attitudes, individual behavior and personality can affect relationship satisfaction. Although the media has never been a central independent variable in any of the articles I have researched, some articles come close such as the study of the affects of respondent's sex-role attitudes. My research was designed to try and understand how media can influence individual's expectations of relationships and their own happiness within their relationship. The expectations of relationships often do not line up with the reality of a relationship. I believe this disconnect can cause a lot of relationship dissatisfaction. I studied the media's affect on relationship satisfaction by using GSS 2010 to cross examine the amount of television an individual watches and their martial happiness. Unfortunately my hypothesis was not supported but there is still a lot to learn from my experiment and perhaps with a different dataset and a second study media intake and relationship satisfaction will have negative correlation.